

BART TO LIVERMORE EXTENSION PROJECT DRAFT ENVIRONMENTAL IMPACT REPORT

Volume 3 of 3
Appendices

State Clearinghouse No. 2012082104



San Francisco Bay Area Rapid Transit District
July 2017

BART TO LIVERMORE EXTENSION PROJECT DRAFT ENVIRONMENTAL IMPACT REPORT

Volume 3 of 3
Appendices

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Prepared for:



San Francisco Bay Area Rapid Transit District

By:

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July 2017

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**APPENDIX A:
NOTICE OF PREPARATION**



BART to Livermore Extension Project EIR Notice of Preparation

To: Interested Agencies, Organizations, and Individuals

Subject: Notice of Preparation of a Draft Environmental Impact Report for the BART to Livermore Extension Project

Lead Agency: San Francisco Bay Area Rapid Transit District
300 Lakeside Drive, 16th Floor
Oakland, CA 94612

Contact Person: Marianne Payne, EIR Project Manager
San Francisco Bay Area Rapid Transit District
Phone: 510.464.6140
Fax: 510.464.7673
Email: mpayne@bart.gov

Project Title: BART to Livermore Extension Project EIR

Project Location: Alameda County, California

SUMMARY:

The San Francisco Bay Area Rapid Transit District (BART), as Lead Agency, is issuing this Notice of Preparation (NOP) to advise other agencies and the public that it will be preparing a Draft Environmental Impact Report (DEIR) for the proposed BART to Livermore Extension Project (Proposed Project). The Proposed Project, which is being developed in partnership with the City of Livermore, consists of a 4.8-mile BART extension along I-580 to a station in the vicinity of the Isabel Avenue/I-580 Interchange incorporating an efficient bus-to-BART transfer; and also includes express bus services linking inter-regional rail service, Priority Development Areas (PDAs) in Livermore, CA, and proposed offsite parking facilities. The DEIR will be prepared in accordance with the guidelines implementing the California Environmental Quality Act (CEQA). The purpose of this NOP is to alert agencies and interested parties regarding the plan to prepare the DEIR, to provide information on the Proposed Project and alternatives, to invite participation in the EIR process, including comments on the scope of the DEIR, and to announce that a public scoping meeting will be conducted.

DATES:

Comments Due Date: Written comments on the scope of the DEIR, including significant environmental issues, reasonable alternatives, and mitigation measures to be considered, should be sent to Marianne Payne, EIR Project Manager, at the address below by Monday, October 1, 2012.

SCOPING MEETING:

A scoping meeting to receive verbal and written comments will be held on Wednesday, September 19, 2012 at the Robert Livermore Community Center, which is located at 4444 East Avenue, Livermore CA, 94550. An informal open house will be held at 6 p.m. followed by the meeting and comments at 7 p.m. If you need language assistance services, please call 510-464-6752. Please call at least 72 hours prior to the date of the meeting.

ADDRESSES:

Written comments on this NOP should be sent to Marianne Payne, EIR Project Manager, BART, 300 Lakeside Drive, 16th Floor, Oakland, CA 94612 or faxed to 510-464-7673 Attention: Marianne Payne. Comments also may be emailed to mpayne@bart.gov.

FOR FURTHER INFORMATION:

For further information contact Marianne Payne (contact information above) or visit the project website at www.bart.gov/livermore.

SUPPLEMENTARY INFORMATION:

Proposed Project

In June, 2010, BART certified a Final Program Environmental Impact Report (FPEIR) for the BART to Livermore Extension (SCH No. 2008062026), analyzing ten alternatives that provided different combinations of alignment, station and maintenance facility locations. The DEIR for the proposed BART to Livermore Extension Project will be a second tier, project-level EIR following the FPEIR. The Proposed Project is a 4.8-mile extension of the BART line from the existing Dublin/Pleasanton Station within the I-580 Corridor freeway median to a new station in the vicinity of the I-580/Isabel Avenue Interchange incorporating an efficient bus-to-BART transfer. A network of express bus services linking inter-regional rail service, Priority Development Areas in Livermore, and proposed offsite parking facilities are also part of the Proposed Project. Express bus routes are tentative and a variety of routes may be evaluated during the scoping and EIR process.

Goals and Objectives

The primary goal of the BART to Livermore Extension Project is to provide an affordable and effective inter-regional and inter-modal link of the existing BART system to inter-regional rail service and Livermore Priority Development Areas. This connection was identified as an important inter-regional link in the San Francisco Bay Area Regional Rail Plan (2007), and regional and inter-regional congestion in this corridor continues to grow. In addition, the Proposed Project is intended to support regional goals of integrating transit and land use policies to create opportunities for transit-oriented development around the proposed I-580/Isabel Avenue BART station, as well as around the inter-regional rail station and the express bus satellite transit nodes in Priority Development Areas in Livermore. The Proposed Project also is intended to alleviate traffic congestion on I-580, improve air quality, and reduce greenhouse gases and other emissions associated with automobile use.

Proposed Project and Alternatives

The Proposed Project and preliminary draft alternatives that may be evaluated in this EIR are listed below. More precise definitions of alternatives, or additional alternatives, may be identified through the EIR scoping process and during preparation of the Draft EIR. In addition to the Proposed Project, the project alternatives currently under consideration include a No Build alternative, a Diesel Multiple Unit (DMU) alternative, and an Express Bus alternative. The Proposed Project, as well as the DMU and Express Bus alternatives, will include tail tracks and maintenance facilities as needed for effective operations.

- **Proposed Project** – A 4.8-mile BART extension along I-580 to a station at the Isabel Avenue/I-580 Interchange incorporating an efficient bus-to-BART transfer, with a network of express bus services linking inter-regional rail, Priority Development Areas in Livermore, and proposed offsite parking facilities. Limited parking also would be provided at the I-580/Isabel Avenue BART station.
- **No Build Alternative** – The No Build Alternative assumes that the proposed project is not constructed. Limited low cost improvements currently planned and funded for the existing intermodal connections may be included.
- **Express Bus Alternative** - This alternative would not include the extension of BART from the existing Dublin/Pleasanton BART Station, but would include Express Bus service to the Dublin/Pleasanton Station with improvements that would provide for more seamless intermodal transfers to the BART system, such as potential improvements to bus access and operations. Transit access could occur using reserved lanes, express bus service, and direct ramps at the Dublin/Pleasanton Station to link with inter-regional rail and Priority Development Areas in Livermore.
- **DMU Alternative** – Using a DMU technology, this alternative would extend from the existing Dublin/Pleasanton BART Station along the Interstate 580 corridor to a Bus-to-DMU transfer station in the vicinity of the Interstate 580/Isabel Avenue Interchange. Limited parking would be provided at this station. A network of express bus service linking inter-regional rail and Priority Development Areas in Livermore would also be included.

Scope of Environmental Analysis

The DEIR for the BART to Livermore Extension Project will be prepared in compliance with the California Environmental Quality Act (CEQA) of 1970, as amended. In general, the purpose of the DEIR is to:

- Analyze the potential environmental effects of the Proposed Project.
- Inform decision-makers, responsible and trustee agencies, and members of the public as to the environmental impacts of the Proposed Project;
- Recommend a set of mitigation measures to avoid or reduce any significant adverse impacts; and
- Analyze a range of reasonable alternatives to the Proposed Project.

Potential environmental effects identified for analysis in the DEIR include:

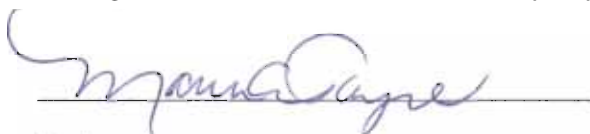
- Transportation
- Air Quality
- Land Use, Housing, and Physical Displacement
- Public Services
- Energy
- Greenhouse Gases and Climate Change
- Noise
- Geology and Seismicity
- Hazardous Materials
- Water Resources
- Biological Resources
- Visual Resources
- Cultural Resources
- Public Utilities
- Growth-Inducing Impacts

More specifically, some of the areas of the EIR will consider:

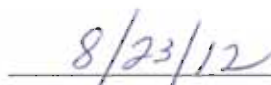
- Land Use Compatibility – What conflicts might be expected with respect to existing land uses in the station areas? What potential displacements might occur?
- Transportation – What effects would there be on local circulation, access, transit system ridership, operations, connectivity and parking?
- Wetlands/Biological Impacts – Would there be direct and indirect disturbance to sensitive areas such as wetlands, creeks, and undisturbed grassland, or to sensitive species in such habitats?
- Safety Considerations – Would changes to the Livermore Airport safety zones have implications for the project?
- Air Quality Impacts – What are the effects of air emissions from transit system construction and operation? What air quality benefits could accrue on the local, regional and global (climate change) levels from providing a transit alternative to the automobile?
- Noise and Vibration Impacts – What are the local effects on sensitive receptors along the alignment and near station areas?
- Visual Impacts – Would the transit improvements affect adjacent visual resources, including the City of Livermore's scenic corridor? Are there height and/or scale compatibility concerns between the improvements and adjoining development patterns?

Public Involvement Program

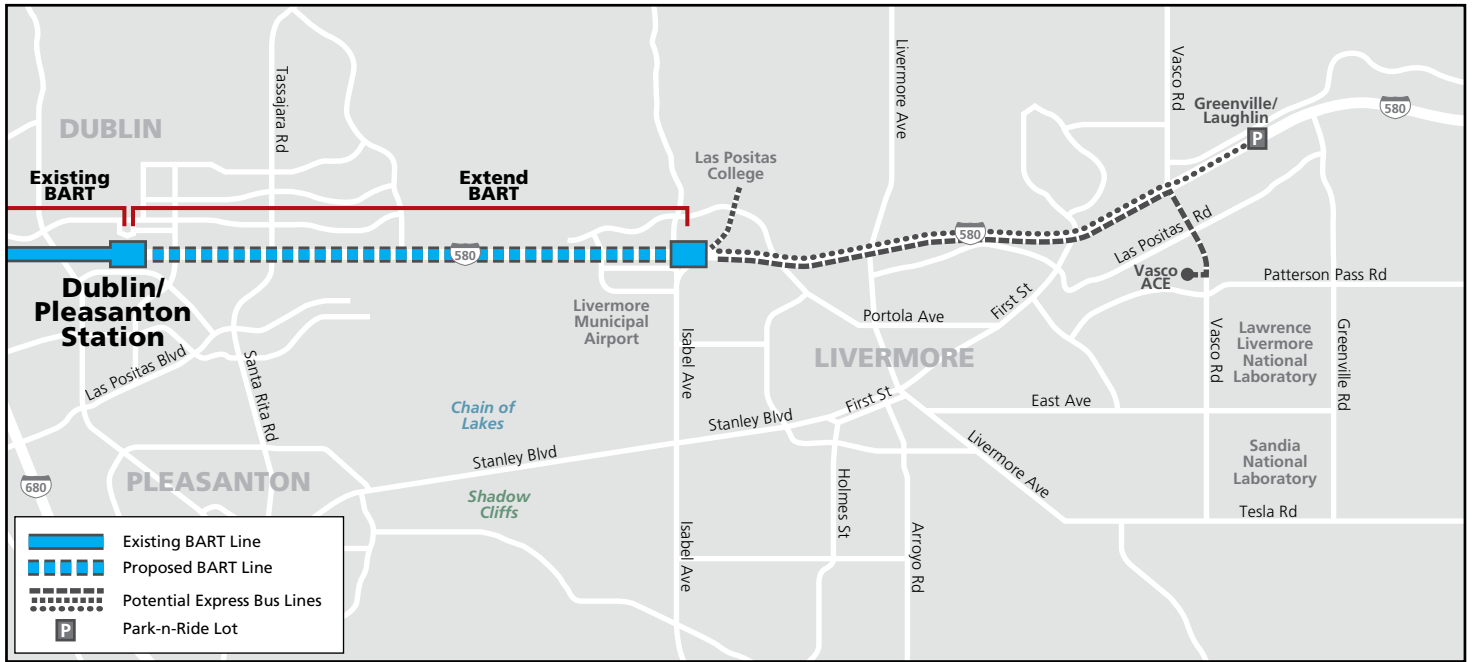
A comprehensive public involvement program will be an integral component of the DEIR preparation process. This program will include a public scoping process, including a public scoping meeting and outreach to local and regional officials and community and civic groups. A public review/comment period and a public hearing will be held on the DEIR following its publication. All comments will be given serious consideration. BART will post project updates on the project web site (www.bart.gov/livermore).



Marianne Payne
EIR Project Manager



Date



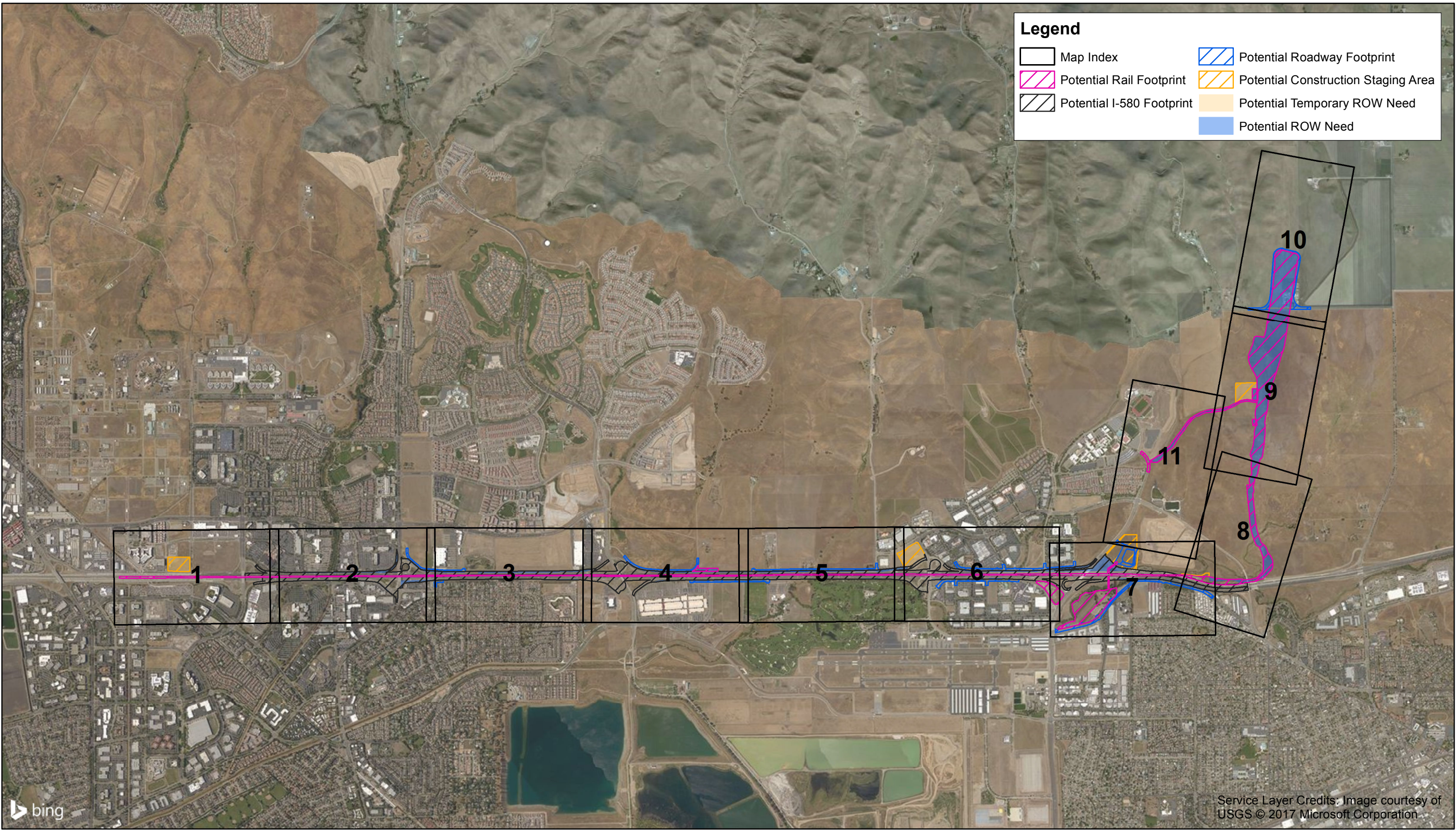
APPENDIX B: FOOTPRINT MAP BOOKS

B.1 Proposed Project

B.2 DMU Alternative

B.3 Express Bus/BRT Alternative

B.1 Footprint Map Books – Proposed Project



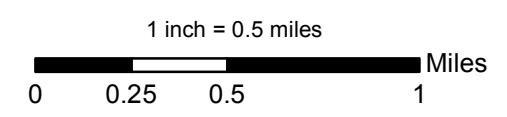
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	Map Index		Potential Roadway Footprint
	Potential Rail Footprint		Potential Construction Staging Area
	Potential I-580 Footprint		Potential Temporary ROW Need
			Potential ROW Need

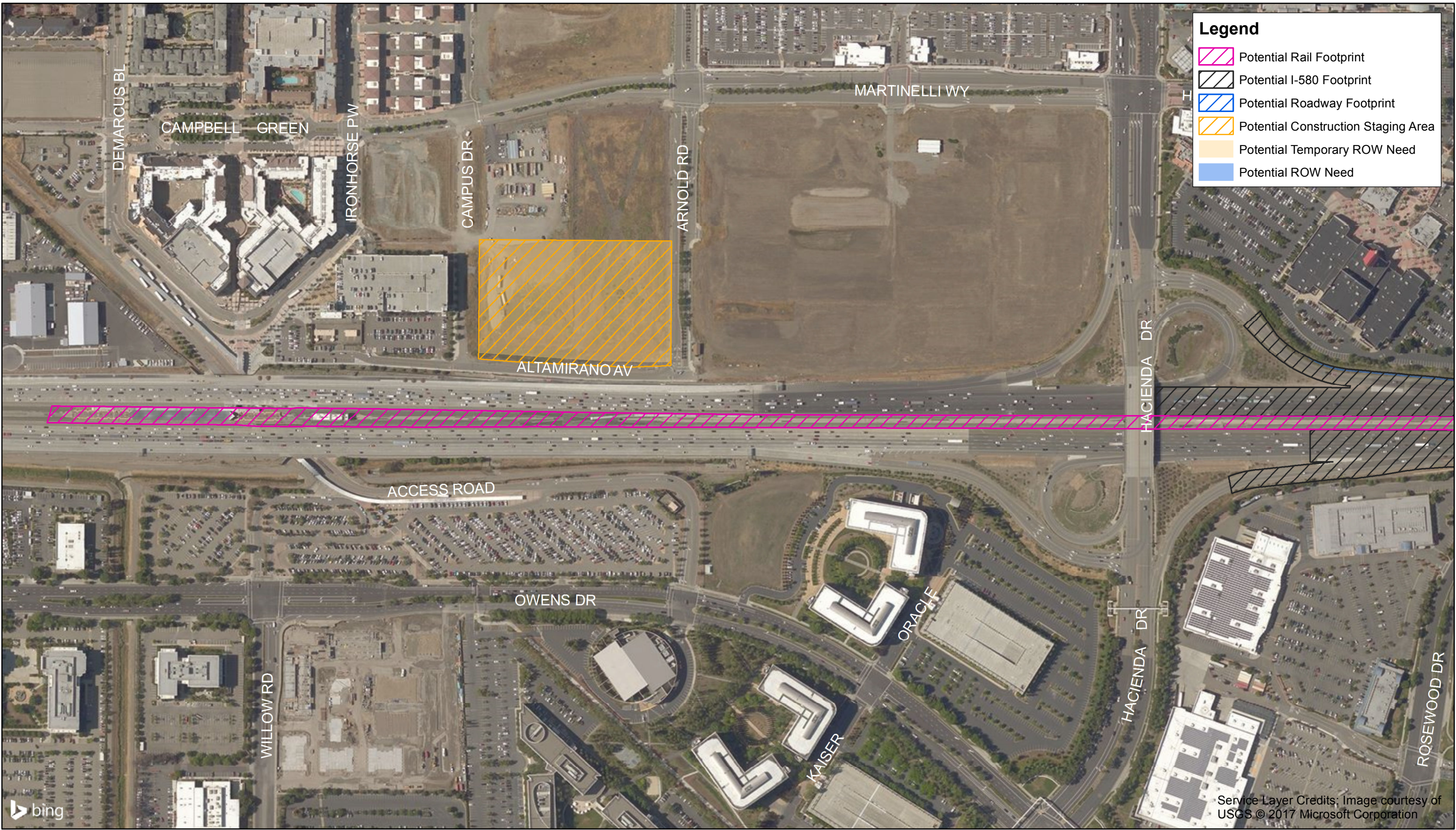
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San Francisco Bay Area Rapid Transit District
BART to Livermore Extension
Proposed Project - Conventional BART
 Index



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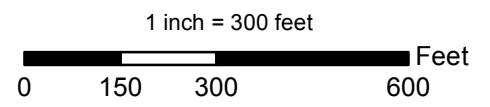
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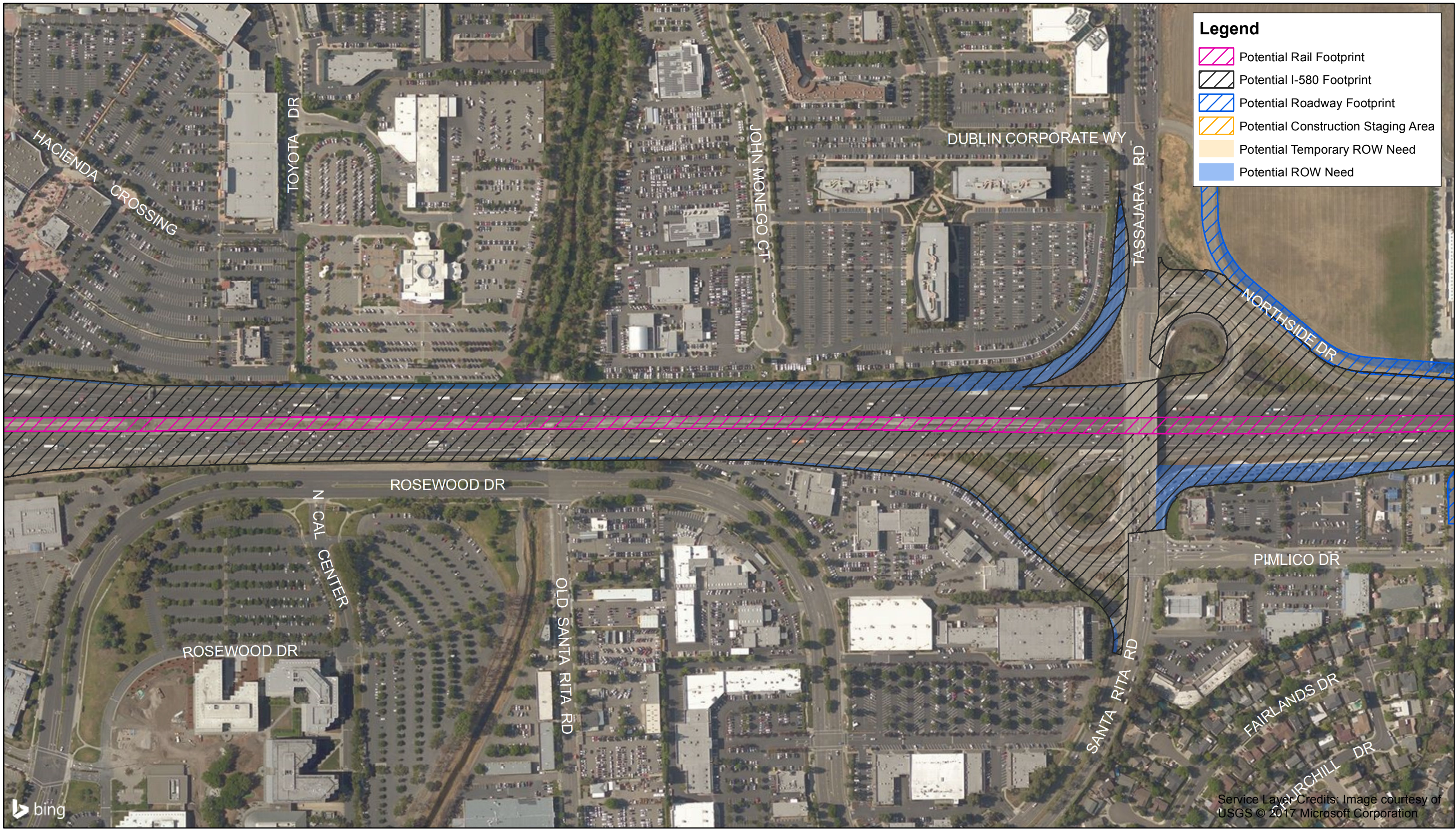
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San Francisco Bay Area Rapid Transit District
BART to Livermore Extension
Proposed Project - Conventional BART

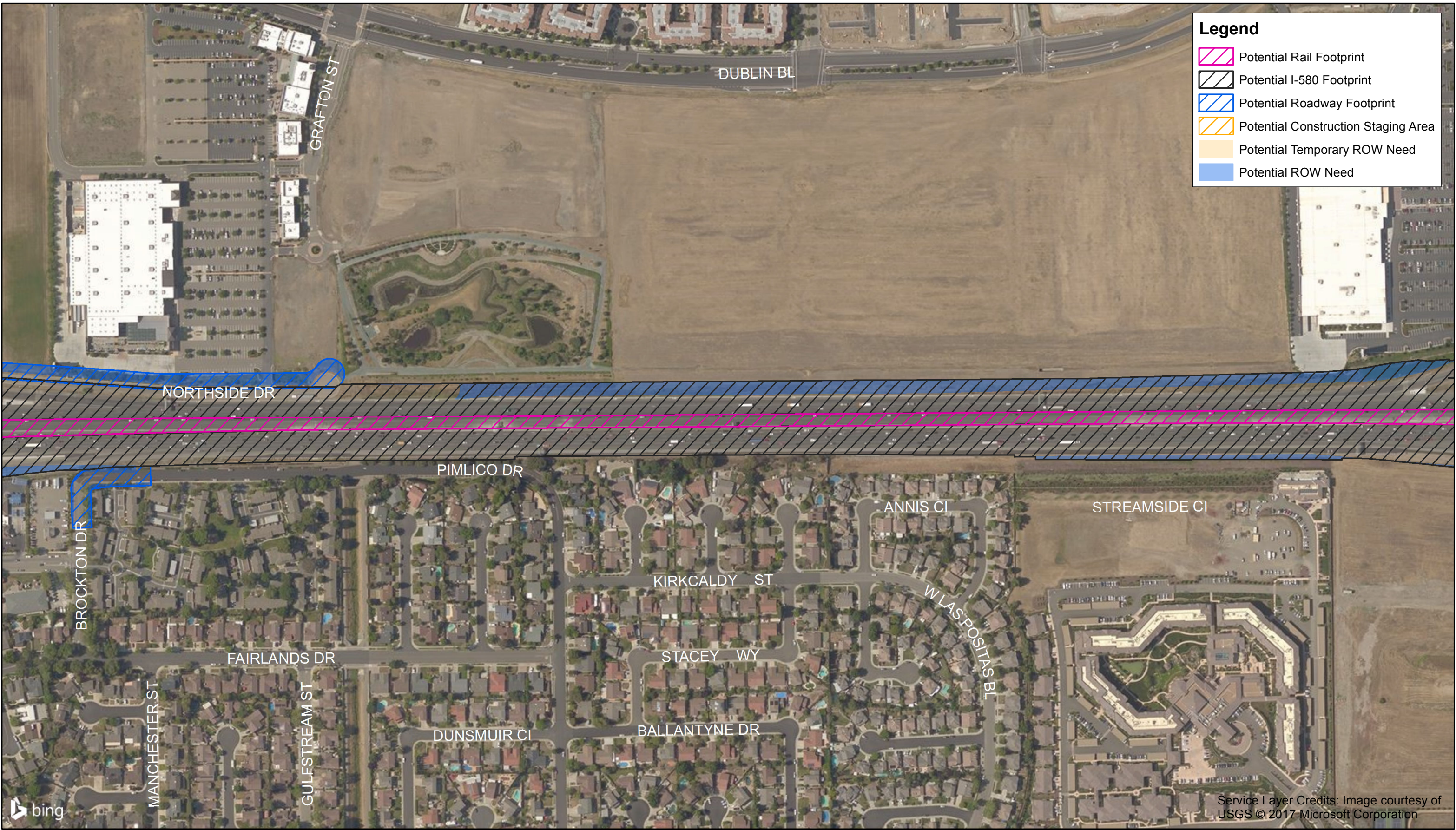


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

- Potential Rail Footprint
- Potential I-580 Footprint
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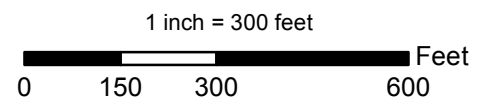
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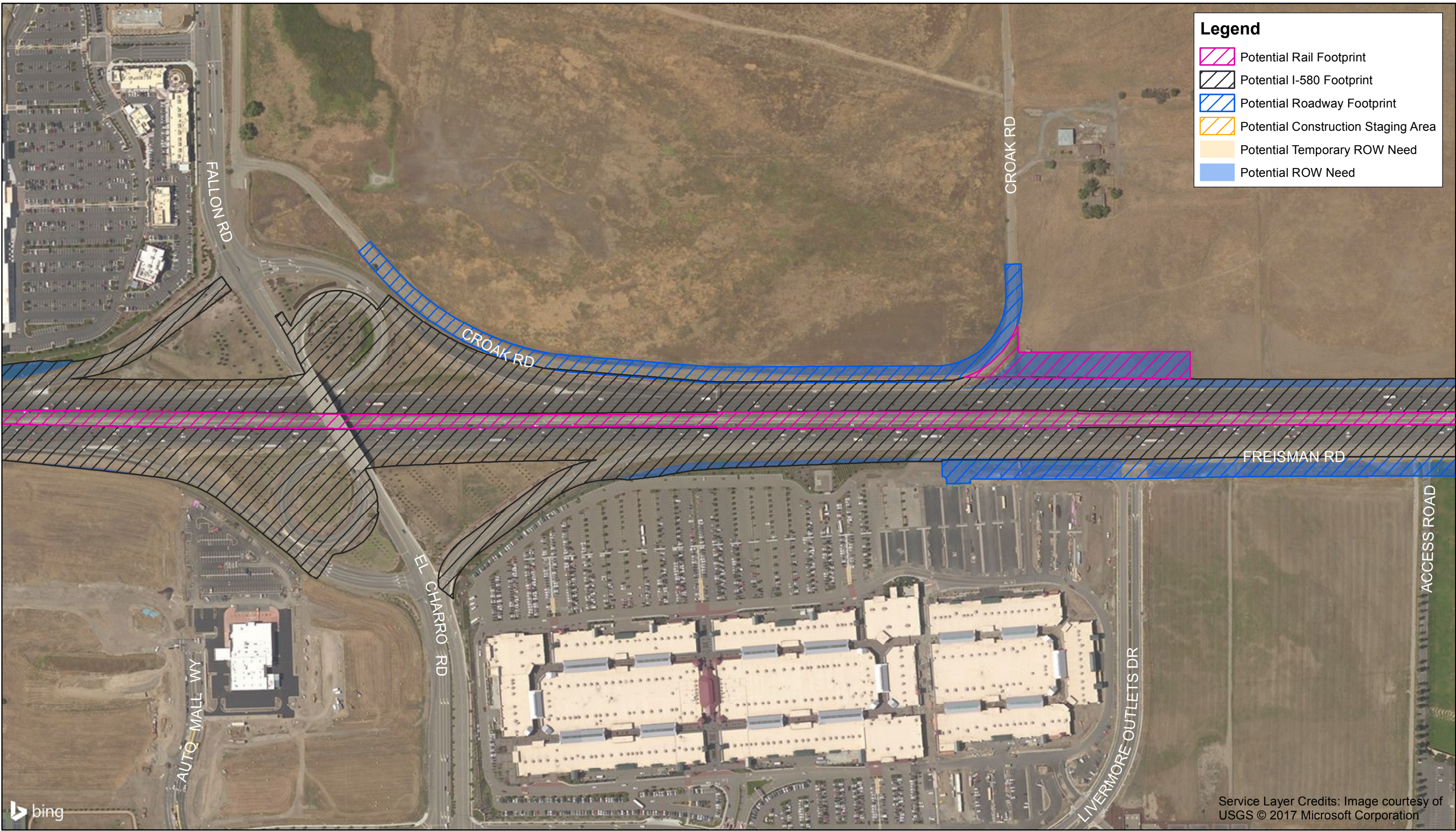
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San Francisco Bay Area Rapid Transit District
BART to Livermore Extension
Proposed Project - Conventional BART



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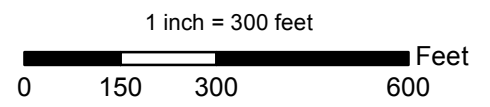
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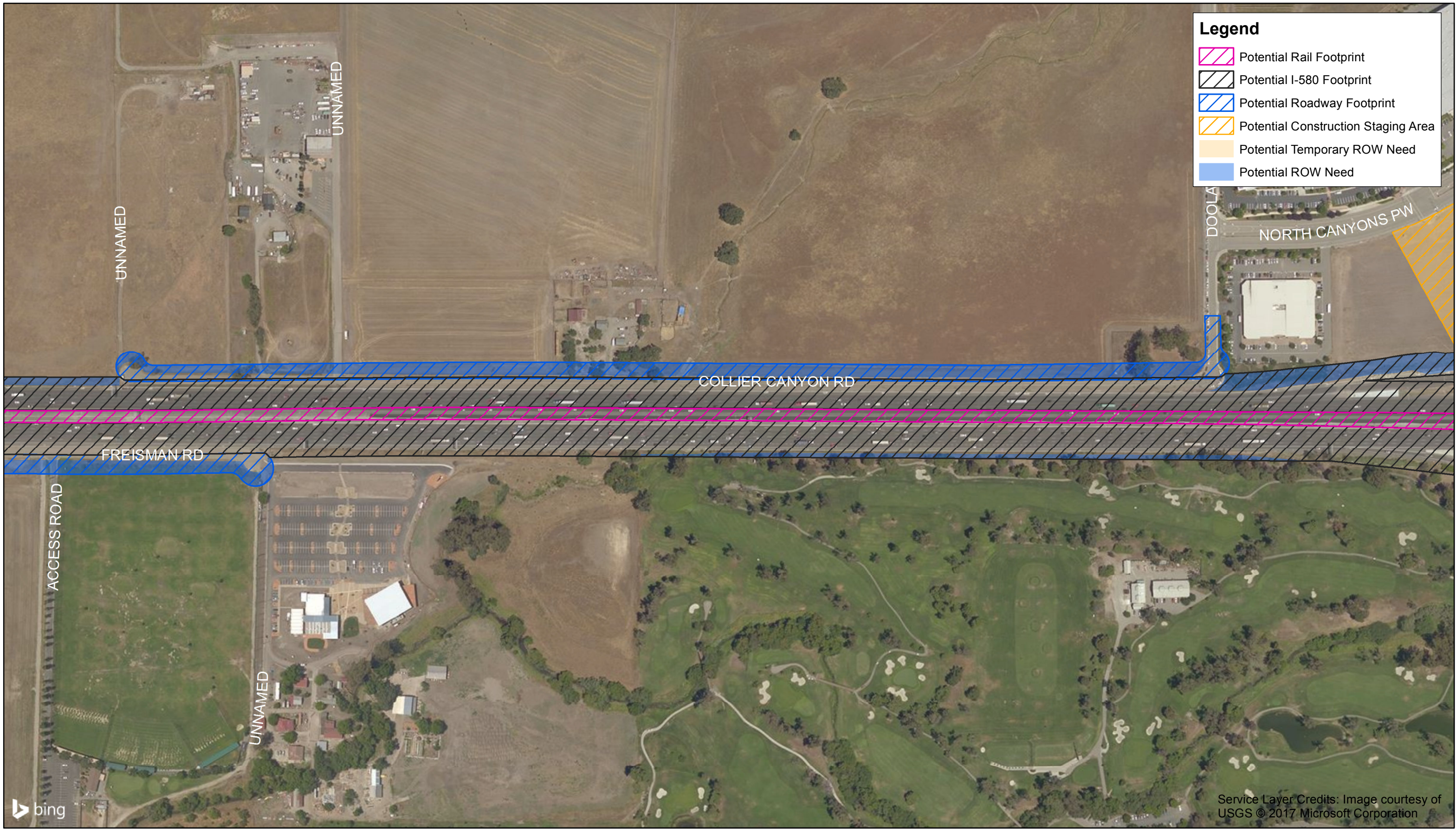
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San Francisco Bay Area Rapid Transit District
BART to Livermore Extension
Proposed Project - Conventional BART



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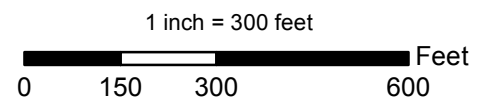
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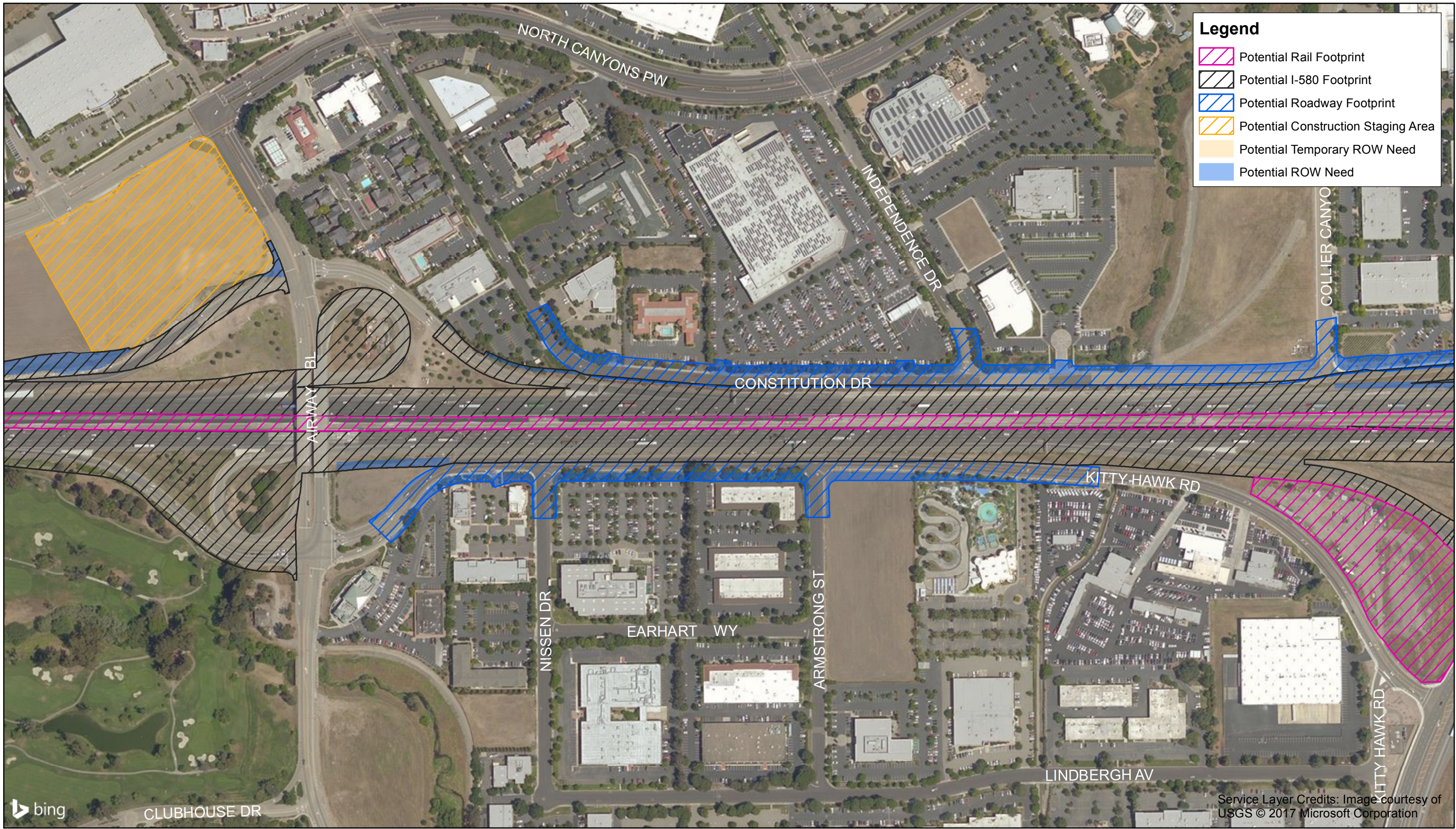
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San Francisco Bay Area Rapid Transit District
BART to Livermore Extension
Proposed Project - Conventional BART

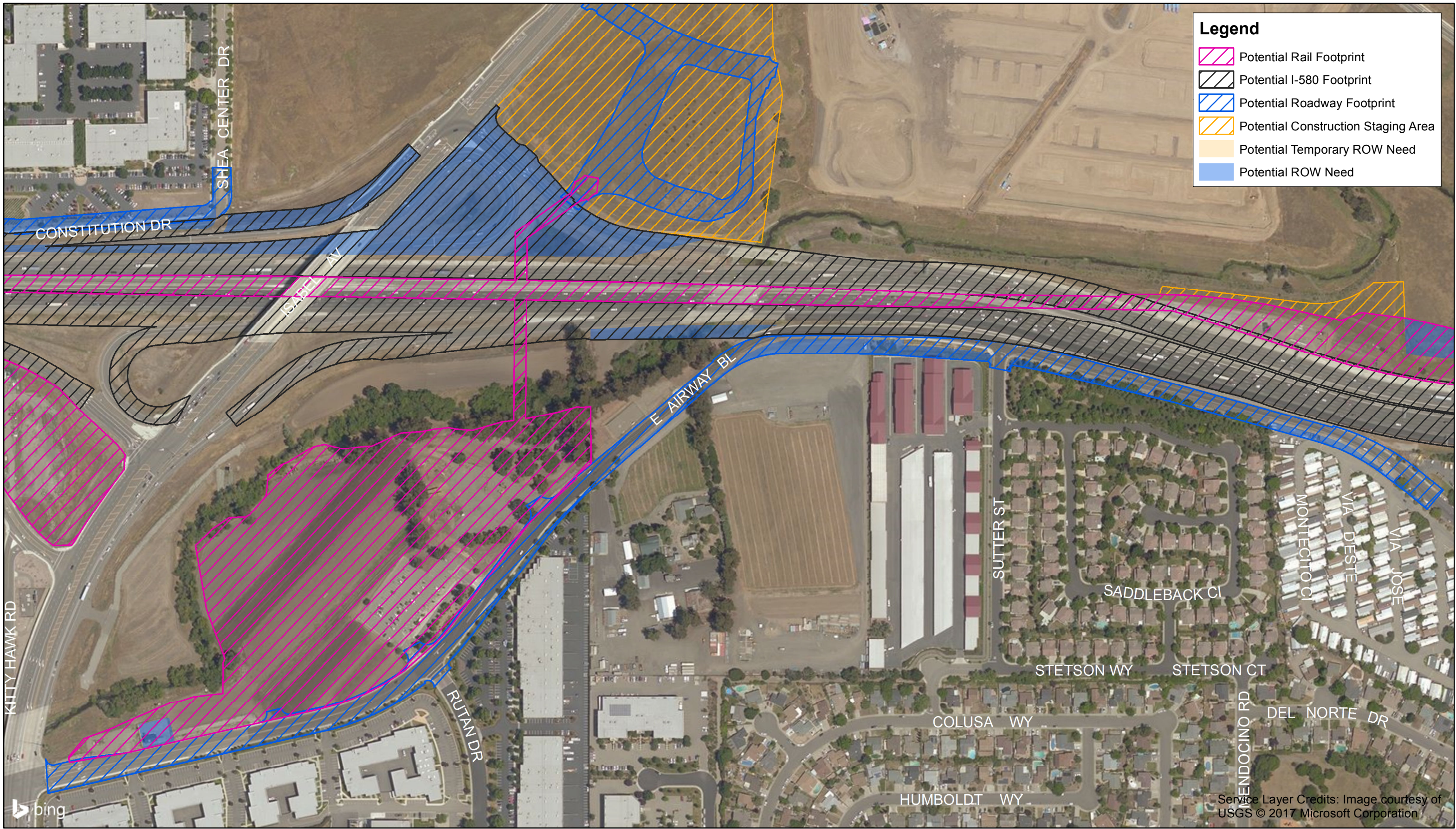


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

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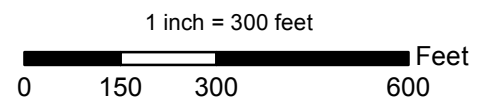
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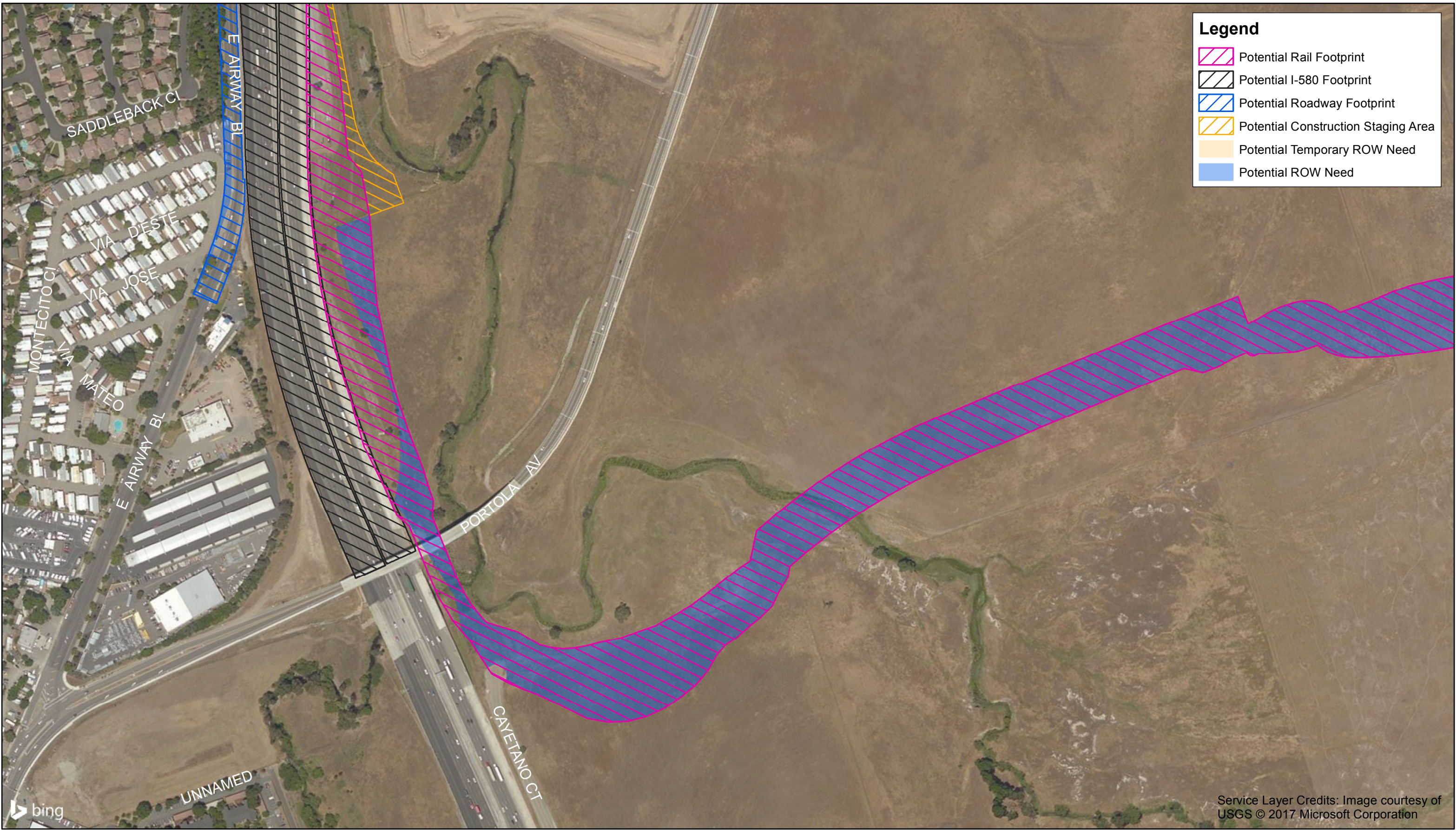
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San Francisco Bay Area Rapid Transit District
BART to Livermore Extension
Proposed Project - Conventional BART



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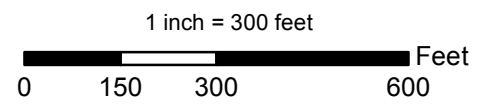
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**San Francisco Bay Area Rapid Transit District
BART to Livermore Extension
Proposed Project - Conventional BART**

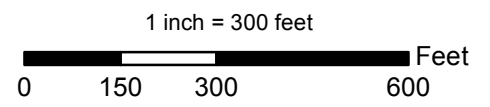


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
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**San Francisco Bay Area Rapid Transit District
BART to Livermore Extension
Proposed Project - Conventional BART**



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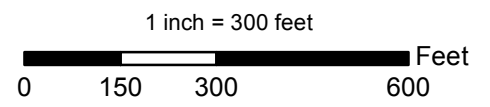
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**San Francisco Bay Area Rapid Transit District
BART to Livermore Extension
Proposed Project - Conventional BART**



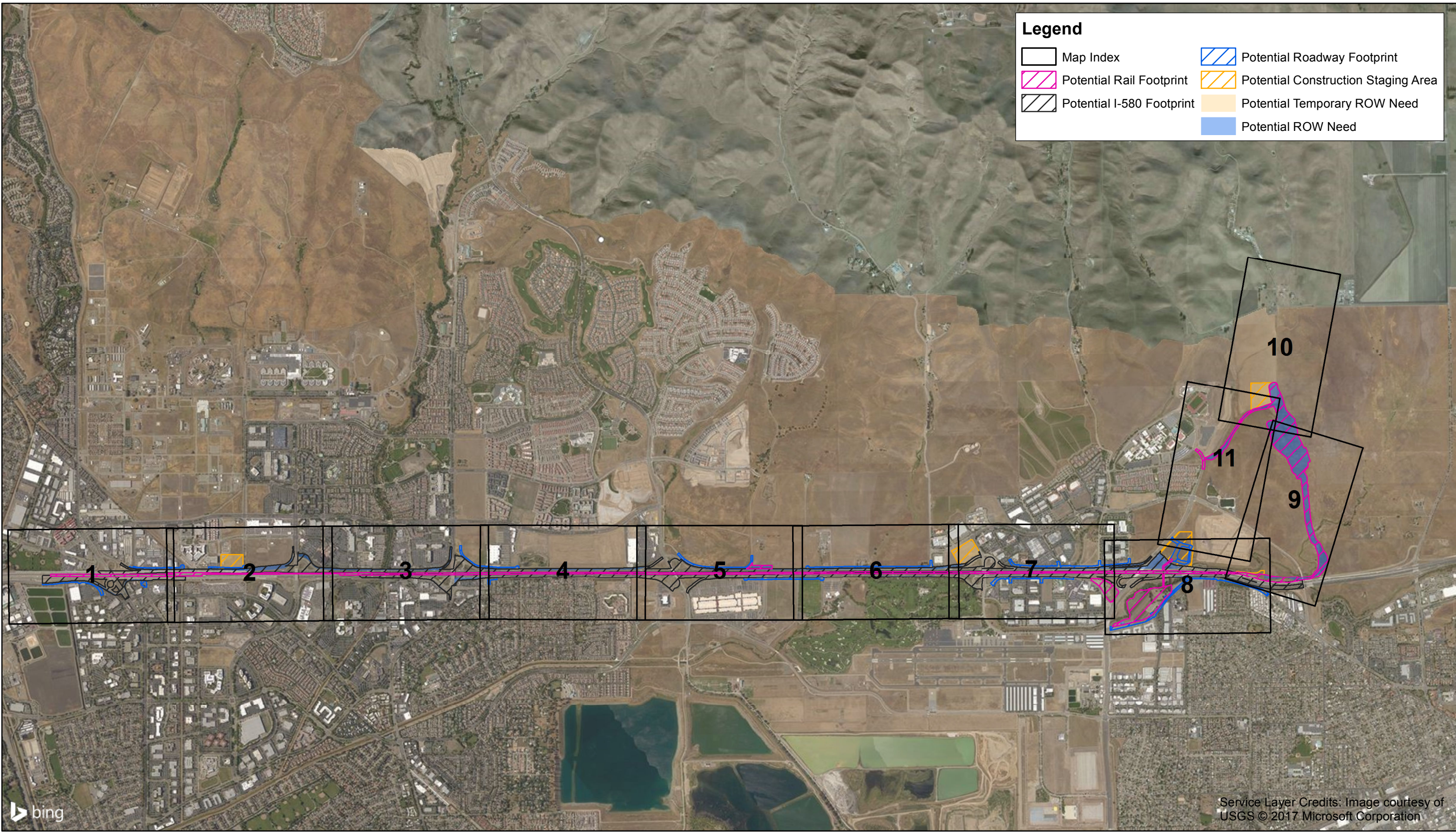
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B.2 Footprint Map Books – DMU Alternative



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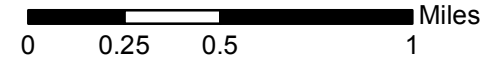
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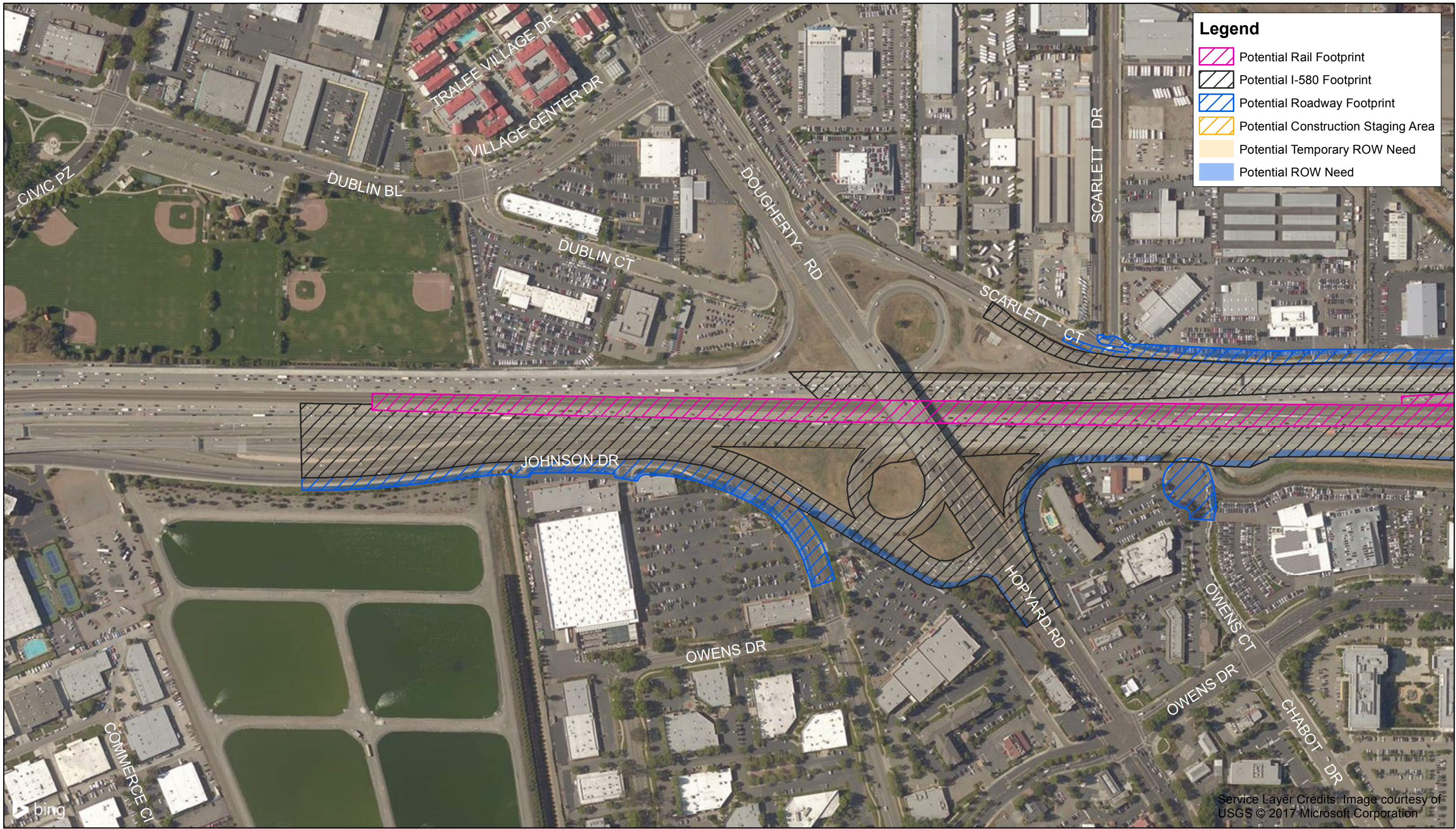


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1 inch = 0.5 miles



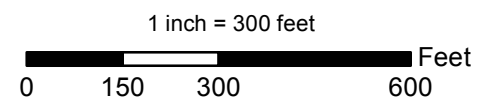
**San Francisco Bay Area Rapid Transit District
BART to Livermore Extension
DMU Alternative
(Same for EMU Option)
Index**

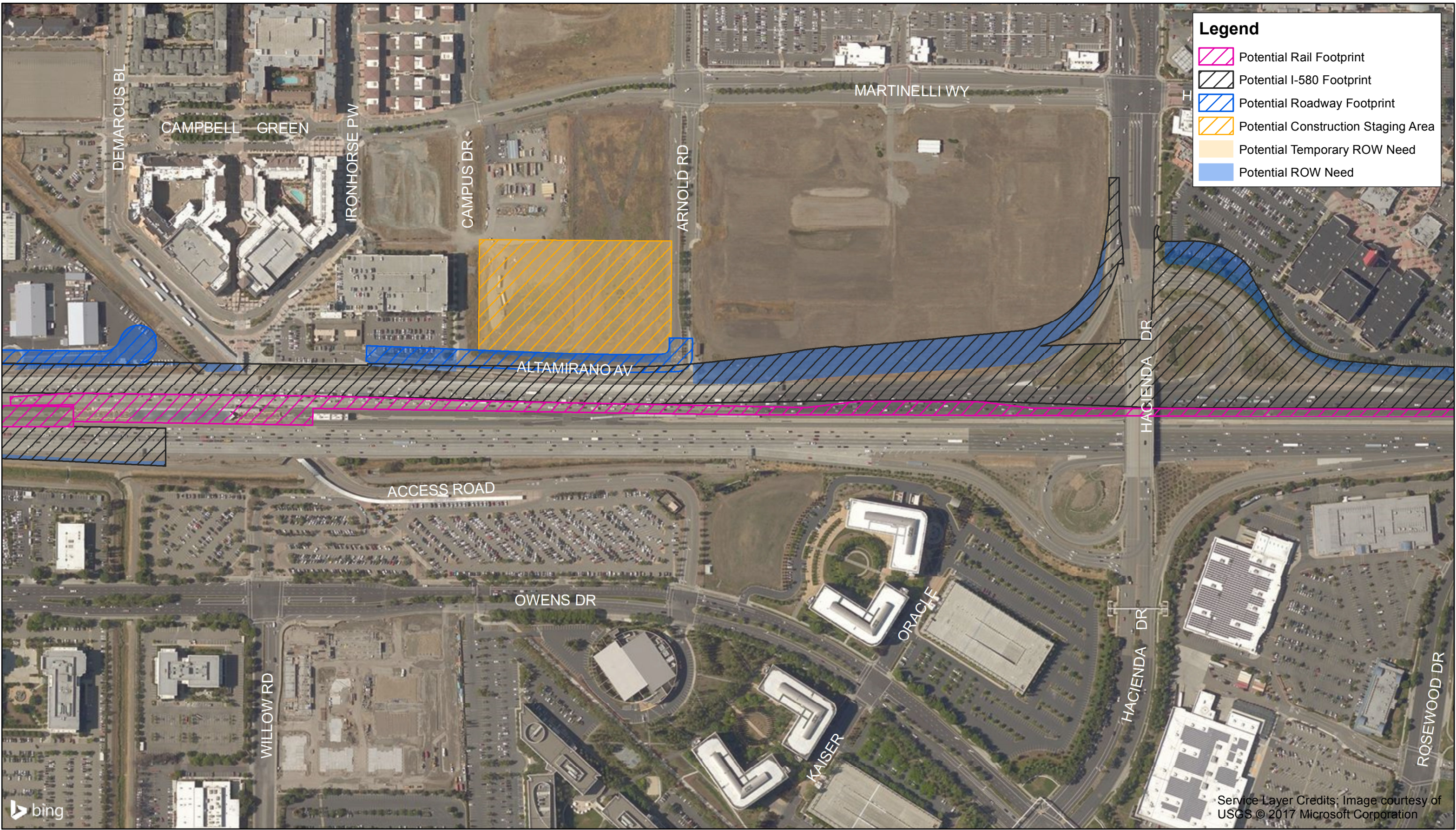


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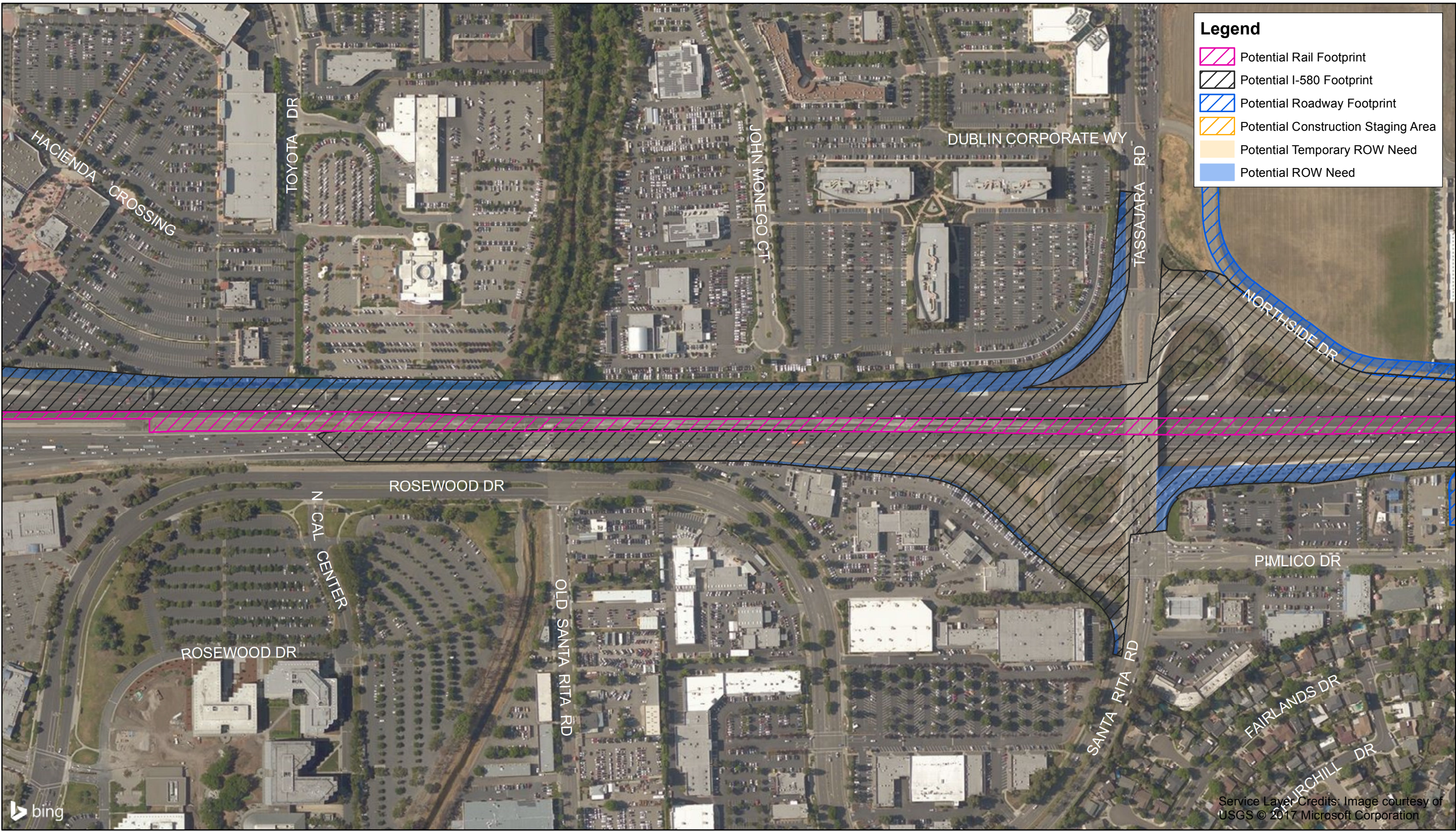


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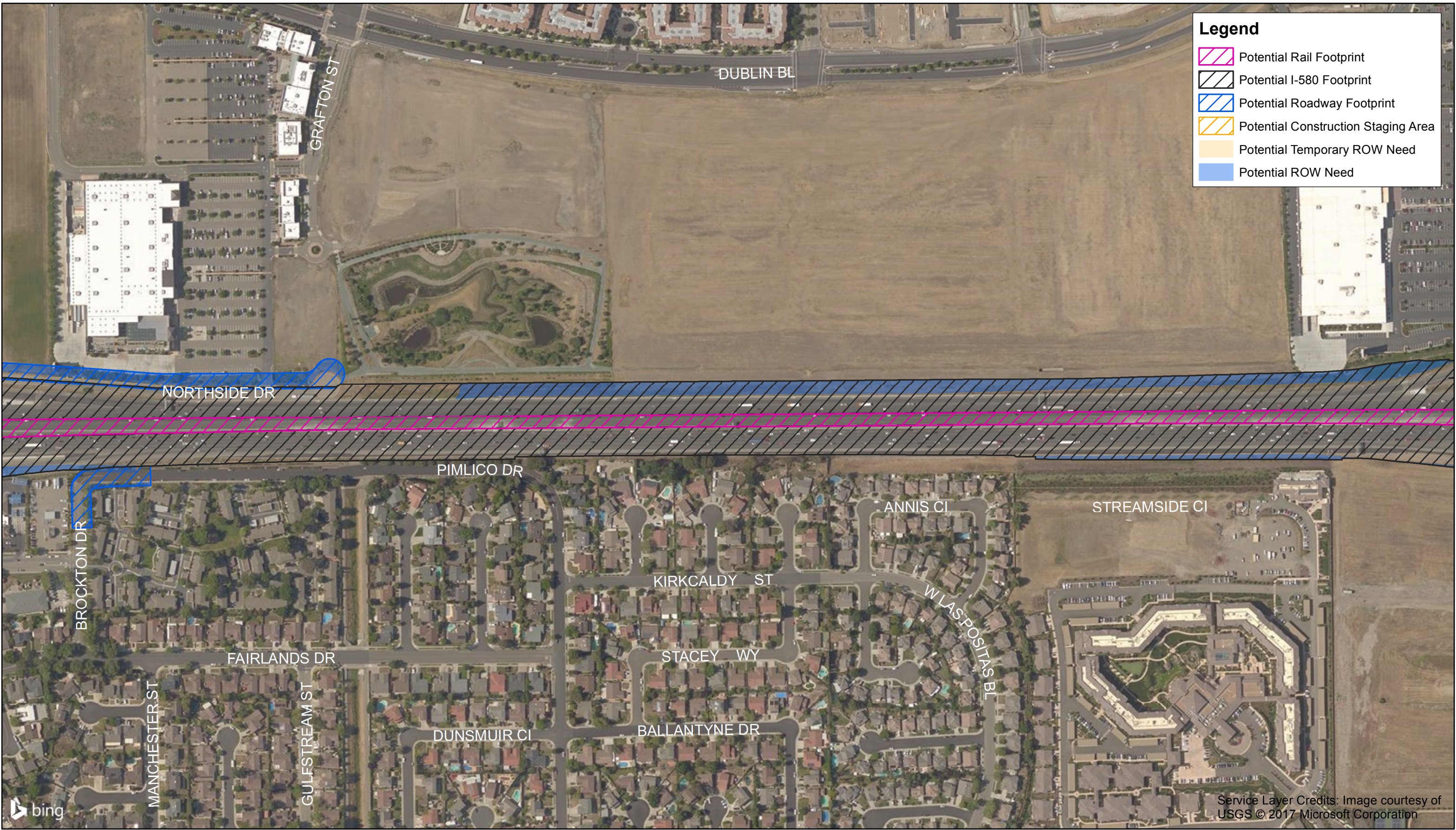


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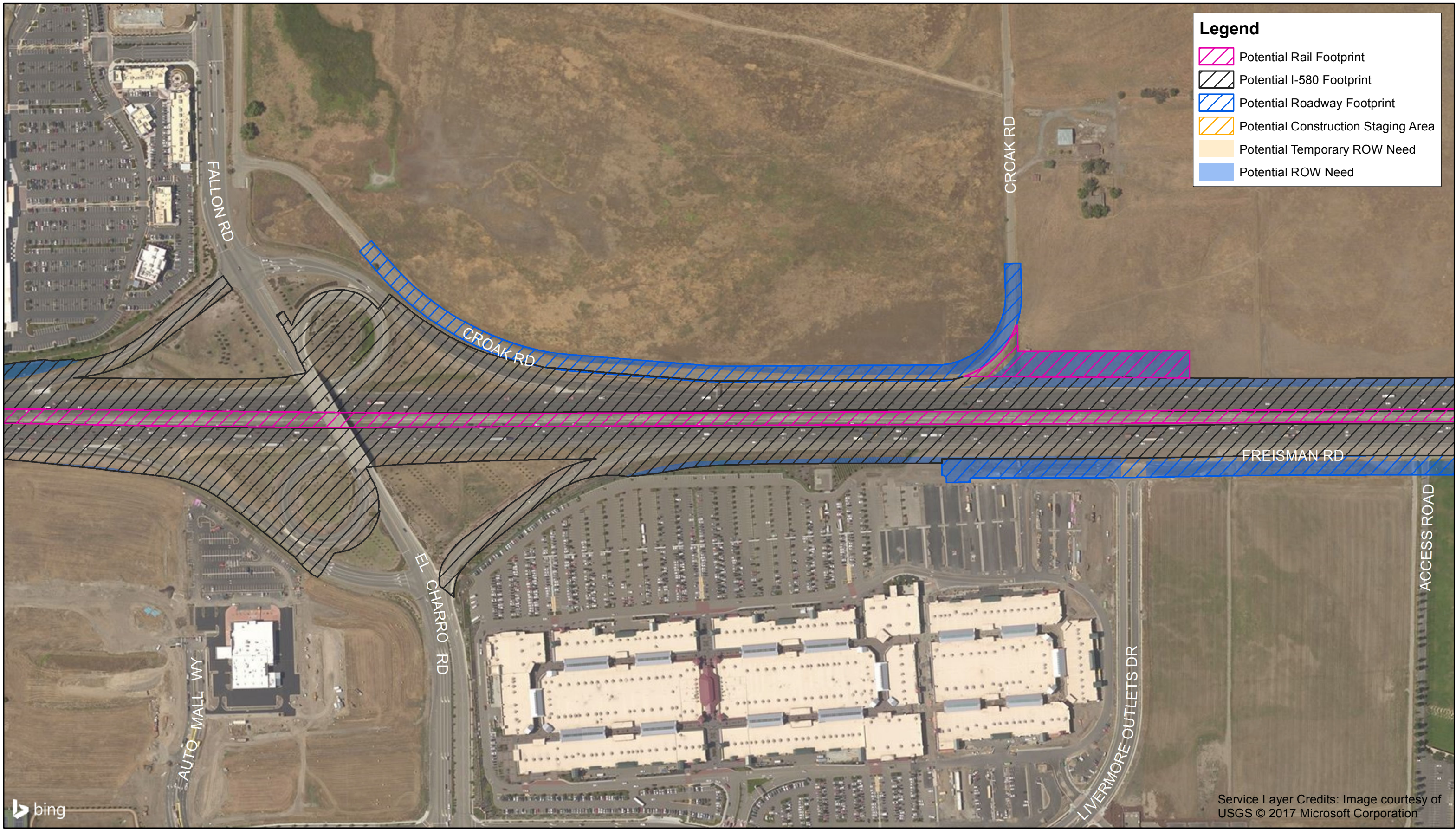
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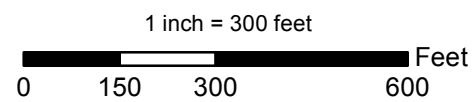


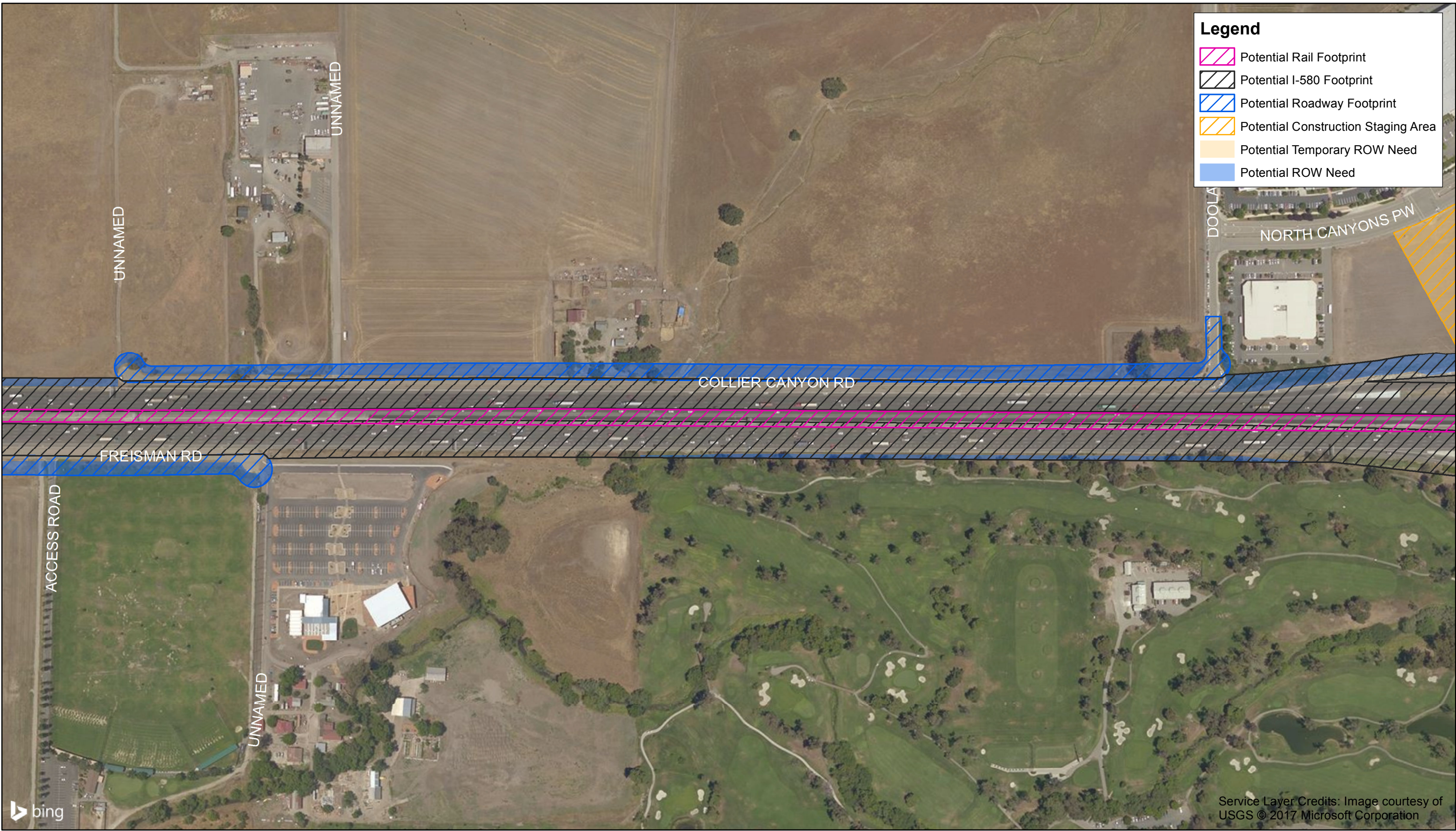
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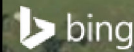
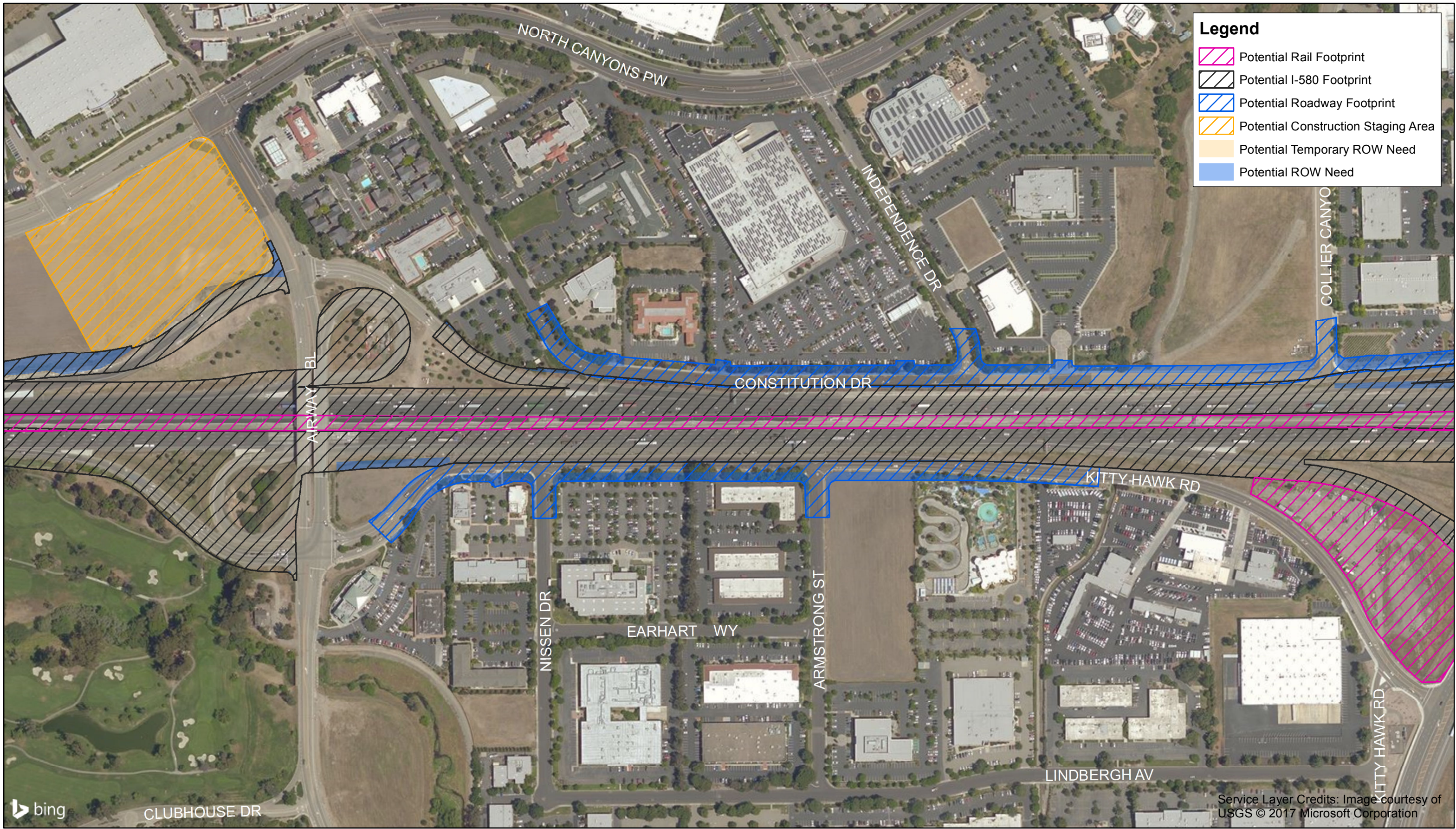


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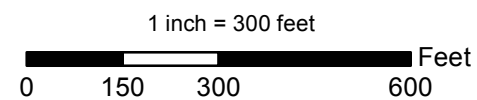
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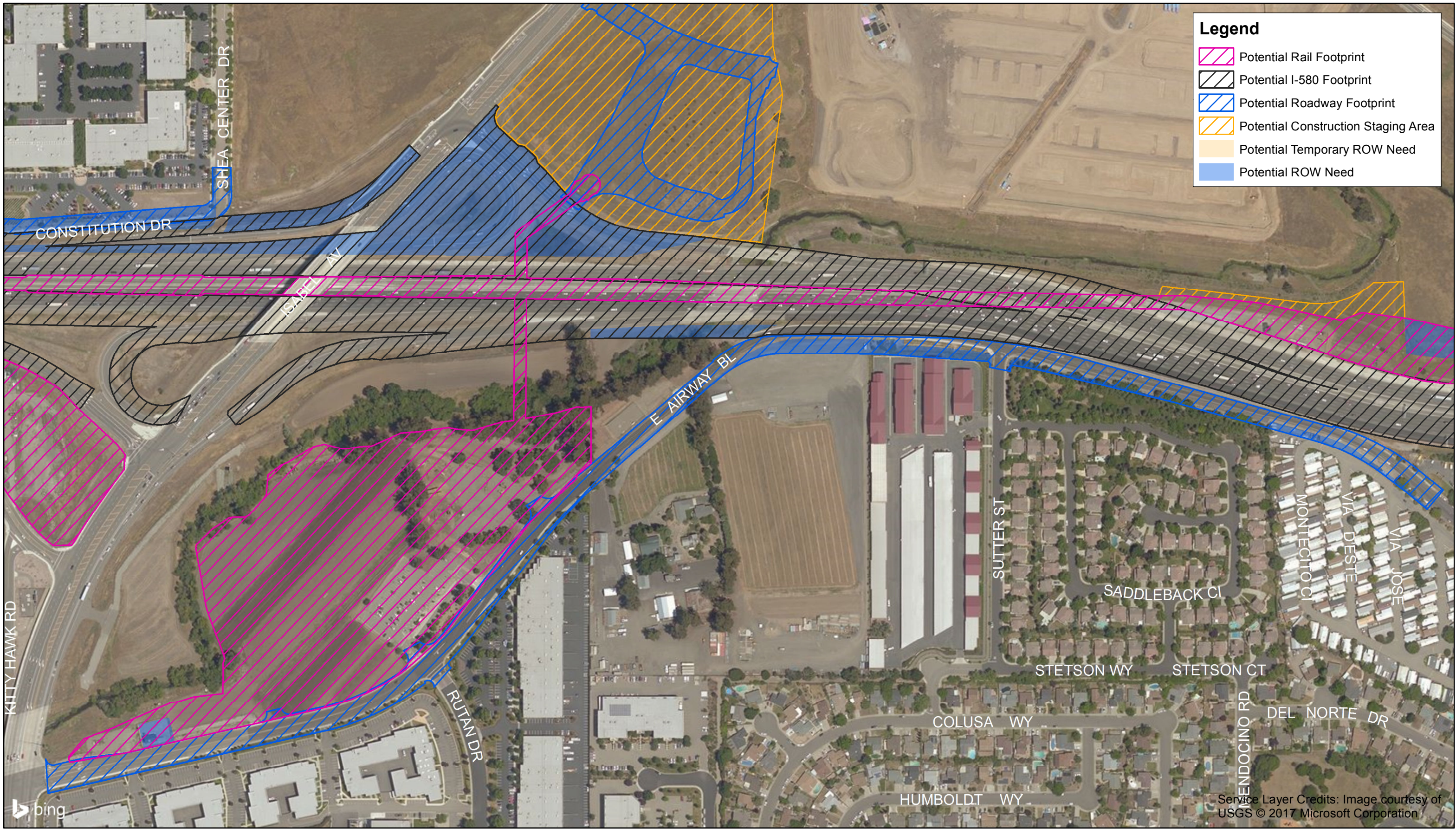


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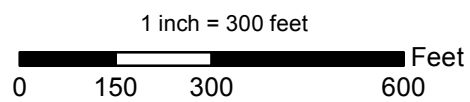


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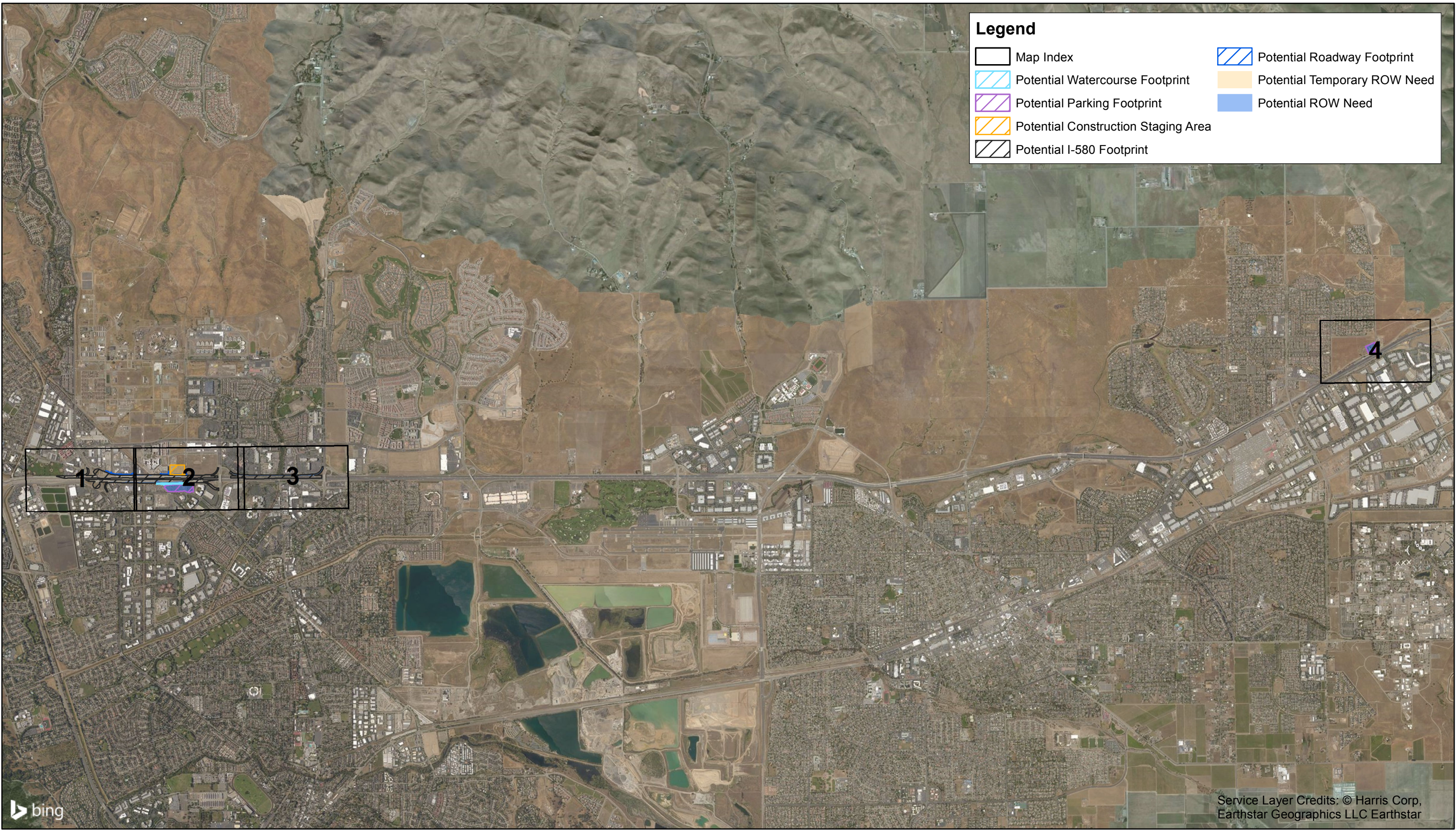











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B.3 Footprint Map Books – Express Bus/ BRT Alternative

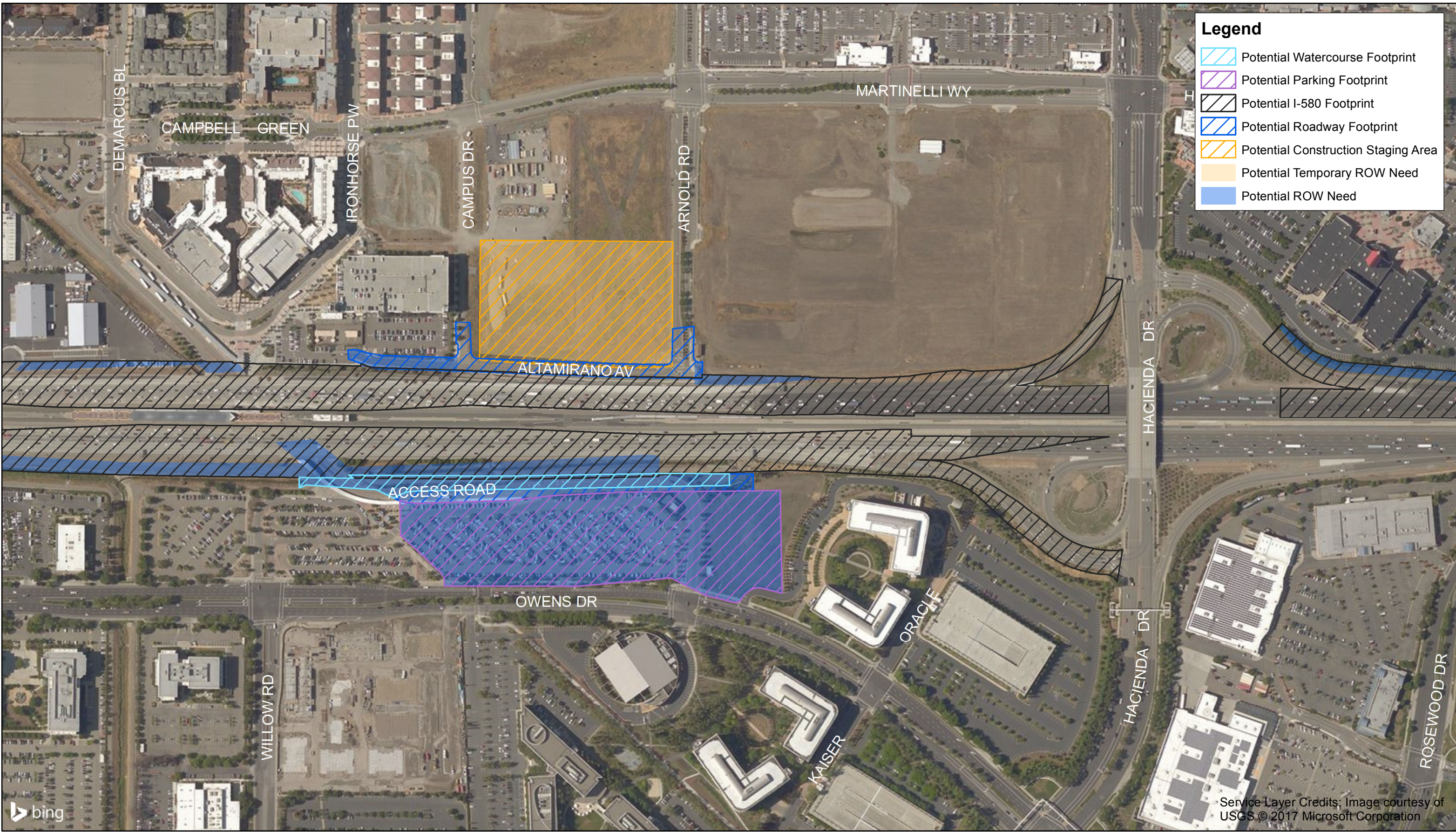











- Legend**
-  Potential Watercourse Footprint
 -  Potential Parking Footprint
 -  Potential I-580 Footprint
 -  Potential Roadway Footprint
 -  Potential Construction Staging Area
 -  Potential Temporary ROW Need
 -  Potential ROW Need

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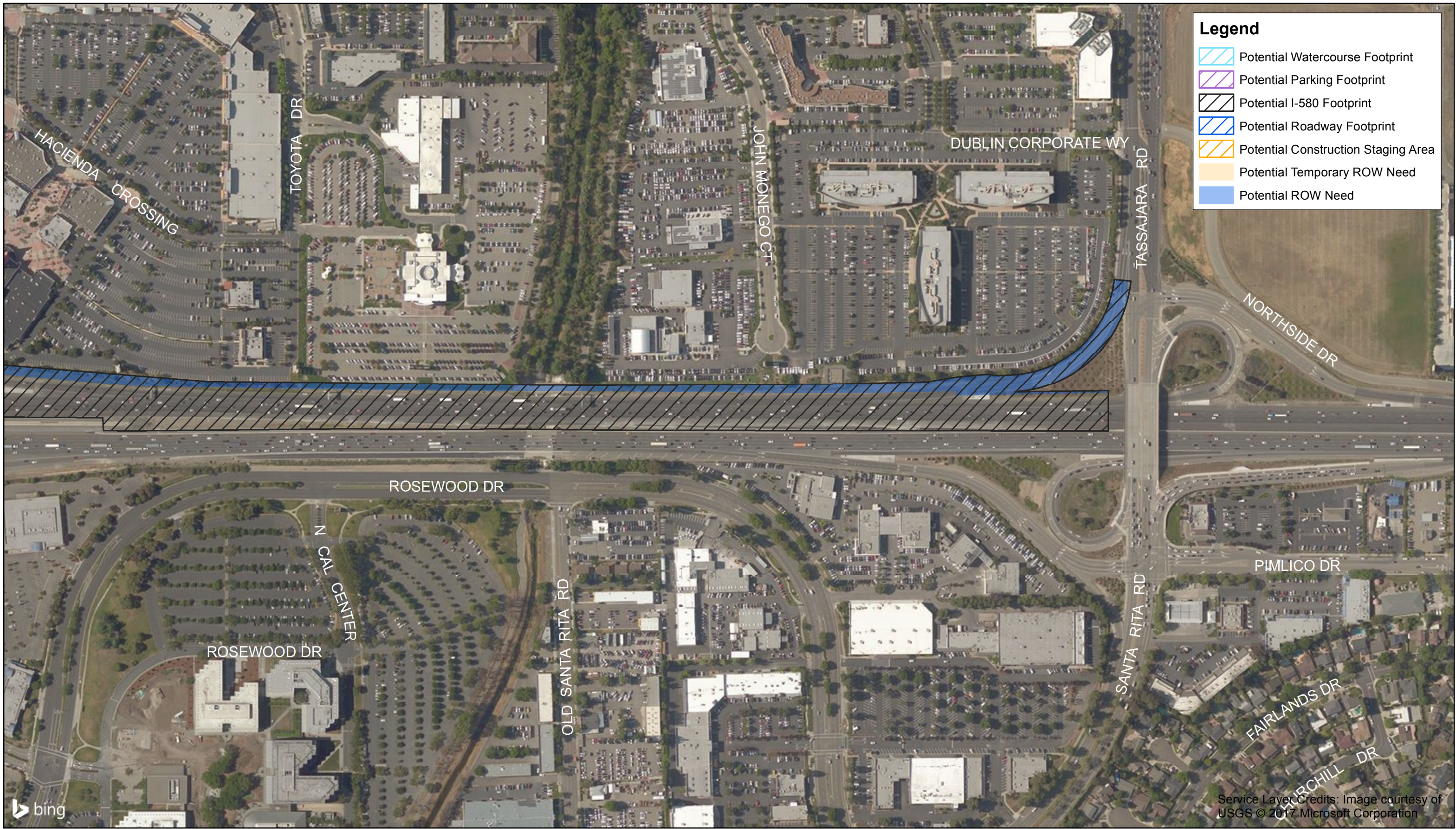
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- Legend**
-  Potential Watercourse Footprint
 -  Potential Parking Footprint
 -  Potential I-580 Footprint
 -  Potential Roadway Footprint
 -  Potential Construction Staging Area
 -  Potential Temporary ROW Need
 -  Potential ROW Need



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- Legend**
-  Potential Watercourse Footprint
 -  Potential Parking Footprint
 -  Potential I-580 Footprint
 -  Potential Roadway Footprint
 -  Potential Construction Staging Area
 -  Potential Temporary ROW Need
 -  Potential ROW Need

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APPENDIX C: RIGHT-OF-WAY INFORMATION

C.1 Proposed Project

C.2 DMU Alternative

C.3 Express Bus/BRT Alternative

C.1 Right-of-Way Information – Proposed Project

Conventional BART Project - Potential Land Acquisition

APN*	Parcel City	Approximate Percent of Parcel Needed for Permanent Project		Land Use
		Footprint	Parcel Address	
099 010001908	LIVERMORE	5.1% to 10.0%	LIVERMORE	Rural property used for agriculture, 10+ acres
099 013000202	LIVERMORE	1.0% to 5.0%	835 PORTOLA	Mobile home park parcel with improvements
099 133101104	LIVERMORE	1.0% to 5.0%	137 AIRWAY	Industrial Flex/R&D use
099 133101303	LIVERMORE	25.1% to 50.0%	283 AIRWAY	Industrial Flex/R&D use
099 133101403	LIVERMORE	1.0% to 5.0%	283 AIRWAY	Industrial Flex/R&D use
099 133102304	LIVERMORE	10.1% to 25.0%	1 AIRWAY	Exempt Public Agency
099 133102305	LIVERMORE	1.0% to 5.0%	1 AIRWAY	Industrial Flex/R&D use
099 133102404	LIVERMORE	1.0% to 5.0%	51 AIRWAY	Industrial Flex/R&D use
099 133102503	LIVERMORE	1.0% to 5.0%	95 AIRWAY	Industrial Flex/R&D use
099 133102800	LIVERMORE	1.0% to 5.0%	487 AIRWAY	Rural property used for agriculture, 10+ acres
099 134409100	LIVERMORE	1.0% to 5.0%	1800 SUTTER	Warehouse-Self Storage
099 134409200	LIVERMORE	5.1% to 10.0%	AIRWAY	SFR - Planned Development Tract, Common Area or use
903 000600304	LIVERMORE	Less than 1%	LIVERMORE	Rural property used for agriculture, 10+ acres
903 000600401	LIVERMORE	51.1% to 75%	1820 HARTMAN	Improved rural-residential homesite.
903 000600405	LIVERMORE	More than 75%	1790 HARTMAN	Improved rural-residential homesite.
903 000600408	LIVERMORE	10.1% to 25.0%	1650 HARTMAN	Rural property in transition to a higher use
903 000800101	LIVERMORE	1.0% to 5.0%	HARTMAN	Rural property in transition to a higher use
903 000800202	LIVERMORE	Less than 1%	LIVERMORE	Rural property in transition to a higher use
903 000800203	LIVERMORE	1.0% to 5.0%	LIVERMORE	Rural property in transition to a higher use
903 000800204	LIVERMORE	25.1% to 50.0%	LIVERMORE	Rural property in transition to a higher use
903 000800302	LIVERMORE	5.1% to 10.0%	LIVERMORE	Rural property used for agriculture, 10+ acres
903 000800401	LIVERMORE	1.0% to 5.0%	LIVERMORE	Rural property used for agriculture, 10+ acres
903 000900603	LIVERMORE	5.1% to 10.0%	US HWY 50 E	Government owned property - vacant land
903 000900604	LIVERMORE	1.0% to 5.0%	US HWY 50 E	Government owned property - vacant land
903 000900610	LIVERMORE	5.1% to 10.0%	US HWY 50 E	Rural property used for agriculture, 10+ acres
903 001000204	LIVERMORE	Less than 1%	COLLIER CANYON	Exempt Public Agency

Conventional BART Project - Potential Land Acquisition

APN*	Parcel City	Approximate Percent of Parcel Needed for Permanent Project		Land Use
		Footprint	Parcel Address	
903 001000300	LIVERMORE	More than 75%	COLLIER CANYON	Exempt Public Agency
903 001000601	LIVERMORE	More than 75%	COLLIER CANYON	Exempt Public Agency
903 001000602	LIVERMORE	10.1% to 25.0%	COLLIER CANYON	Industrial Flex/R&D use
903 001000701	LIVERMORE	More than 75%	CONSTITUTION	Exempt Public Agency
903 001000702	LIVERMORE	More than 75%	CONSTITUTION	Exempt Public Agency
903 001000703	LIVERMORE	5.1% to 10.0%	CONSTITUTION	One to five story office building
903 001001000	LIVERMORE	More than 75%	CONSTITUTION	Exempt Public Agency
903 001002401	LIVERMORE	1.0% to 5.0%	PORTOLA	Single family residential (tract) common area or use
903 001002402	LIVERMORE	1.0% to 5.0%	PORTOLA	Single family residential (tract) common area or use
903 001003601	LIVERMORE	51.1% to 75%	PORTOLA	Exempt Public Agency
903 001003602	LIVERMORE	1.0% to 5.0%	PORTOLA	Exempt Public Agency
903 001003701	LIVERMORE	51.1% to 75%	PORTOLA	Exempt Public Agency
903 001004000	LIVERMORE	5.1% to 10.0%	PORTOLA	Vacant residential tract lot
903 001005400	LIVERMORE	Less than 1%	PORTOLA	Vacant industrial land (may include misc. imps)
903 001400700	LIVERMORE	Less than 1%	PORTOLA	Vacant commercial land (may include misc. imps)
904 000100112	LIVERMORE	Less than 1%	US HWY 50 W	Church
904 000100314	LIVERMORE	1.0% to 5.0%	1780 FREISMAN	Golf course
904 000101102	LIVERMORE	1.0% to 5.0%	FREISMAN	Vacant industrial land (may include misc. imps)
904 000200600	LIVERMORE	Less than 1%	909 CLUB HOUSE	Exempt Public Agency
904 000401001	LIVERMORE	5.1% to 10.0%	2650 KITTY HAWK	Other recreational activity, e.g. rinks, stadiums
904 000401002	LIVERMORE	5.1% to 10.0%	2600 KITTY HAWK	Warehouse
904 000401804	LIVERMORE	1.0% to 5.0%	2348 KITTY HAWK	Automobile dealership
904 000405400	LIVERMORE	1.0% to 5.0%	2400 KITTY HAWK	Other recreational activity, e.g. rinks, stadiums
904 000405700	LIVERMORE	5.1% to 10.0%	2474 NISSEN	Shopping Center-NBHD without anchor (strip mall)
904 000406700	LIVERMORE	1.0% to 5.0%	ARMSTRONG	Vacant industrial land (may include misc. imps)
904 000500330	LIVERMORE	More than 75%	200 AIRWAY	Exempt Public Agency
904 000500407	LIVERMORE	10.1% to 25.0%	US HWY 50 E	Vacant rural-res homesites, may incl misc. imps
904 001100100	LIVERMORE	1.0% to 5.0%	KITTY HAWK	Exempt Public Agency
904 001100200	LIVERMORE	1.0% to 5.0%	881 AIRWAY	Shopping Center-NBHD without anchor (strip mall)
904 001100300	LIVERMORE	10.1% to 25.0%	KITTY HAWK	Exempt Public Agency

Conventional BART Project - Potential Land Acquisition

APN*	Parcel City	Approximate Percent of Parcel Needed for Permanent Project		Land Use
		Footprint	Parcel Address	
904 001301200	LIVERMORE	1.0% to 5.0%	2774 LIVERMORE OUTLETS #2768	Shopping Center-Regional Mall
905 000100102	LIVERMORE	1.0% to 5.0%	US HWY 50 W	Rural property used for agriculture, 10+ acres
905 000100202	LIVERMORE	25.1% to 50.0%	3000 DOOLAN	Exempt Public Agency
905 000100302	LIVERMORE	1.0% to 5.0%	1421 COLLIER CANYON	Rural property used for agriculture, 10+ acres
905 000100403	DUBLIN	1.0% to 5.0%	2061 COLLIER CANYON	Vacant industrial land (may include misc. imps)
905 000100404	DUBLIN	Less than 1%	1881 COLLIER CANYON	Residential Imps on Industrial Land
905 000100502	DUBLIN	1.0% to 5.0%	US HWY 50 W	Vacant industrial land (may include misc. imps)
905 000100603	DUBLIN	1.0% to 5.0%	3457 CROAK	Residential Imps on Industrial Land
905 000901303	LIVERMORE	5.1% to 10.0%	COLLIER CANYON	Vacant industrial land (may include misc. imps)
905 000902701	LIVERMORE	1.0% to 5.0%	2800 INDEPENDENCE	Discount store
905 000905702	LIVERMORE	25.1% to 50.0%	US HWY 50 W	Exempt Public Agency
905 000906000	LIVERMORE	10.1% to 25.0%	2705 CONSTITUTION	One to five story office building
905 000908100	LIVERMORE	1.0% to 5.0%	2772 CONSTITUTION	Condominium-commercial retail, common area or use
905 001501700	LIVERMORE	5.1% to 10.0%	CONSTITUTION	One to five story office building
905 001501800	LIVERMORE	1.0% to 5.0%	CONSTITUTION	Vacant industrial land (may include misc. imps)
905 001502600	LIVERMORE	5.1% to 10.0%	2620 COLLIER CANYON	Vacant industrial land (may include misc. imps)
905 001502700	LIVERMORE	5.1% to 10.0%	2620 COLLIER CANYON	Vacant industrial land (may include misc. imps)
905 001608800	LIVERMORE	10.1% to 25.0%	COLLIER CANYON	Condominium-commercial retail, common area or use
941 277900900	PLEASANTON	Less than 1%	4515 ROSEWOOD	Shopping Center-NBHD/grocery anchor
941 278002402	PLEASANTON	Less than 1%	580 INTERSTATE	Exempt Public Agency
946 110002103	PLEASANTON	5.1% to 10.0%	3992 SANTA RITA	Exempt Public Agency
946 110002202	PLEASANTON	1.0% to 5.0%	4355 ROSEWOOD	Automobile dealership
946 110002302	PLEASANTON	1.0% to 5.0%	4345 ROSEWOOD	Automobile dealership
946 110004300	PLEASANTON	Less than 1%	4283 ROSEWOOD	Shopping Center-NBHD/grocery anchor
946 110100803	PLEASANTON	More than 75%	PIMLICO	Exempt Public Agency
946 110101501	PLEASANTON	More than 75%	SANTA RITA	Exempt Public Agency

Conventional BART Project - Potential Land Acquisition

APN*	Parcel City	Approximate Percent of Parcel Needed for Permanent Project		Land Use
		Footprint	Parcel Address	
946 110101502	PLEASANTON	1.0% to 5.0%	6800 SANTA RITA	Restaurant
946 110102901	PLEASANTON	1.0% to 5.0%	PIMLICO	Vacant commercial land (may include misc. imps)
946 110102902	PLEASANTON	More than 75%	PIMLICO	Exempt Public Agency
946 110103101	PLEASANTON	Less than 1%	PIMLICO	Exempt Public Agency
946 110103102	PLEASANTON	1.0% to 5.0%	4003 PIMLICO	Automobile dealership
946 110103501	PLEASANTON	51.1% to 75%	PIMLICO	Exempt Public Agency
946 110103603	PLEASANTON	25.1% to 50.0%	PIMLICO	Exempt Public Agency
946 112017200	PLEASANTON	5.1% to 10.0%	PIMLICO	Exempt Public Agency
946 112017300	PLEASANTON	1.0% to 5.0%	PIMLICO	Townhouse - Planned Development, Common Area or use
946 462300806	PLEASANTON	Less than 1%	3300 STONERIDGE CREEK	Multiple residential building of 5 or more units.
946 462300904	PLEASANTON	1.0% to 5.0%	3300 STONERIDGE CREEK	Vacant apartment land, capable of 5 or more units
946 462301000	PLEASANTON	Less than 1%	2750 STONERIDGE	Vacant commercial land (may include misc. imps)
985 002700200	DUBLIN	Less than 1%	FALLON	Vacant commercial land (may include misc. imps)
985 002700300	DUBLIN	Less than 1%	US HWY 50 W	Vacant commercial land (may include misc. imps)
985 002700400	DUBLIN	25.1% to 50.0%	3410 CROAK	Vacant industrial land (may include misc. imps)
985 002700500	DUBLIN	More than 75%	CROAK	Vacant commercial land (may include misc. imps)
985 002700902	DUBLIN	1.0% to 5.0%	LOCKHART	Vacant commercial land (may include misc. imps)
985 005100400	DUBLIN	1.0% to 5.0%	TASSAJARA	Rural property in transition to a higher use
985 005100500	DUBLIN	1.0% to 5.0%	TASSAJARA	Rural property in transition to a higher use
985 006100100	DUBLIN	More than 75%	US HWY 50 WEST	Vacant rural-res homesites, may incl misc. imps
985 006100400	DUBLIN	5.1% to 10.0%	DUBLIN	Condominium-office, common area or use
985 006100500	DUBLIN	1.0% to 5.0%	DUBLIN	Vacant commercial land (may include misc. imps)
985 006100700	DUBLIN	5.1% to 10.0%	DUBLIN	Shopping Center-Power Center
985 006101500	DUBLIN	5.1% to 10.0%	DUBLIN	Shopping Center-Power Center
985 007900103	DUBLIN	1.0% to 5.0%	3620 FALLON	Shopping Center-Community
985 007900600	DUBLIN	10.1% to 25.0%	3620 FALLON	Shopping Center-NBHD/grocery anchor

Conventional BART Project - Potential Land Acquisition

APN*	Parcel City	Approximate Percent of Parcel Needed for Permanent Project		Land Use
		Footprint	Parcel Address	
986 000800100	DUBLIN	Less than 1%	5000 DUBLIN	Shopping Center-NBHD/grocery anchor
986 000801700	DUBLIN	1.0% to 5.0%	4808 DUBLIN #2	Shopping Center-NBHD/grocery anchor
986 001600401	DUBLIN	1.0% to 5.0%	4200 JOHN MONEGO	Automobile dealership
986 001601300	DUBLIN	1.0% to 5.0%	4140 DUBLIN	One to five story office building
986 001601600	DUBLIN	Less than 1%	TASSAJARA	Exempt Public Agency
986 001601700	DUBLIN	51.1% to 75%	TASSAJARA	Government owned property - vacant land
986 001601800	DUBLIN	1.0% to 5.0%	DUBLIN	Exempt Public Agency
986 001602300	DUBLIN	1.0% to 5.0%	DUBLIN	Vacant commercial land (may include misc. imps)
986 001602400	DUBLIN	1.0% to 5.0%	4321 TOYOTA	Automobile dealership

* Note: Parcels are listed by APN from least to greatest.

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C.2 Right-of-Way Information – DMU Alternative

DMU Alternative - Potential Land Acquisition

APN*	Parcel City	Approximate Percent of Parcel Needed for Permanent Project		Land Use
		Footprint	Parcel Address	
099 010001908	LIVERMORE	5.1% to 10.0%	LIVERMORE	Rural property used for agriculture, 10+ acres
099 013000202	LIVERMORE	1.0% to 5.0%	835 PORTOLA	Mobile home park parcel with improvements
099 133101104	LIVERMORE	1.0% to 5.0%	137 AIRWAY	Industrial Flex/R&D use
099 133101303	LIVERMORE	25.1% to 50.0%	283 AIRWAY	Industrial Flex/R&D use
099 133101403	LIVERMORE	1.0% to 5.0%	283 AIRWAY	Industrial Flex/R&D use
099 133102304	LIVERMORE	10.1% to 25.0%	1 AIRWAY	Exempt Public Agency
099 133102305	LIVERMORE	1.0% to 5.0%	1 AIRWAY	Industrial Flex/R&D use
099 133102404	LIVERMORE	1.0% to 5.0%	51 AIRWAY	Industrial Flex/R&D use
099 133102503	LIVERMORE	1.0% to 5.0%	95 AIRWAY	Industrial Flex/R&D use
099 133102800	LIVERMORE	1.0% to 5.0%	487 AIRWAY	Rural property used for agriculture, 10+ acres
099 134409100	LIVERMORE	1.0% to 5.0%	1800 SUTTER	Warehouse-Self Storage
099 134409200	LIVERMORE	5.1% to 10.0%	AIRWAY	SFR - Planned Development Tract, Common Area or use
903 000800101	LIVERMORE	10.1% to 25.0%	HARTMAN	Rural property in transition to a higher use
903 000800204	LIVERMORE	1.0% to 5.0%	LIVERMORE	Rural property in transition to a higher use
903 000800302	LIVERMORE	10.1% to 25.0%	LIVERMORE	Rural property used for agriculture, 10+ acres
903 000800401	LIVERMORE	5.1% to 10.0%	LIVERMORE	Rural property used for agriculture, 10+ acres
903 000900603	LIVERMORE	5.1% to 10.0%	US HWY 50 E	Government owned property - vacant land
903 000900604	LIVERMORE	1.0% to 5.0%	US HWY 50 E	Government owned property - vacant land
903 000900610	LIVERMORE	5.1% to 10.0%	US HWY 50 E	Rural property used for agriculture, 10+ acres
903 001000204	LIVERMORE	Less than 1%	COLLIER CANYON	Exempt Public Agency
903 001000300	LIVERMORE	More than 75%	COLLIER CANYON	Exempt Public Agency
903 001000601	LIVERMORE	More than 75%	COLLIER CANYON	Exempt Public Agency
903 001000602	LIVERMORE	10.1% to 25.0%	COLLIER CANYON	Industrial Flex/R&D use
903 001000701	LIVERMORE	More than 75%	CONSTITUTION	Exempt Public Agency
903 001000702	LIVERMORE	More than 75%	CONSTITUTION	Exempt Public Agency
903 001000703	LIVERMORE	5.1% to 10.0%	CONSTITUTION	One to five story office building
903 001001000	LIVERMORE	More than 75%	CONSTITUTION	Exempt Public Agency
903 001002401	LIVERMORE	1.0% to 5.0%	PORTOLA	Single family residential (tract) common area or use
903 001002402	LIVERMORE	1.0% to 5.0%	PORTOLA	Single family residential (tract) common area or use
903 001003601	LIVERMORE	51.1% to 75%	PORTOLA	Exempt Public Agency
903 001003602	LIVERMORE	1.0% to 5.0%	PORTOLA	Exempt Public Agency

DMU Alternative - Potential Land Acquisition

APN*	Parcel City	Approximate Percent of Parcel Needed for Permanent Project		Parcel Address	Land Use
		Footprint			
903 001003603	LIVERMORE	25.1% to 50.0%		PORTOLA	Exempt Public Agency
903 001003701	LIVERMORE	51.1% to 75%		PORTOLA	Exempt Public Agency
903 001003704	LIVERMORE	25.1% to 50.0%		PORTOLA	Exempt Public Agency
903 001004000	LIVERMORE	5.1% to 10.0%		PORTOLA	Vacant residential tract lot
903 001005400	LIVERMORE	Less than 1%		PORTOLA	Vacant industrial land (may include misc. imps)
903 001400700	LIVERMORE	Less than 1%		PORTOLA	Vacant commercial land (may include misc. imps)
904 000100112	LIVERMORE	Less than 1%		US HWY 50 W	Church
904 000100314	LIVERMORE	1.0% to 5.0%		1780 FREISMAN	Golf course
904 000101102	LIVERMORE	1.0% to 5.0%		FREISMAN	Vacant industrial land (may include misc. imps)
904 000200600	LIVERMORE	Less than 1%		909 CLUB HOUSE	Exempt Public Agency
904 000401001	LIVERMORE	5.1% to 10.0%		2650 KITTY HAWK	Other recreational activity, e.g. rinks, stadiums
904 000401002	LIVERMORE	5.1% to 10.0%		2600 KITTY HAWK	Warehouse
904 000401804	LIVERMORE	1.0% to 5.0%		2348 KITTY HAWK	Automobile dealership
904 000405400	LIVERMORE	1.0% to 5.0%		2400 KITTY HAWK	Other recreational activity, e.g. rinks, stadiums
904 000405700	LIVERMORE	5.1% to 10.0%		2474 NISSEN	Shopping Center-NBHD without anchor (strip mall)
904 000406700	LIVERMORE	1.0% to 5.0%		ARMSTRONG	Vacant industrial land (may include misc. imps)
904 000500330	LIVERMORE	More than 75%		200 AIRWAY	Exempt Public Agency
904 000500407	LIVERMORE	10.1% to 25.0%		US HWY 50 E	Vacant rural-res homesites, may incl misc. imps
904 001100100	LIVERMORE	1.0% to 5.0%		KITTY HAWK	Exempt Public Agency
904 001100200	LIVERMORE	1.0% to 5.0%		881 AIRWAY	Shopping Center-NBHD without anchor (strip mall)
904 001100300	LIVERMORE	10.1% to 25.0%		KITTY HAWK	Exempt Public Agency
904 001301200	LIVERMORE	1.0% to 5.0%		2774 LIVERMORE OUTLETS	Shopping Center-Regional Mall
905 000100102	LIVERMORE	1.0% to 5.0%		US HWY 50 W	Rural property used for agriculture, 10+ acres
905 000100202	LIVERMORE	25.1% to 50.0%		3000 DOOLAN	Exempt Public Agency
905 000100302	LIVERMORE	1.0% to 5.0%		1421 COLLIER CANYON	Rural property used for agriculture, 10+ acres
905 000100403	DUBLIN	1.0% to 5.0%		2061 COLLIER CANYON	Vacant industrial land (may include misc. imps)
905 000100404	DUBLIN	Less than 1%		1881 COLLIER CANYON	Residential Imps on Industrial Land
905 000100502	DUBLIN	1.0% to 5.0%		US HWY 50 W	Vacant industrial land (may include misc. imps)
905 000100603	DUBLIN	1.0% to 5.0%		3457 CROAK	Residential Imps on Industrial Land

DMU Alternative - Potential Land Acquisition

APN*	Parcel City	Approximate Percent of Parcel Needed for Permanent Project		Land Use
		Footprint	Parcel Address	
905 000901303	LIVERMORE	5.1% to 10.0%	COLLIER CANYON	Vacant industrial land (may include misc. imps)
905 000902701	LIVERMORE	1.0% to 5.0%	2800 INDEPENDENCE	Discount store
905 000905702	LIVERMORE	25.1% to 50.0%	US HWY 50 W	Exempt Public Agency
905 000906000	LIVERMORE	10.1% to 25.0%	2705 CONSTITUTION	One to five story office building
905 000908100	LIVERMORE	1.0% to 5.0%	2772 CONSTITUTION	Condominium-commercial retail, common area or use
905 001501700	LIVERMORE	5.1% to 10.0%	CONSTITUTION	One to five story office building
905 001501800	LIVERMORE	1.0% to 5.0%	CONSTITUTION	Vacant industrial land (may include misc. imps)
905 001502600	LIVERMORE	5.1% to 10.0%	2620 COLLIER CANYON	Vacant industrial land (may include misc. imps)
905 001502700	LIVERMORE	5.1% to 10.0%	2620 COLLIER CANYON	Vacant industrial land (may include misc. imps)
905 001608800	LIVERMORE	10.1% to 25.0%	COLLIER CANYON	Condominium-commercial retail, common area or use
941 055001803	DUBLIN	Less than 1%	SCARLETT	Exempt Public Agency
941 055002400	PLEASANTON	More than 75%	6085 SCARLETT	Automobile dealership
941 055002502	DUBLIN	1.0% to 5.0%	6085 SCARLETT	Automobile dealership
941 055002800	DUBLIN	Less than 1%	5787 SCARLETT	Warehouse
941 055003000	PLEASANTON	More than 75%	6015 SCARLETT #LOTA	Automobile dealership
941 055003202	DUBLIN	5.1% to 10.0%	6015 SCARLETT #LOTA	Automobile dealership
941 055003203	DUBLIN	1.0% to 5.0%	6031 SCARLETT	Parking lot
941 055007701	DUBLIN	10.1% to 25.0%	5777 SCARLETT	Exempt Public Agency
941 130000208	PLEASANTON	Less than 1%	7176 JOHNSON	Exempt Public Agency
941 130101404	PLEASANTON	Less than 1%	US HWY 50 W	Exempt Public Agency
941 130101702	PLEASANTON	1.0% to 5.0%	5331 HOPYARD	Restaurant
941 130101802	PLEASANTON	5.1% to 10.0%	5375 OWENS	Motel
941 130101902	PLEASANTON	10.1% to 25.0%	HOPYARD	Automobile dealership
941 130102102	PLEASANTON	1.0% to 5.0%	5341 OWENS	Other recreational activity, e.g. rinks, stadiums
941 130103402	PLEASANTON	1.0% to 5.0%	6010 JOHNSON	Shopping Center-NBHD/grocery anchor
941 131500503	PLEASANTON	1.0% to 5.0%	JOHNSON	Shopping Center-NBHD/grocery anchor
941 131500600	PLEASANTON	10.1% to 25.0%	6015 JOHNSON	Shopping Center-NBHD/grocery anchor
941 131500700	PLEASANTON	51.1% to 75%	5755 JOHNSON	Vacant commercial land (may include misc. imps)
941 131500901	PLEASANTON	10.1% to 25.0%	HOPYARD	Vacant commercial land (may include misc. imps)
941 277100700	PLEASANTON	5.1% to 10.0%	CHABOT	Exempt Public Agency
941 277102500	PLEASANTON	10.1% to 25.0%	OWENS	Exempt Public Agency

DMU Alternative - Potential Land Acquisition

APN*	Parcel City	Approximate Percent of Parcel Needed for Permanent Project	Footprint	Parcel Address	Land Use
941 277103101	PLEASANTON	Less than 1%		5871 OWENS	Automobile dealership
941 278002402	PLEASANTON	Less than 1%		580 INTERSTATE	Exempt Public Agency
946 110002103	PLEASANTON	5.1% to 10.0%		3992 SANTA RITA	Exempt Public Agency
946 110002202	PLEASANTON	1.0% to 5.0%		4355 ROSEWOOD	Automobile dealership
946 110002302	PLEASANTON	1.0% to 5.0%		4345 ROSEWOOD	Automobile dealership
946 110004300	PLEASANTON	Less than 1%		4283 ROSEWOOD	Shopping Center- NBHD/grocery anchor
946 110100803	PLEASANTON	More than 75%		PIMLICO	Exempt Public Agency
946 110101501	PLEASANTON	More than 75%		SANTA RITA	Exempt Public Agency
946 110101502	PLEASANTON	1.0% to 5.0%		6800 SANTA RITA	Restaurant
946 110102901	PLEASANTON	1.0% to 5.0%		PIMLICO	Vacant commercial land (may include misc. imps)
946 110102902	PLEASANTON	More than 75%		PIMLICO	Exempt Public Agency
946 110103101	PLEASANTON	Less than 1%		PIMLICO	Exempt Public Agency
946 110103102	PLEASANTON	1.0% to 5.0%		4003 PIMLICO	Automobile dealership
946 110103501	PLEASANTON	More than 75%		PIMLICO	Exempt Public Agency
946 110103603	PLEASANTON	25.1% to 50.0%		PIMLICO	Exempt Public Agency
946 112017200	PLEASANTON	5.1% to 10.0%		PIMLICO	Exempt Public Agency
946 112017300	PLEASANTON	1.0% to 5.0%		PIMLICO	Townhouse - Planned Development, Common Area or use
946 462300806	PLEASANTON	Less than 1%		3300 STONERIDGE CREEK	Multiple residential building of 5 or more units.
946 462300904	PLEASANTON	1.0% to 5.0%		3300 STONERIDGE CREEK	Vacant apartment land, capable of 5 or more units
946 462301000	PLEASANTON	Less than 1%		2750 STONERIDGE	Vacant commercial land (may include misc. imps)
985 002700200	DUBLIN	Less than 1%		FALLON	Vacant commercial land (may include misc. imps)
985 002700300	DUBLIN	Less than 1%		US HWY 50 W	Vacant commercial land (may include misc. imps)
985 002700400	DUBLIN	25.1% to 50.0%		3410 CROAK	Vacant industrial land (may include misc. imps)
985 002700500	DUBLIN	More than 75%		CROAK	Vacant commercial land (may include misc. imps)
985 002700902	DUBLIN	1.0% to 5.0%		LOCKHART	Vacant commercial land (may include misc. imps)
985 005100400	DUBLIN	1.0% to 5.0%		TASSAJARA	Rural property in transition to a higher use
985 005100500	DUBLIN	1.0% to 5.0%		TASSAJARA	Rural property in transition to a higher use
985 006100100	DUBLIN	More than 75%		US HWY 50 WEST	Vacant rural-res homesites, may incl misc. imps
985 006100400	DUBLIN	5.1% to 10.0%		DUBLIN	Condominium-office, common area or use

DMU Alternative - Potential Land Acquisition

APN*	Parcel City	Approximate Percent of Parcel Needed for Permanent Project	Footprint	Parcel Address	Land Use
985 006100500	DUBLIN		1.0% to 5.0%	DUBLIN	Vacant commercial land (may include misc. imps)
985 006100700	DUBLIN		5.1% to 10.0%	DUBLIN	Shopping Center-Power Center
985 006101500	DUBLIN		5.1% to 10.0%	DUBLIN	Shopping Center-Power Center
985 007900103	DUBLIN		1.0% to 5.0%	3620 FALLON	Shopping Center-Community
985 007900600	DUBLIN		10.1% to 25.0%	3620 FALLON	Shopping Center-NBHD/grocery anchor
986 000100301	DUBLIN		Less than 1%	DOUGHERTY	Exempt Public Agency
986 000800100	DUBLIN		10.1% to 25.0%	5000 DUBLIN	Shopping Center-NBHD/grocery anchor
986 000801700	DUBLIN		10.1% to 25.0%	4808 DUBLIN #2	Shopping Center-NBHD/grocery anchor
986 001600401	DUBLIN		5.1% to 10.0%	4200 JOHN MONEGO	Automobile dealership
986 001601300	DUBLIN		1.0% to 5.0%	4140 DUBLIN	One to five story office building
986 001601600	DUBLIN		Less than 1%	TASSAJARA	Exempt Public Agency
986 001601700	DUBLIN		51.1% to 75%	TASSAJARA	Government owned property - vacant land
986 001601800	DUBLIN		1.0% to 5.0%	DUBLIN	Exempt Public Agency
986 001602300	DUBLIN		5.1% to 10.0%	DUBLIN	Vacant commercial land (may include misc. imps)
986 001602400	DUBLIN		1.0% to 5.0%	4321 TOYOTA	Automobile dealership
986 003300400	DUBLIN		10.1% to 25.0%	MARTINELLI	Vacant commercial land (may include misc. imps)
986 003300502	DUBLIN		10.1% to 25.0%	MARTINELLI	Vacant commercial land (may include misc. imps)
986 003300600	DUBLIN		10.1% to 25.0%	MARTINELLI	Vacant commercial land (may include misc. imps)
986 003401400	DUBLIN		1.0% to 5.0%	DOUGHERTY	Exempt Public Agency

* Note: Parcels are listed by APN from least to greatest.

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C.3 Right-of-Way Information – Express Bus/ BRT Alternative

Express Bus/BRT Alternative - Potential Land Acquisition

APN*	Parcel City	Approximate Percent of Parcel Needed for Permanent Project			Land Use
		Footprint	Parcel Address		
941 055001803	DUBLIN	Less than 1%	SCARLETT	Exempt Public Agency	
941 055002400	PLEASANTON	51.1% to 75%	6085 SCARLETT	Automobile dealership	
941 055002502	DUBLIN	1.0% to 5.0%	6085 SCARLETT	Automobile dealership	
941 055002800	DUBLIN	1.0% to 5.0%	5787 SCARLETT	Warehouse	
941 055003000	PLEASANTON	More than 75%	6015 SCARLETT #LOTA	Automobile dealership	
941 055003202	DUBLIN	1.0% to 5.0%	6015 SCARLETT #LOTA	Automobile dealership	
941 055003203	DUBLIN	1.0% to 5.0%	6031 SCARLETT	Parking lot	
941 055003705	DUBLIN	Less than 1%	6265 SCARLETT	Warehouse-Self Storage	
941 055007701	DUBLIN	5.1% to 10.0%	5777 SCARLETT	Exempt Public Agency	
941 130101802	PLEASANTON	1.0% to 5.0%	5375 OWENS	Motel	
941 130101902	PLEASANTON	10.1% to 25.0%	HOPYARD	Automobile dealership	
941 140000103	DUBLIN	1.0% to 5.0%	DUBLIN	Exempt Public Agency	
941 140000213	DUBLIN	Less than 1%	6700 DUBLIN	Exempt Public Agency	
941 140000700	DUBLIN	1.0% to 5.0%	6450 DUBLIN	Automobile dealership	
941 140000902	DUBLIN	1.0% to 5.0%	6440 DUBLIN	Discount store	
941 277100700	PLEASANTON	25.1% to 50.0%	CHABOT	Exempt Public Agency	
941 277101200	PLEASANTON	More than 75%	580 INTERSTATE	Exempt Public Agency	
941 277101400	PLEASANTON	More than 75%	580 INTERSTATE	Exempt Public Agency	
941 277102500	PLEASANTON	10.1% to 25.0%	OWENS	Exempt Public Agency	
941 277800103	PLEASANTON	More than 75%	580 INTERSTATE	Exempt Public Agency	
941 277800104	PLEASANTON	More than 75%	580 INTERSTATE	Exempt Public Agency	
941 277800305	PLEASANTON	10.1% to 25.0%	5805 OWENS	One to five story office	
986 000100301	DUBLIN	1.0% to 5.0%	DOUGHERTY	Exempt Public Agency	
986 000800100	DUBLIN	5.1% to 10.0%	5000 DUBLIN	Shopping Center- NBHD/grocery anchor	
986 000801700	DUBLIN	5.1% to 10.0%	4808 DUBLIN #2	Shopping Center- NBHD/grocery anchor	
986 001600401	DUBLIN	1.0% to 5.0%	4200 JOHN MONEGO	Automobile dealership	
986 001601300	DUBLIN	1.0% to 5.0%	4140 DUBLIN	One to five story office building	
986 001601600	DUBLIN	Less than 1%	TASSAJARA	Exempt Public Agency	
986 001601700	DUBLIN	51.1% to 75%	TASSAJARA	Government owned property - vacant land	
986 001601800	DUBLIN	1.0% to 5.0%	DUBLIN	Exempt Public Agency	
986 001602300	DUBLIN	1.0% to 5.0%	DUBLIN	Vacant commercial land (may include misc. imps)	
986 001602400	DUBLIN	1.0% to 5.0%	4321 TOYOTA	Automobile dealership	
986 003300502	DUBLIN	1.0% to 5.0%	MARTINELLI	Vacant commercial land (may include misc. imps)	
986 003401400	DUBLIN	Less than 1%	DOUGHERTY	Exempt Public Agency	

* Note: Parcels are listed by APN from least to greatest.

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**APPENDIX D:
BART'S PARKING MANAGEMENT TOOLKIT**



Parking Management Toolkit



Strategies for Action in BART Station Areas



Prepared for: Bay Area Rapid Transit District

Prepared by: Richard Willson, Ph.D. AICP

October 2000

Parking Management Toolkit

Strategies for Action in BART Station Areas



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How to Use This Toolkit

This toolkit outlines ways to address parking issues in the vicinity of the BART stations. It is intended to help key stakeholders--community members, city officials, property owners, merchants and others--as they develop parking strategies that support community goals.

The report provides a step-by-step process for exploring parking issues and selecting parking management strategies. The toolkit includes worksheets that can be used to facilitate problem solving at community meetings and workshops.

Parking management techniques work best when they are tailored to local conditions. A "one-size-fits-all" approach is less effective than carrying out the specific planning activities suggested in this toolkit. BART is issuing this report to support collaborative approaches to parking management.

About BART

The BART system consists of 95 miles of track and 39 stations in four Bay Area counties. Now under construction, the BART San Francisco International Airport Extension will add 8.7 miles of new revenue service track and four new stations in San Mateo County.

BART connects residential areas with key employment, shopping and recreational destinations throughout the Bay Area. At the same time, BART provides a focus for community development in the areas surrounding the stations. Parking for BART patrons and local uses is an integral part of station area planning.

The BART system is changing, as are the land use patterns around stations. For BART, ridership is up and the upcoming SFO Extension will provide new services and accessibility. For many local communities, station area development presents opportunities for parking management. This toolkit provides a process for addressing these issues and ideas about effective strategies.

Who to Call for More Information

BART is providing this document as resource to community members, city officials, property owners, merchants and others. The primary responsibility for addressing local parking regulations lies with the respective cities. They adopt, implement and enforce on-street parking regulations, set policies for city-owned off-street parking, and control the amount of parking that private developers must provide. However, property owners, merchants, employers and others generally control the use of off-street parking. Finally, BART manages the parking in its own station facilities.

If you wish to discuss station area parking issues in your city, you should call your city staff, usually in the Planning or Engineering department.

For BART-specific questions call Peter Albert, Station Area Planning Manager, at (510) 287-4702.

Introduction

Parking management involves the use of programs and policies that affect the use, price and availability of parking. Parking management ranges from simple time limits to sophisticated computer-based systems that direct traffic flow to available parking. Nationwide, communities are using parking management to support their transportation, environmental and community development objectives.

BART provides over 40,000 parking spaces throughout the region. Although more than half of BART riders in the AM peak (57 percent) reach stations by travel modes that *do not* involve parking, parking is still an important part of BART service.

Recent trends call for a closer look at station area parking. For BART, policy issues related to transit-oriented development, environmental quality and customer service are important strategic directions. Furthermore, BART ridership is increasing and new BART service--the SFO Extension--will open soon. These service additions will affect station areas throughout the region. For new stations, there will be easy connections to the region, a new community focus, and community development opportunities. Existing station areas may be used more intensively as their transportation and land use focus increases. Parking management

can ensure that the available parking is used in an efficient manner in keeping with the goals of BART and the community.

BART recently addressed parking and other access issues with the adoption of a new BART Access Management and Improvement Policy Framework. It provides guidance on the strategies BART may consider on a system- and station-specific basis. With respect to parking, the policy directs BART to reconsider existing parking management strategies and create new strategies that make station areas functional, accessible and attractive.

For local communities, BART station areas are important elements of their community development and economic development plans. In addition, station areas play a part in livable community and traffic mitigation objectives.

Local communities may initiate their own reviews of on- and off-street parking policy and programs in station areas for a variety of reasons. This toolkit is provided to support those efforts.

Sometimes, a strategy that phases in parking programs can help local stakeholders adjust to a new approach and provide opportunities for refinements. Some policies may already be in place and working well. If change is expected, however, development of a preliminary

consensus may be needed before that change occurs, with implementation keyed to actual changes. Still other long-term strategies may be discussed in a conceptual way but not required until a station area reaches a certain maturity.

Many entities control parking. BART is responsible for BART parking at BART stations. Local jurisdictions are responsible for managing on-street and municipal off-street parking, setting development standards for private development, and facilitating traffic flow. Finally, property owners, employers and merchants are responsible for managing their own private parking.

Many people (e.g., neighbors, businesses, and commuters) have a stake in station-area parking, and their interests and perspectives may vary quite considerably. Studies have shown that when the various stakeholders work together they can achieve “win-win” parking solutions that promote community development and community livability. With the release of this toolkit, it is BART's hope to encourage such collaborative solutions.

The Parking Management Toolkit

This toolkit provides ideas and suggestions on how to analyze and respond to parking issues in BART station areas. It includes diagrams and checklists to assist stakeholders in finding mutually beneficial solutions to parking issues.

Who should undertake such a study? Any stakeholder could initiate a station area parking study, but the best approach is collaboration between BART, the city and relevant stakeholders. This way, the analysis is more informed and conclusions can respond to the issues of the primary stakeholders.

The first step is to understand the parking issues as outlined in Figure 1: The What-When-Where-Who-Why of Parking Management. This modification of the classic reporter's approach to writing a newspaper story is useful for understanding parking issues. Good parking strategies depend on a solid understanding of existing conditions.

The second step is to consider alternative strategies. Tables 1 and 2 (pages 8 and 13, respectively) identify possible strategies, addressing on-street and off-street parking, respectively. Appendix A includes blank

versions of these figures and tables for use in workshop activities.

The third step is to design and implement programs. The advice provided in this section emphasizes the importance of gaining support from all stakeholders and establishing the mechanisms to implement the strategy.

Step 1: Understand the Parking Issues

Developing effective parking strategies depends on a complete understanding of the nature of the parking issues at hand. This is particularly important in station areas because there are many groups of people using the area's parking resources--BART riders, local residents, shoppers, workers and others--and the patterns of parking use by each group may be different.

Detailed information about existing conditions is required if the parking study is to sort out the priorities to be given to each parking user group.

Faulty conclusions about parking strategies can be reached if the causes of a parking problem are not fully understood. An example is when a decision is made to build additional parking when in fact the

problem stems from the inconvenience of using existing parking. Alternatively, a parking strategy could inadvertently disadvantage one group of parkers while trying to solve the problems of another group. For example, unrestricted parking in residential areas provides flexibility for all, but can be problematic if too many parkers from outside the neighborhood use on-street parking, reducing parking availability for residents and their guests.

The following paragraphs outline in greater detail what is meant by the what-when-where-who-why framework.

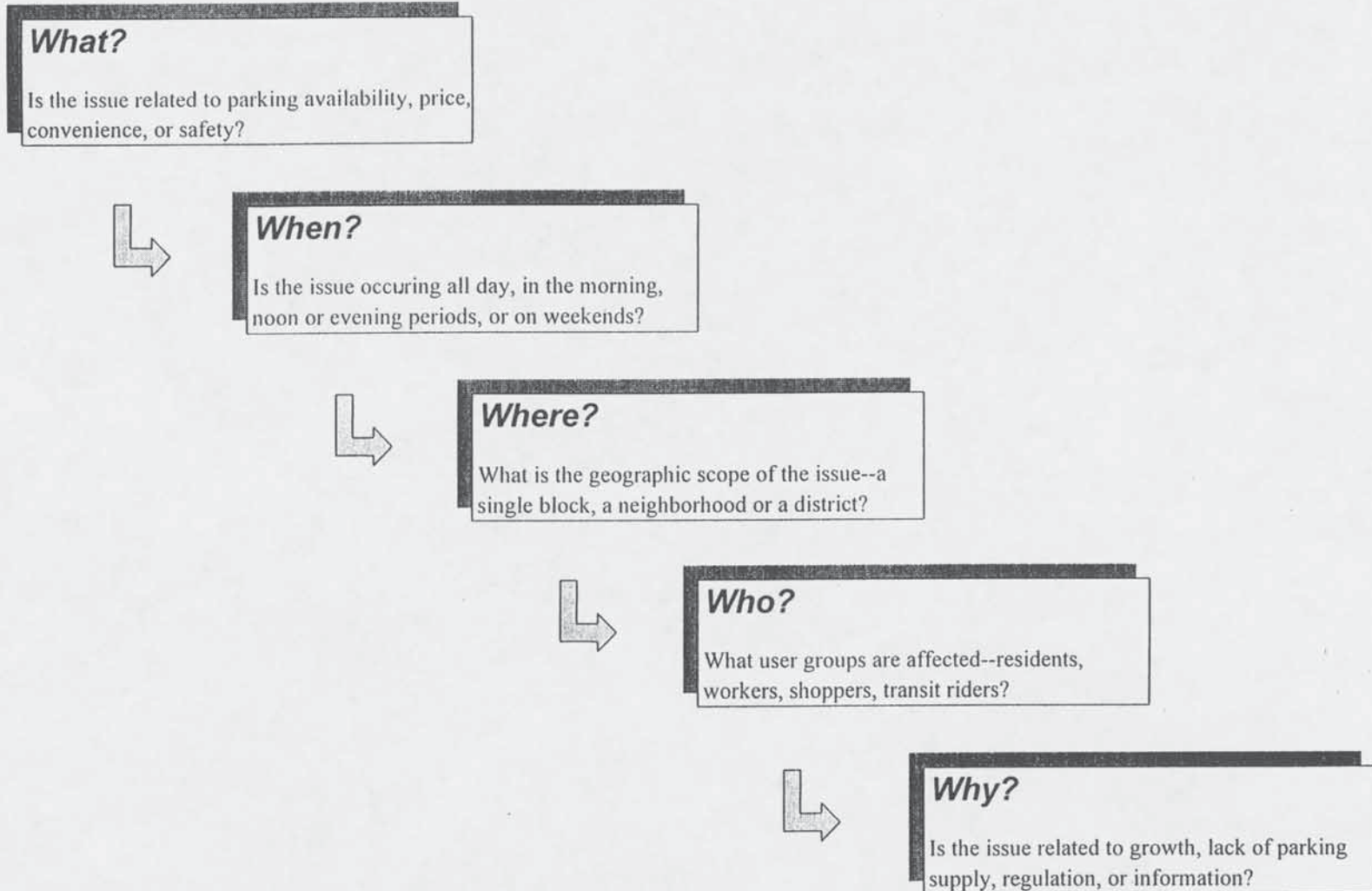
What? What is the issue?

Parking issues usually concern the availability, price, convenience and/or safety of parking. Other possible issues include the predictability of space availability and traffic congestion issues related to drivers searching for parking spaces. Often, the bottom line for parkers is that the space they want is not available when they want it (or at a price they are willing to pay).



The "what" question is important because the definition of the problem is closely tied to the type of strategies selected. It is not unusual to start with one issue but arrive at a series of other issues after more detailed analysis. For example, when shoppers have difficulty finding parking they may assume that there are not enough

Figure 1: The What-When-Where-Who-Why of Parking Management



spaces, when in fact the issue is the turnover rate of the most convenient spaces (e.g., how many cars use each space per day).

When? When does the problem occur? Parking may have a particular pattern of use



throughout the day, among days of the week, or even among different seasons. For example, an issue may be related to the holiday shopping period (for merchants), or weekday lunch periods (for restaurants), throughout the day (for workers), or in the evening (for movie theaters). The shorter the duration of a parking problem, the greater the possibility that some sort of shared parking arrangement can be developed. Nearby uses may have spaces available when another use has a shortage.

Where? Where is the parking issue occurring? The geographic location and the extent of the area affected will affect the type of strategies that may be used. Does the issue affect a single block, a commercial district, a neighborhood, or the entire community?



Are there concerns about the impact of a commercial area on a residential area, or visa versa? It is a good practice to map the area affected by the parking issue. The answers to the "where" questions

determine the geographic extent of policies and possible effects at the boundary of the area affected by a new policy.

Who? Who is using parking in a way that is creating impacts?

Who is affected by the new parking use patterns? The needs of different users of parking must be understood, as should the way in which different uses affect each other's access to parking. People who use station area parking include the residents of the station area, those who work in the station area, visitors to local businesses, shoppers, and transit riders. Among transit riders, users include those who park at stations for all-day work trips, shorter mid-day trips, and when the SFO Extension opens, possibly airport travelers using BART to access the SFO airport.



A comprehensive parking strategy should address and set priorities for each user group. A consensus should be built among those who own or control parking about the entitlement of each group to use parking, taking into account their historical claim to the parking, broader city goals, willingness to pay, and how much parking each group owns. Such a discussion should include consideration of how alternative transportation modes could be used to shift parking demand characteristics. For example, how would shifting BART access modes to bus transit

affect parking for patrons of local merchant parking? Similarly, how can rideshare programs for station area employees free up spaces for shoppers?

Why? Why has the issue emerged and why now? Has there been growth in business activity that has brought more visitors to the area? Has residential



population and automobile ownership growth outpaced parking supply? Has the growth in BART patronage increased parking by transit riders? Have parking issues emerged simply because of a lack of information or a lack of coordination between property owners and activities? The answers to the "why" questions point to the type of responses that are appropriate and who should be responsible for solving them.

How to Answer These Questions

The framework presented in Figure 1 is a tool to assist stakeholders in analyzing parking issues. Answering these questions requires local research. Depending on local circumstances, a consortium of station area businesses, public agencies and resident groups could be formed to sponsor these studies. A variety of study techniques can provide the needed information:

1) Parking utilization studies. Such surveys provide a baseline of the conditions, including a map that shows the percentage of spaces occupied at different times of the day. They can answer questions about where shortages or surpluses exist, highlight shared parking opportunities and provided a basis against which change can be assessed. As appropriate, they should also survey parking charges and rates, the presence of validation systems and other parking control measures in place.

2) Field studies of parking conditions, which can include observation of parking patterns, parking counts, license plate surveys, or duration surveys over multiple time periods.

3) Surveys of parkers, addressing parking purposes, trip origin, length of time parked, and attitudes about parking facilities. Such surveys could also probe for reasons why parkers do not use other access modes such as bus transit, walking, biking, etc.

4) Studies of comparable station areas. These studies can reveal strategies that have been effective in similar situations.

Parking utilization surveys are most useful in addressing the what, when and where questions. Field studies, parking surveys and interviews can address the who and why questions.

In answering these questions, one needs to understand trends and likely future events that might change the context for station area parking policy. That trend analysis is needed for the station area and the broader regional context.

An important question in addressing parking issues is determining the degree of responsibility of different land uses for accommodating parking demand. For example, if BART commences operations at a new station and a new development opens at the same time, it is important to distinguish between the impact of each of those activities. Comparing those conditions to the pre-BART conditions is a good way of measuring impacts.

Finally, there must be a discussion and a consensus formed on the broader community goals that parking programs must serve. For example, some communities might make automobile mobility their priority, while others might shift their policies to promote livable communities that do not rely on the automobile. These basic directions strongly influence which alternative programs would be chosen, particularly with regard to the question of whether new parking is to be added in response to demand.

Notes:

Step 2: Consider Alternative Strategies

Strategy checklists have been developed for on-street parking (Table 1) and off-street parking (Table 2). A series of common parking issues is listed on the vertical axis. These issues are typical of what might result from a "what-when-where-who-why" analysis. The horizontal axis lists various strategies for parking management. The checks in the matrix represent strategies that are worthy of investigation for each parking issue.

On-Street Parking

On-street parking regulation is under the purview of each city.



A city can address parking issues in establishing and enforcing regulations, time limits and parking meter rates. Modification of on-street parking regulations is most effective when done in coordination with changes in policies for off-street facilities.

Issues

The following explains four typical on-street parking issues that are summarized in Table 1. They include:

1. *Residents and/or their guests cannot find on-street parking spaces in their neighborhood.* If residents complain of

insufficient parking, it is important to measure parking utilization at various times and days of the week. Residential neighborhoods may lack available on-street parking for a number of reasons. For example, shortages can exist if the residential population and automobile ownership exceed levels anticipated in local off-street parking regulations. Similarly, if neighborhoods are located near other uses that have high parking demand, such as commercial areas or transit stations, then those seeking parking may be using neighborhood parking resources. Finding the cause of the problem has a bearing on the type of strategy to be implemented.

Sometimes residents have plenty of neighborhood parking but do not want others to use it. Discussions can explore programs that provide benefits to communities that share their on-street parking, such as returning parking revenues to neighborhood improvement projects.

2. *Convenient spaces are not available to shoppers in commercial areas.* This is often an issue because the desirable spaces are not used productively. On-street spaces are often shoppers' first choice for parking; each of these spaces can serve many short-term patrons during the day.

Understanding the reason for the lack of availability is important. For example, if

an employee parks all-day in a desirable space, then many potential customers are prevented from using that space. Similarly, if parkers from adjacent areas "invade" commercial parking there could be shortages for shoppers.

3. *It is difficult to find on-street parking anywhere in the station area.* If there is a lack of available on-street parking in the entire station area, it suggests an imbalance between activity levels. Some communities may have removed on-street parking to enable greater through traffic flow, address safety concerns or achieve aesthetic goals, making off-street parking insufficient. Alternatively, the lack of on-street spaces could be connected to a shortage of off-street parking or a problem regarding the management of on-street parking, e.g., on-street parking is being used for long-term parking and vehicle storage.

The approach taken to this situation depends on the overall character that is appropriate for the station area--in a suburban context there may be an effort to accommodate parking demand, while in an urban context the total demand would not be supplied because of land constraints, urban design priorities and transit and pedestrian objectives. But even in suburban areas, the total demand might not be supplied because of a community vision to support public transit and reduce automobile use for local trips.

Table 1: On-Street Parking Issues and Responses


Parking Issue	Permit parking programs	Enforcement	Merchant programs	Time limits and restrictions	Urban design/signage/traffic calming	Assignment of parking location	Parking charges	Parking Benefit Districts	Restriping for more spaces	Add off-street parking	Alternatives to driving
1. Residents cannot find spaces in their neighborhoods.	✓	✓		✓	✓			✓	✓	✓	✓
2. Convenient spaces are not available to shoppers in commercial areas.		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
3. It is difficult to find on-street parking anywhere in the station area.		✓		✓		✓	✓	✓	✓	✓	✓
4. Traffic congestion problems occur as drivers search for on-street parking.		✓	✓		✓	✓	✓			✓	✓

= a suitable response

4. *Traffic congestion problems occur as drivers search for on-street parking spaces.* For example, if drivers are circling for extended periods of time or waiting for spaces to become available they create additional traffic congestion. In certain locations, the vehicular maneuvering while parking can be also an impediment to traffic flow.

Strategies


The horizontal axis of Table 1 shows a variety of on-street parking strategies that address the issues described above. They include:

 *Permit parking programs.* Permit parking programs create a system where all-day or overnight parking is reserved for residents of some other designated group. These programs are used in many Bay Area communities. They are appropriate when parking demand from one land use affects the parking provided for another.

A permit parking program, for example, can prevent BART patrons from parking in residential neighborhoods around a station. Under a permit parking system, local residents and their guests would be able to use on-street parking, but cars parked for more than a defined number of hours without permits would be cited. Appendix B provides details on the implementation of permit parking districts. Most often, the


permit parking district is established by the city at the request of a local neighborhood.

Permit parking can also be applied to on-street parking in commercial districts around stations. The concept provides unrestricted access to parking for residents (or employees) who have business in a parking district. Those without permits would be ticketed and/or towed if they parked longer than the permitted time. The design of permit programs should consider implementation costs for the city.

 *Enforcement of on-street parking regulations.*




New enforcement programs can increase parking availability if regulations have not been enforced, or not consistently enforced. If a city is about to more stringently enforce time limits, however, sufficient notice should be provided to those who might be ticketed. Warnings, tickets, booting vehicles and towing can increase compliance. The public will support enforcement if it is consistently applied and tied to benefits such as increasing the availability of convenient spaces.


 *Merchant programs.*


Merchants can provide programs to reduce parking demand, such as incentives for store employees to use alternative travel modes. If employees drive and park,


merchant programs can encourage them to use underutilized off-street parking facilities.

 *Time limits and time-based use restrictions.* Time limits are perhaps the simplest way to control the uses of on-street parking facilities. For example, parking use is effectively limited to customers by setting a two-hour limit in commercial areas. Even a four-hour time limit in a commercial area would discourage workers from using those spaces (whether riding BART or working locally). The time limit for spaces can be adjusted to reflect the particular purpose for the parking, ranging from a drop-off to longer-term parking. These time limits can be varied according to the convenience of the spaces to direct all-day parkers to underutilized spaces. If time limits are combined with parking charges, state-of-the-art parking meter systems offer flexibility in varying time limits and provide convenience to the parker.

Time-based parking restrictions prohibit parking for certain periods to preserve roadway capacity during peak commuting periods and to save parking resources for particular user groups. For example, early morning parking prohibitions reserve parking resources for mid-day parkers.

 *Urban design/signage/traffic calming.* Urban design features can make more distant on-street parking spaces known to commuters and enhance pedestrian connections to those spaces. Good signage can direct parkers quickly and efficiently to available spaces. Sometimes the solution is as simple as providing information about space location and availability. Traffic calming, which includes strategies that moderate traffic speeds in order to improve the pedestrian environment, can also support parking management strategies. Traffic calming makes the pedestrian environment safer and more pleasant and increases parkers' willingness to walk from more distant parking spaces. Or, for those living or working nearby a station an improved pedestrian environment might reduce their use of a car to access BART.

 *Assignment of parking location.* This strategy assigns particular parking users to specific locations to increase the efficiency with which spaces are used. For example, employer policy could require all-day parkers to parking in remote facilities to free up close-in on-street parking. Alternatively, the most convenient spaces could be devoted to pick up and drop off functions.

 *Charges for on-street parking.* A system of differentiated parking meter rates is a key element in encouraging drivers to use parking efficiently, by


directing long-term parking to less convenient spaces and gaining the most productivity from the most attractive on-street spaces. There are many alternatives for collecting on-street parking charges, ranging from traditional parking meters, to centralized parking machines, to debit card systems. Multi-space parking meters can be programmed to implement different parking charges by day of the week. They can also implement charges that differentiate between short- and long-term use, time of day, and the location of a particular parking space.

If implemented for on- and off-street facilities, parking charges reduce auto use and increase transit and pedestrian access. They provide more effective capacity from a given number of spaces because they encourage quicker turnover of spaces and increase the use of alternative modes of access (e.g., transit or carpool).


Parking charges make space availability more predictable for shoppers. The rates can be set so that there are always spaces available. Finally, parking charges create a revenue stream that can fund new parking or area improvements. Any parking charge system can include validation programs that reduce or eliminate parking charges for preferred user groups, such as shoppers.


Some residential areas might have excess on street parking, but prohibit non-residents from using it because no benefits


flow back to the community from letting others use that parking. The parking benefit district concept is setting up a system in which residents parking free (using some type of residential permit system) but non residents would be charged the market price for parking. The revenues would be used for additional public services in the neighborhood where the revenue was collected, such as street cleaning, tree maintenance, sidewalk maintenance, or other improvements. The incentive of these improvements might cause neighborhoods to open up new on-street supply to other users.

 *Parking benefit districts for on-street parking.* This concept is a variation of an on-street parking charge scheme for residential areas. Instead of prohibiting non-resident parking in neighborhoods, as occurs with a residential permit parking program, non resident parking could be allowed with an appropriate parking charge. The charge could be collected with meters, payboxes or monthly passes. Revenues from the charge would flow back to the community, for neighborhood or transportation improvements. Some neighborhoods might prefer to allow non-resident parking if it benefited local parks, landscaping or transportation facilities.



 *Increasing on-street parking supply through restriping/redesigning spaces.* Additional curbside areas can be striped for on-street parking, including angle parking, if right-of-way and traffic conditions allow. In addition, on-street parking has a traffic calming effect and improves the pedestrian environment, by physically protecting pedestrians from moving traffic. City officials can also review the size of on-street parking spaces to see if their size could be reduced. Spaces do not have to be individually marked in locations that use central parking machines, enabling a greater density of parked cars. However, there is a tradeoff between smaller parking spaces and the traffic impact of cars maneuvering into parking spaces.

 *Development of off-street parking facilities.* If existing parking facilities are being efficiently used (e.g., employees are parking in off-street lots and on-street spaces turn over frequently), then cities and property owners may consider adding *off-street* parking. Off-street parking can take the pressure off on-street supplies. Of course, provision of additional parking must take into account other potential community goals, such as reducing traffic congestion and auto dependency, improving environmental quality, and achieving livable communities.

 *Initiate new or enhanced alternatives to driving.* This toolkit focuses on parking management strategies, not the larger group of transportation demand management measures. However, any on-street parking supply issue can be addressed by changing parking demand through incentives that convince parkers to use other modes, whether that be new shuttle bus services, bicycle lockers, or financial incentives. Furthermore, strategies that provide a mix of land uses in an area may reduce automobile ownership and use.

Notes:

Off-Street Parking

Off-street parking regulations and policy are under the purview of both public and private entities. Publicly owned facilities are subject to policies established by the government agency with responsibility, i.e., the city, BART or others. However, most off-street parking is owned and operated by private property owners. In those instances, the property owner or the tenant establishes policies for the use of the facilities based on the ownership or lease arrangements. The actual operation of much off-street parking is contracted to parking management companies.

The connection between public and private parking entities is established in the minimum parking requirements contained in the city's zoning ordinance. These requirements compel developers to provide a certain amount of parking when they build a project. Parking supply is also influenced by lender requirements and standard development practices. However, minimum parking requirements are not addressed here because parking requirements are primarily an issue for new development, whereas the focus of this toolkit is managing existing parking.

Issues

Table 2 summarizes a series of off-street parking issues that are elaborated further below:

1. *Convenient spaces are not available to shoppers in commercial areas.* This may be an issue if spaces are not used productively. For example, if an employee parks all-day in a desirable off-street space, many potential customers are prevented from using that space. Similarly, there may be parking shortages for shoppers or employees if parkers from adjacent areas "invade" free, uncontrolled commercial or workplace parking.

2. *Parking lots and structures are usually full.* When the off-street parking supply is less than the demand, users compete for parking on a first-come, first-served basis. This could occur when a new land use has increased the parking demand without a commensurate increase in parking supply, or a new tenant has a high employee density or a high level of visitors. When these conditions exist, market prices for parking generally emerge to ration the scarce parking resource, and/or parking spills over to on-street and other off-street parking.

3. *Parking patterns are uneven--some lots are full and others underused.* Uneven use of parking may relate to the access policies of the owners of those facilities, differences in attractiveness, perceptions of safety, temporary factors relating to the occupancy of the buildings, and so on. The opportunity presented by such an uneven distribution is policies that shift

parking location to change the perceived availability of parking.

4. *Parking "poaching" is occurring--parkers from one use occupy parking provided for another use.* Parking poaching can occur when off-street parking does not have regulations, enforcement programs or parking access control. Examples of poaching include circumstances where employees park in spaces provided for retail uses or where BART transit riders park in spaces provided for employees.

5. *Cars are parked for long periods of time, thereby excluding daily parkers.* Cars parked for more than 24 hours take away spaces from more productive short-term uses. In this instance, "productive" is measured in terms of length of time parked.

Strategies

Table 2 also summarizes potential responses to off-street parking issues. The paragraphs that follow describe them in greater detail:


 *Access control.* A wide variety of devices are available to control the use of off-street parking. The following describes some examples, ranging from simple to more complex systems:


Table 2: Off-Street Parking Issues and Responses


Parking Issue	Access control (gate arms, validation systems)	Enforcement	Employer programs	Time limits and restrictions	Signage/ITS/design	Shared parking	Parking cash-out	Parking charges	Provide more parking	Alternatives to driving
1. Convenient spaces are not available to shoppers in commercial areas.	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
2. Parking lots and structures are usually full.			✓	✓		✓	✓	✓	✓	✓
3. Parking patterns are uneven.	✓	✓		✓	✓	✓	✓	✓		
4. Parking "poaching" is occurring-parkers from one use occupy parking provided for another use.	✓	✓	✓	✓	✓			✓	✓	
5. Cars are parked for long periods of time, excluding daily parkers.		✓		✓				✓		


= a suitable response

- 1) For retail locations, property owners can:
 - post signs that limit who can use the parking facility and for what purposes. Existing security personnel give warnings, post notices, and if necessary arrange for towing. Closed circuit television and intelligent transportation systems (ITS) can support enforcement activities.
 - chain off parking entrances until stores open in the later morning period. This prevents most journey-to-work transit commuters from poaching parking.
 - use gate arm access controls (with validation systems for customers if free parking is provided). Such a system prevents non-shoppers from using the facility entirely or charges them a price.
- 2) For worksites, employees can:
 - establish a hang tag or sticker system for employee parking. Existing security personnel give warnings, post notices, and if necessary arrange for towing.
 - use a validation system that ensures that parkers are those intended to use facility. For example, workers enter their parking space number on a validation machine within their workplace.

- use gate arm access controls and access card systems for employees. Such a system prevents non-employees from using the facility entirely, or alternatively charges them for parking.


 *Enforcement.* Simple information and enforcement programs can be surprisingly effective. Such regulations include time limits or restrictions on who can use the parking. Security and parking control officers can assist with enforcement.


 *Employer programs.* Employers can provide incentives for employees to use rideshare, transit, or non-automobile travel modes. Incentives include use of *Commuter Choice* tax provisions, guaranteed ride home programs, providing vanpool start up costs, etc. Rideshare programs can also provide information on alternative travel modes and ridematching assistance. All these programs reduce the number of cars driven to work for each employee, thereby lowering parking demand. Employers can also create programs that relocate employee parking to remote parking locations that have excess capacity, e.g., employees of a shopping mall during the holiday peak shopping period.

 *Time limits and time-based use restrictions.* Time limits are a simple way to control the use of off-street parking facilities. The time limit for spaces can be adjusted to reflect the particular purpose

for the parking. These time limits can be established on a differential basis to direct all-day parkers to underutilized spaces (e.g., the top levels of a parking structure).

Time-based use restrictions can prohibit parking for certain periods to reserve parking resources for a user group. For example, early morning parking prohibitions reserve parking resources for mid-day parkers.

 *Signage/ITS/Design.* Good signage directs parkers quickly and efficiently to available spaces. In the case of parking structures, the challenge is to get the upper stories of parking structure occupied. Sometimes the problem is as simple as providing information. Intelligent Transportation Systems (ITS) offer sophisticated ways of guiding drivers to available parking. Finally, parking structures designed with good passive safety and logical circulation are more likely to be fully used than those that appear unsafe.


 *Shared parking.* If the time of peak parking demand varies among uses, shared parking strategies can use existing parking with greater efficiency. Shared parking reduces the need to add more parking by recognizing that each land use has a different peak parking utilization period. If those peak periods do not overlap, then at least a portion of the parking facility can be shared. For example, an office building

has low parking demand in the evening, which is the peak demand period for a restaurant. These two uses could share a portion of the parking.


Shared parking is normally thought of for an individual mixed-use site. But uses on separate sites can share parking. For example, BART has an arrangement at the Colma station where BART users use a portion of a bowling alley's parking during the day. The concept can be further expanded to include the sharing of parking on a station area basis. Shared parking reduces the cost of development and increases convenience for parkers.

Shared parking is normally used as a strategy for new development, but existing uses can develop shared parking arrangements with nearby property owners. Such arrangements can be privately initiated and implemented or carried out in cooperation with a city.


Although parking requirements for new development are not a focus of this toolkit, the use of in-lieu programs (where a developer makes a cash payment instead of providing a parking space) can facilitate shared parking concepts.

 *Parking cash-out.* Employers can cash-out parking charges. Under a parking cash-out program, the employer offers workers the cash value of the cost of the parking space that is provided. Many

employees choose to trade their parking space for the cash and commute to work using another travel mode. The cash out offer costs the employer nothing because it reduces expenditures on employee parking.


 *Parking charges.* Research shows that parking charges at workplaces are the most effective tool for encouraging travelers to use efficient travel modes. Parking charges increase the level of transit use and ridesharing. Greater transit use and ridesharing, in turn, reduces parking demand.

Parking charges at commercial locations increase the rate at which parking spaces turn over. This increases the effective capacity of a fixed number of parking spaces.

 *Provide more off-street parking.* Increasing efficiency through restriping, stacked parking, and attended parking provides more off street parking spaces per acre. However, if lower cost parking management options have been implemented and there are still shortages of parking, consideration may be given to constructing additional off-street parking.

Consideration of this strategy depends on the broader goals of the city concerning traffic congestion and auto dependency, improving environmental quality, and achieving livable communities.

If adding parking is consistent with community goals and there is available roadway capacity to serve the parking facility, existing surface parking lots can be converted to higher intensity uses by decking and the construction of multi-story structures. However, substantial parking demand and a high willingness to pay must be present to generate enough revenues to cover the costs of providing additional parking.

 *Initiate new or enhanced alternatives to driving.* This toolkit focuses on parking management strategies, not the larger group of transportation demand management measures. However, any off-street parking supply issue can be addressed by changing parking demand through incentives that convince parkers to use other modes, whether that be new shuttle bus services, bicycle lockers, financial incentives. Furthermore, strategies that provide a mix of land uses in an area may reduce automobile ownership and use.



Step 3: Design and Implement Parking Programs

Parking is important to many members of a community. It affects the convenience with which they use the transportation system, the cost of travel and feelings they have about their neighborhoods and communities. Because parking is so important to many different people, parking policy should be developed and implemented in a collaborative manner. In addition, it should support broader community objectives laid out in community visions, general plans, specific plans, redevelopment strategies and other initiatives.

Since parking is under the control of many stakeholders--the city, private property owners, merchants and employers--it is important to involve key stakeholders and find policies that can help each group achieve their goals. Stakeholders include those who own or control parking and community members who are affected by parking policies.

Many groups can take the lead in bringing stakeholders together. The city could convene such an effort, but equally could a neighborhood group or merchant group.

Many Bay Area cities have implemented parking management strategies, so there is a substantial body of experience that can be shared. Appendix C lists some of the approaches used in BART station areas.

The key steps in designing and implementing a parking program are as follows:

1) Collect background information on the issue and complete the "what-when-where-who-why" analysis (see Step 1, page 3). Consult existing parking utilization studies and conduct any field studies that are required. Assemble relevant policy statements from general plans and other city policies.

2) Review alternative strategies from Tables 1 and 2 (see Step 2, page 7). Assess the most suitable approaches, based on the strengths and weaknesses of each approach and their respective fit with local conditions and local policy. Develop new approaches if those listed do not respond to local conditions.

One the most significant questions that must be answered is whether parking issues will be addressed by managing existing supplies (in combination, perhaps, with incentives for alternative travel modes) or whether additions to parking will be considered. The answer to this question rests, in turn, with the

community's general plan policies, environmental policies, resources available for new programs and its philosophy about sustainability, quality of life and other questions.

Once the general direction of parking policy is established, more specific criteria can be developed, including:

- effectiveness in addressing the parking problem,
- community acceptability,
- compatibility with local plans,
- cost and financing feasibility,
- time frame for implementation, and
- implications for congestion and air quality.

3) Create a process to identify and work with stakeholders. Develop formal and informal processes to discuss the issue, the potential approaches and implementation issues. Identify local supporters of the process who can explain the issues to the community.

4) Take alternative approaches to the community to gain further feedback. Build consensus on the preferred approaches.

5) Develop implementation plan(s), including estimates of costs and revenues associated with the strategies. For projects where there is joint responsibility for the problem, develop agreements on cost

sharing and implementation responsibility.
Present the plan to the appropriate body or
bodies for adoption and implementation.

Secure funding and assign organizational
responsibility for carrying out programs.
Create institutional structures (e.g., parking
authorities, oversight bodies) and hire or
assign staff to work on the project.

Develop marketing and public information
programs to inform residents, the business
community and commuters of the changes
that are planned.

6) Implement the strategy and
monitor its success,
considering conditions before
and after its implementation.



Make adjustments after the initial period of
implementation to make sure that the
programs are working as intended.

Notes:

Parking Resources

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Chrest, A, M. Smith, S. Bhuyan (1996) *Parking Structures*. New York: Chapman and Hall.

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Kodama, M., R. Willson and W. Francis (1996) *Using Demand-Based Parking Strategies to Meet Community Goals*. Los Angeles: Mobile Source Reduction Committee.

ITS International (1997) "Parking Control." In *ITS International*. November/December 1997, pp. 35-36.

Shoup, D. (1997) *Cashing in on Curb Parking Access*. pp. 20-26.

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Willson, R. (2000) "Reading between the Regulations: Parking Requirements, Planners' Perspectives, and Transit." *Journal of Public Transit*. 3: 111-128.

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Appendix A: Worksheets

The blank worksheets that follow are for use in community meetings and workshops. Public officials and community members can explore issues and strategies by filling the appropriate boxes.



The worksheets can be used in a number of ways. They can be filled out by individuals and then tallied for the group to indicate areas of commonality. Alternatively, small groups can discuss the issues raised in the worksheets and develop a consensus around the issues and strategies.

The worksheets include the following:

- The What-When-Where-Who-Why of Parking Management
- On-Street Parking Issues and Responses
- Off-Street Parking Issues and Responses

Notes:

Analysis Worksheet: The What-When-Where-Who-Why of Parking Management

What?

Is the issue related to parking availability, price, convenience, or safety?



When?

Is the issue occurring all day, in the morning, noon or evening periods, or on weekends?



Where?

What is the geographic scope of the issue--a single block, a neighborhood or a district?



Who?

What user groups are affected--residents, workers, shoppers, transit riders?



Why?

Is the issue related to growth, lack of parking supply, regulation, or information?

Analysis Worksheet: On-Street Parking Issues and Responses

Write in parking issues below:

- Permit parking programs
- Enforcement
- Merchant programs
- Time limits and restrictions
- Urban design/signage/traffic calming
- Assignment of parking location
- Parking charges
- Parking Benefit Districts
- Restriping for more spaces
- Add off-street parking
- Alternatives to driving
- Other: _____

Note: Add a check or a rating (1 - 3) for those strategies that are appropriate for the issues you have identified.

Notes:

Analysis Worksheet: Off-Street Parking Issues and Responses

Write in parking issues below:

- Access control (gate arms, validation systems)
- Enforcement
- Employer programs
- Time limits and restrictions
- Signage/TTS/design
- Shared parking
- Parking cash-out
- Parking charges
- Alternatives to driving
- Other: _____
- Other: _____

Note: Add a check or a rating (1 - 3) for those that are appropriate strategies for the issues you have identified.

Notes: _____

Appendix B: Permit Parking Programs

Residential parking permit parking programs are designed to provide reasonably available and convenient on-street parking for residents when parking demand from nearby uses would otherwise occupy that parking. Cities generally establish permit parking districts that are designated on a map and for which specific parking regulations apply. Many of the communities around BART stations have implemented residential permit parking programs (See Appendix C)

Permit parking districts regulate time aspects of parking for non-residents. For example, a district may restrict parking for non-residents to 2 hours, allowing for visitors but not all-day parking. Residents of the district are entitled to a permit that releases them from the particular parking restrictions. Residents may also request guest permits for visitors. Residents must provide proof of residency, complete an application, and in most cases pay a small fee, which pays for the administrative costs of operating the program. The ordinance establishing such a program should include provisions for appeals.

Cities usually set thresholds for the creation of a permit parking programs. For example, the establishment of a program

could require a petition signed by a certain percentage of residents residing within the zone, or could be based on the initiative of the city. Most cities then require a study by the City traffic engineer or planner, followed by a recommendation to the City Council.

Many programs include policies regarding the number of parking permits to be issued to guests. The rules prohibit the sale, rent or lease of any permit to any other individual. Generally, permits are not transferable between areas.

In the case of BART, it would be prudent to involve the community in the planning process before BART SFO Extension begins revenue service. Permit parking is a substantial change from normal parking policies, so community buy-in is a must.

Effective enforcement and appropriate fines must accompany permit parking programs. That is a key to maintaining the credibility of the program. Police support is a must.

Finally, the parking district must be sized so that spillover effects on other neighborhoods are limited. Too small an area will displace parkers. Too large an area will undermine the need for the program. Threshold criteria should be established for determining areas that are eligible.

Notes:

Appendix C: Bay Area Experience with Transit-Related Parking Management

The table on the following page summarizes the experience of a series of BART and Caltrain station areas in the Bay Area where parking management has been an issue, as compiled by BART staff. These stations tend to be those with high parking demand. Since parking policies are subject to change, please contact the relevant local jurisdiction for the most current information.

The following are some specific examples of innovative parking programs in the Bay Area:

- The City of Lafayette has developed a program to charge BART users for available on-street parking on three streets in the vicinity of the stations. Parking on the two streets closest to the station is \$3 per day. Signs indicate the restrictions on parking. Each space is numbered and payment boxes are provided at the entrance to the station. These are spaces that were not previously used by residents. The program benefits BART riders and
- provides about \$35,000 in revenue to the city.
- Private off-street lots are providing parking for BART users on a paid basis in the West Oakland and El Cerrito del Norte stations. BART patrons pay up to \$5 per day for this parking.
- Shared parking is used for overflow BART parking at the Colma station. In this case, SamTrans pays the property owner for the right of BART to use a portion of the Sierra Bowl parking lot. The parking is provided free to BART riders.
- Spillover parking from the Oakland Coliseum is allowed to use BART station parking on a paid basis.
- Many cities institute various forms of on-street parking control systems in the vicinity of BART stations, ranging from parking meters, to time limits, to permit programs. Examples BART stations with permit parking programs include Daly City, Balboa Park, Concord, Pleasant Hill, Rockridge, West Oakland, El Cerrito Del Norte, El Cerrito Plaza, North Berkeley, Downtown Berkeley and Ashby.
- Caltrain uses a \$1 per day parking charge in many of its commuter rail stations.
- Numerous owners of private parking lots use parking signage, validation programs, management and enforcement to ensure that parking is available for their customers. Strategies range from posting signs, to chaining off the parking facility before the stores open, to enforcement activities. Examples include the Hillsdale Shopping Center (Caltrain), the El Cerrito Plaza, the Embassy Suites in Pleasant Hill, and others.

Appendix Table C-1: Example Bay Area Parking Management Strategies

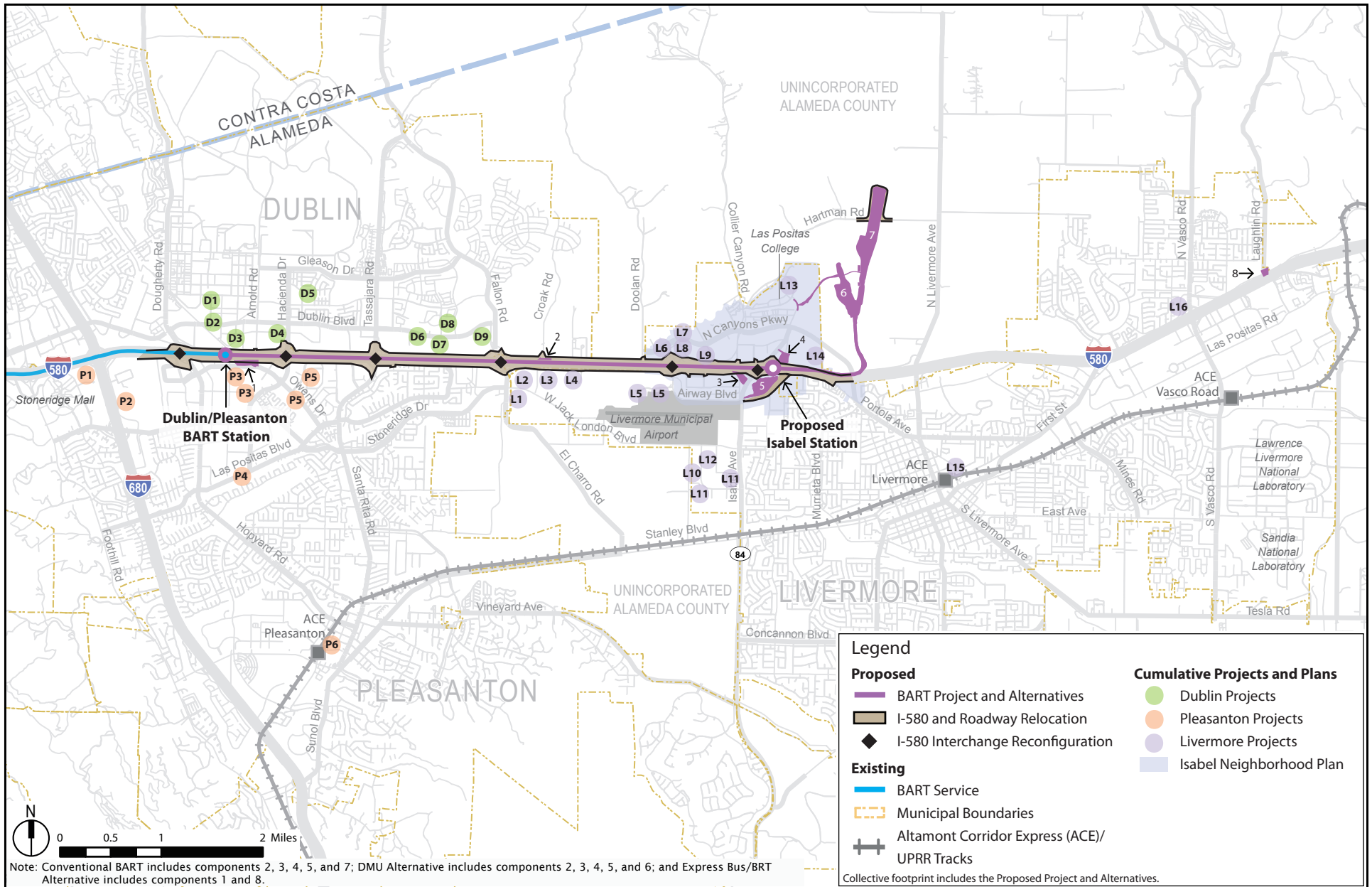
	Signage for private off-street lots	Parking meters	On-street parking time limitations	Enforcement	Residential parking permit program	Validation systems
BART San Francisco Stations	Yes	Yes	Yes--varies	City police	Yes	Varies
BART Bay Fair Station	Yes		Yes--four hour limit	BART police, shopping center security, city police		
BART Colma Station	Yes		Yes--four hour limit	BART police, city police		
BART Lafayette		Yes--for BART users	Yes	BART police, city police		
BART Concord Station			Yes--four hour limit	BART police, city police		
BART Daly City Station			Yes--four hour limit	BART police, city police	Yes	
BART El Cerrito Plaza Station	Yes		Yes--four hour limit	BART police, shopping center security, city police		
BART Pleasant Hill Station	Yes		Yes--two hour limit	BART police, city police		Embassy Suites
BART Rockridge Station		Yes	Yes--four hour limit	BART police, city police		
BART West Oakland Station			Yes--four hour limit	BART police, Caltrans personnel, city police	Yes	
Caltrain Hillsdale Station				Parking lot personnel, city police		Yes
Caltrain Millbrae Station			Yes, various			

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APPENDIX E: CUMULATIVE PROJECTS LIST

APPENDIX E: CUMULATIVE PROJECTS LIST

As described in Section 3.A, Introduction to Environmental Analysis, of this Draft EIR, the proposed Dublin/Pleasanton Station Parking Expansion and the City of Livermore's Isabel Neighborhood Plan (INP) are two specific probable future projects/plans that are the focus of the projects/plans considered in the cumulative analysis. In addition, a list of other approved or reasonably foreseeable projects in the BART project corridor was developed. This list includes projects in Dublin, Pleasanton, and Livermore, as shown in Figure 1 listed in Table 1, below.



Source: Arup, 2017; Urban Planning Partners, 2016; Alameda County, 2016; City of Dublin, 2016; City of Pleasanton, 2016; City of Livermore, 2016.

Figure 1
Appendix E
Cumulative Projects and Plans

TABLE 1 CUMULATIVE PROJECTS AND PLANS

Project Number (see Figure 1)	Project Name	Description	Location/Address	Concurrent Construction with Proposed Project or Build Alternatives?
DUBLIN				
D1	Dublin Crossing Specific Plan	189 acres with up to 1,995 residential units (single-family, townhomes, and condominiums); up to 200,000 square feet of commercial uses; a 12-acre school/park site; and a 30-acre community park	North of Dublin Boulevard between Scarlett Drive and Arnold Road	Start: 2016 Completion: Unknown (buildout over 8 to 12 years)
D2	Transit Center Site A-1	2.9 acres with 52 residential townhomes	Bounded by Dublin Boulevard (north), Campbell Lane (east), and Iron Horse Trail (southwest)	Completion: 2016/2017
D3	Dublin Station - Avalon II	505 residential apartment units	North of I-580 between DeMarcus Boulevard and Iron Horse Parkway	Construction Complete
D4	IKEA Retail Center/Project Clover	27.5 acres with an IKEA store, 377,000 square feet of retail, and additional retail/hotel buildings (total 430,000 square feet), with 1,424 parking spaces	5144 and 5344 Martinelli Way	Start: Unknown Completion: Unknown
D5	Dougherty Elementary School Kindergarten Classroom	0.55 acres expansion with six additional classrooms, new play area, and daycare relocation (total 32,640 square feet)	Hibernia Drive/Central Parkway	Start: 2016 Completion: Fall 2017
D6	Grafton Plaza Mixed-Use Development	12.23 acres for 115 residential townhomes with 345 parking spaces; four-story hotel with 127 guest rooms and 140 parking spaces; and up to 55,400 square feet of retail	Southeast corner of Grafton Street and Dublin Boulevard	Completion: 2017/2018
D7	Kaiser Dublin Medical Center	58 acres with 950,000-square-foot Kaiser medical campus, including medical offices, medical services buildings, an energy center, 250,000 square feet of commercial space, and 3,300 to 5,200 parking spaces	Bounded by Dublin Boulevard (north), Fallon Gateway retail center (east), I-580 (south), and water quality basin (west)	Start: June 2016 Completion: 2035

TABLE 1 CUMULATIVE PROJECTS AND PLANS

Project Number (see Figure 1)	Project Name	Description	Location/Address	Concurrent Construction with Proposed Project or Build Alternatives?
D8	The Groves – Lot 3	6.4 acres with 122 residential townhomes	Along Dublin Boulevard, south of Central Parkway, east of Keegan Street	Under construction
D9	Fallon Gateway	379,000-square-foot retail center	Southwest corner of Fallon Road and Dublin Boulevard	Under construction
PLEASANTON				
P1	Workday	32.3 acres with new 430,000-square-foot office building, along with two parking garages and a surface parking (combined total of 3,188 to 3,421 parking spaces)	6110 Stoneridge Mall Road	Start: 2016 Completion: 2016/2017
P2	Johnson Drive Economic Development Zone	40 acres with up to 509,990 square feet of new building space; net increase of 285,302 square feet over existing occupied buildings within the economic development zone. Initial phase (Phase I) includes hotel (88,000 square feet), club retail (148,000 square feet), and general retail (23,500 square feet).	7106-7315 Johnson Drive	Start: 2017/18 Completion: 2028
P3	BRE Sites 5 and 6	Transit-oriented, mixed-use development with 506 residential units across both sites and retail: Site 5 (Property North) – mixed-use development with up to 251 residential units, four live/work units, and 5,700 square feet of retail space Site 6 (Property East) – high-density residential development with up to 247 residential units with four live/work units	Site 5 (Property North): Southeast corner of Owens Drive and Willow Road Site 6 (Property East): North corner of Hacienda Drive and Gibraltar Drive	Completion: 2016
P4	Summerhill (Los Positas Townhome Condominiums)	5.9 acres with 94 residential condominium units ranging from two to three stories, with 248 parking spots	5850 West Las Positas Boulevard	Completion: 2016/2017

TABLE 1 CUMULATIVE PROJECTS AND PLANS

Project Number (see Figure 1)	Project Name	Description	Location/Address	Concurrent Construction with Proposed Project or Build Alternatives?
P5	Residences at California Center	19.3 acres with multi-family residential with up to 305 dwelling units; two retail buildings totaling 7,520 square feet; five-story structured parking garage with up to 941 spaces plus 489 parking spaces for residents (total of up to 1,430 parking spaces); and open space up to 101,605 square feet	4400-4460 Rosewood Drive	Completion: 2023 (assumed)
P6 (see also L15)	ACEforward Program	The proposed ACEForward Program would expand service from Lathrop southward to Manteca and Modesto by 2019, and increase the number of daily round trips from four to six. As soon as 2023, service would be extended farther to Turlock and Merced, and the number of daily round trips would be increased to ten.	Pleasanton ACE Station/Livermore ACE Station	Per NOP (dated May 2016), some construction may be complete by 2018 (first phase), the remainder as early as 2022
LIVERMORE				
L1	The Shoppes	12 acres with up to 124,000 square feet of retail, including restaurant space, and approximately 670 parking spaces	Southeast corner of El Charro Road and Jack London Boulevard	Start: 2018 Completion: 2019/2020
L2	San Francisco Premium Outlets	57 acres retail project, with phase II recently completed; total of 700,000 square feet of retail space with parking requirement of 2,800 to 3,850 spaces	2774 Livermore Outlets Drive; south of I-580, bounded by El Charro Road (west), West Jack London Boulevard (south), and Livermore Outlets Drive (east)	Construction Complete
L3	Crosswinds Site	22 acres with up to 168,000 square feet of commercial retail; a 76,500-square-foot (130-room) hotel; 672 to 924 retail parking spaces; and 306 to 924 hotel parking spaces	Southeast corner of Freisman Road and Livermore Outlets Drive	Start: 2018 Completion: 2020

TABLE 1 CUMULATIVE PROJECTS AND PLANS

Project Number (see Figure 1)	Project Name	Description	Location/Address	Concurrent Construction with Proposed Project or Build Alternatives?
L4	Sywest Site	Approximately 18.5 acres within the El Charro Specific Plan; maximum development of 249,000 square feet of commercial space and 996 to 1,370 parking spaces	Freisman Road	Unknown
L5	Five Rivers Aviation	Proposed 403 acres addition of 133,777 square feet of hanger and office space within two new buildings next to recently constructed fixed-base operator and new administration buildings within the Livermore Municipal Airport, consistent with long-term plan for airport (2009)	700 Terminal Circle	Start: 2017 Completion: 2018
L6 ^a	Chamberlin	Approximately 11 acres with an assumption for development of up to 100,000 square feet of commercial and office space	Southwest corner of Airway Boulevard and North Canyons Parkway	No current developer. Unknown.
L7 ^a	Livermore Valley Charter School	19 acres construction of a soccer field, performing arts theater, and parking lot on a 13-acre vacant property. Combined total of up to 73,000 square feet of building space. Includes conversion of existing light industrial buildings totaling 80,000 square feet into a 1,080-student high school. Total of 447 parking spaces proposed. Existing light industrial buildings are two stories high and would remain. New building architecture would be consistent with design of existing buildings.	Northwest corner of Constitution Drive and North Canyons Parkway	Completion: 2016-2017
L8 ^a	Hyatt Hotel	Approximately 2.5 acres that would replace existing Residence Inn with two new Hyatt hotels (241 guest rooms total)	1000 Airway Boulevard	Start: 2017 Completion: 2020
L9 ^a	Home 2 Suites	2.4 acres that would replace existing hotel with a new 65,825-square-foot hotel, including up to 108 guest rooms and 139 parking spaces	2625 Constitution Drive	Start: 2016 Completion: 2018

TABLE 1 CUMULATIVE PROJECTS AND PLANS

Project Number (see Figure 1)	Project Name	Description	Location/Address	Concurrent Construction with Proposed Project or Build Alternatives?
L10	Oaks Business Park ^b	Approximately 20.5 acres that would assume development of about 750,000 square feet of light industrial space on remaining land within Oaks Business Park	Southwest corner of Isabel Avenue and Jack London, along Discovery Drive	Unknown
L11	Trammel Crow ^b	72.6 acres of industrial use with 1,298,000 square feet of warehouse and distribution space across two lots, including three buildings: 636,000 square feet, 295,000 square feet, and 368,000 square feet	201 Discovery Drive, 800-801 Atlantis Street	Start: 2015 Complete
L12	Gillig Bus Manufacturing ^b	40 acres of industrial use with bus manufacturing facility with 559,500-square-foot primary building and two single-story buildings of 50,000 and 27,000 square feet (total 363,500 square feet), and up to 836 parking spaces	451 Discovery Drive	Start: 2015 Completion: 2017
L13 ^a	Las Positas College	147 acres of educational use for which the Las Positas College Facilities Master Plan (2012) includes a projection of 10,500 students in 2025 with 8 new buildings, demolition of 15 buildings, temporary structures, new athletics fields, and other site improvements	3000 Campus Hill Drive	Start: Unknown Completion: 2025 or later
L14 ^a	Shea Homes – Sage Project	59.2 acres with up to 476 residential condo units in 62 two- and three-story buildings along with a community open space, and approximately 1,281 parking spaces	Southeast corner of Isabel Avenue and Portola Road	Start: 2015 Completion: 2018
L15	ACEforward Program	See P6 above.		
L16	Central Crossing	5.2 acres of residential development with 49 two-story, single-family homes	Central Avenue at Northfront Road	Start: 2017–2019

TABLE 1 CUMULATIVE PROJECTS AND PLANS

Project Number (see Figure 1)	Project Name	Description	Location/Address	Concurrent Construction with Proposed Project or Build Alternatives?
[Not mapped]	Recreation and Trails Draft Master Plan (Cayetano Creek Trail and North Canyons Parkway Trail)	156,800 acres of open and recreational space with the development of eight additional multi-sports fields, two youth softball and baseball fields, 5.5 miles of multi-use trails, and increased trail connectivity	Draft Master Plan area is bound by Contra Costa County (north), San Joaquin County (east), Santa Clara County (south), and the cities of Pleasanton and Dublin (west)	Unknown; Master Plan is through 2035

Notes:

^a Some projects listed above are also included in the INP and Plan Bay Area, which inform the projections-based cumulative analyses.

^b Outside of 0.5-mile radius

ACE = Altamont Corridor Express

Projects are ordered from west to east and from north to south.

No reasonably foreseeable Alameda County projects of sufficient size or complexity occur within the study area, and no major projects occur within the study area vicinity; therefore, no Alameda County projects are included in the cumulative projects list.

Sources: City of Livermore, 2016; City of Pleasanton, 2016; City of Dublin, 2016; Alameda County, 2016; BART, 2016.

APPENDIX F: TRANSPORTATION

- F.1 Transportation Data for EIR**
- F.2 Transit Ridership and Vehicle Miles Travelled Under Alternative Land Use Assumptions**

F.1 Transportation – Transportation Data for EIR

APPENDIX F.1

TRANSPORTATION DATA FOR EIR

A. INTRODUCTION

This analysis assessed the performance of intersections and freeway segments within the project study area under various scenarios. These findings informed the identification of significant impacts created by the Proposed Project or the Build Alternatives.

At the end of this appendix, the following attachments are provided: (1) the intersection analysis Synchro output sheets; (2) freeway analysis volume-to-capacity sheets; and (3) model link volume plots.

B. DATA SOURCES AND METHODOLOGY

This analysis drew from various sources representing existing and forecasted future conditions of intersections and freeways within the study area. The study area is generally extends from Greenville Road on the east, Dublin Boulevard and North Canyons Parkway on the north, Interstate (I-) 680 on the west, and Stanley Boulevard on the south. The facilities included in the analysis vary according to transportation sub topic.

1. Existing Conditions

Existing conditions data was drawn from recent existing studies and, where necessary, from new data collection efforts.

a. Intersections

Turning movement counts are observed counts of vehicles making specific movements (e.g., northbound left, northbound through, northbound right, southbound left, etc.) through a given intersection during an identified study period.

A total of 50 intersections were analyzed. In the case of 23 study intersections, counts collected from recent traffic studies conducted within the cities of Dublin and Pleasanton (ranging from January 2015 to April 2016) were used. For 34 intersections where recent counts were not available, new counts were collected (between April and May 2016).

b. Freeways – Alameda County Transportation Commission 2014 Level of Service Monitoring Report

Existing conditions on freeways in the project study area were established by data provided in the Alameda County Transportation Commission’s (Alameda CTC’s) Level of Service Monitoring Report. Every two years, the Alameda CTC prepares a report assessing the performance of roadways in Alameda County and identifies trends over time.

2. Future Performance Projections

To estimate the performance of roadway networks under various future scenarios, outputs from the Alameda Countywide Travel Demand Model were processed in conjunction with other datasets.

a. Alameda Countywide Travel Demand Model

The Alameda Countywide Travel Demand Model is a regional travel demand model maintained by Alameda CTC to estimate the performance of transportation infrastructure under various future conditions, including the implementation of major transportation and land use projects.

For this analysis, a version of the Alameda Countywide Travel Demand Model customized for the BART to Livermore Extension Project was used to test the effects of the Proposed Project and Build Alternatives. Direct outputs of the model include project ridership, other transit ridership, link traffic volumes, and vehicle-miles traveled (VMT).

b. Manual Adjustments

In some cases, direct outputs from the Alameda Countywide Travel Demand Model were manually adjusted for this analysis to reflect known and expected travel patterns within the project study area.

3. Intersection Performance

Using data from the sources identified above, future volume forecasts for each scenario were developed and the operations of study area intersections were assessed.

a. Future Intersection Volume Generation

Roadway volume data, as contained in the various above sources, is combined to produce estimates for each specific turning movement in each intersection under each scenario.

- **Difference Method**
 - The “difference method” was used to develop estimates for future scenario intersection turning movement volumes. This method calculates the difference in model-reported volumes between an existing scenario for which observed data exists and a specific future scenario. This difference is then added to observed turning movement volumes to generate estimate future scenario turning movement volumes.
- **Furness Balancing**
 - Specific intersection turning volumes, as predicted by a regional travel demand model, are frequently unrealistic by themselves. This stems from the fact that regional travel demand models are primarily intended to forecast broader regional travel trends; “model noise” can frequently be significant at the finer resolution of individual intersections or, specifically, for the individual turning movements of individual intersections. “Furness balancing” is a process used to balance specific forecasted future volumes by accounting for the relative proportions of turning movements as observed in existing turning movement counts. Erratic and unrealistic spikes in volumes that a regional travel demand model may predict are consequently dampened to yield more realistic turning movement volume forecasts.

b. HCM 2000

Once turning movement volumes are calculated, the performance of each study intersection is evaluated according to Highway Capacity Manual 2000 (HCM 2000) methodology using Synchro 9 software. HCM 2000 is a widely-used standard methodology for evaluating the operations of roadway intersections. Synchro 9 is a commonly-used software application for assessing intersection operations (including HCM-based analysis). The primary metric evaluated is average delay per vehicle; a level of service (LOS) value is accordingly assigned based on average delay. (LOS A corresponds to conditions with minimal queuing or delay; LOS F corresponds to overcapacity and highly congested conditions with significant persistent queuing.)

More recent versions of the HCM methodology, including HCM 2010 and HCM 6, have not seen widespread adoption due to limitations in software implementation for non-standard intersections, and, accordingly, not used for this analysis.

4. Freeway Performance

HCM 1985 methodology was used to evaluate traffic operations on I-580 within the study area. This methodology compares the volume of traffic using each freeway link with the capacity of the link. A volume-to-capacity ratio (V/C ratio) is reported and a level of

service (LOS) value assigned. (LOS A corresponds to lightly used, free-flow conditions; LOS F corresponds to overcapacity and highly congested conditions.)

C. INTERSECTION ANALYSIS – SYNCHRO OUTPUT SHEETS

This section includes the calculations generated by the Synchro 9 software package to estimate the performance of roadway intersections in the project study area with the Proposed Project and Build Alternatives (in accordance with Highway Capacity Manual 2000 [HCM 2000] methodology).

D. FREEWAY ANALYSIS – VOLUME-TO-CAPACITY SHEETS

This section includes the volume-to-capacity (V/C) calculations used to estimate the performance of freeway segments in the project study area with the Proposed Project and Build Alternatives (in accordance with Highway Capacity Manual 1985 [HCM 1985] methodology).

E. MODEL LINK VOLUME PLOTS

The diagrams on the following pages are direct outputs from the Alameda Countywide Travel Demand Model. Each diagram presents a link-by-link comparison of volumes between scenarios. Green lines indicate a volume increase, compared to a No Project scenario and red lines indicate a volume decrease. The thickness of each line is proportional to the change in volume between scenarios.

HCM Signalized Intersection Capacity Analysis
1: Dougherty Rd & Amador Valley Rd



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	72	336	341	673	1581	146
Future Volume (vph)	72	336	341	673	1581	146
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5	5.7	5.7	
Lane Util. Factor	1.00	1.00	1.00	0.95	0.95	
Frt	1.00	0.85	1.00	1.00	0.99	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1770	1583	1770	3539	3494	
Flt Permitted	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	1770	1583	1770	3539	3494	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	78	365	371	732	1718	159
RTOR Reduction (vph)	0	329	0	0	5	0
Lane Group Flow (vph)	78	36	371	732	1872	0
Turn Type	Perm	Perm	Prot	NA	NA	
Protected Phases			5	2	6	
Permitted Phases	4	4				
Actuated Green, G (s)	9.0	9.0	23.5	72.9	44.9	
Effective Green, g (s)	9.0	9.0	23.5	72.9	44.9	
Actuated g/C Ratio	0.10	0.10	0.26	0.79	0.49	
Clearance Time (s)	4.5	4.5	4.5	5.7	5.7	
Vehicle Extension (s)	1.8	1.8	2.0	4.0	4.0	
Lane Grp Cap (vph)	172	154	451	2801	1703	
v/s Ratio Prot			c0.21	0.21	c0.54	
v/s Ratio Perm	c0.04	0.02				
v/c Ratio	0.45	0.23	0.82	0.26	1.10	
Uniform Delay, d1	39.2	38.4	32.3	2.5	23.6	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.7	0.3	11.0	0.1	54.4	
Delay (s)	39.9	38.6	43.3	2.6	78.0	
Level of Service	D	D	D	A	E	
Approach Delay (s)	38.9			16.3	78.0	
Approach LOS	D			B	E	

Intersection Summary

HCM 2000 Control Delay	53.0	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.94		
Actuated Cycle Length (s)	92.1	Sum of lost time (s)	14.7
Intersection Capacity Utilization	83.5%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
2: Dougherty Rd & Dublin Blvd



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↑↑↑	↖↗	↖↗↘	↑↑↑	↖	↖↗↘	↑↑↑	↖↗	↖↗	↑↑↑	↖↗
Traffic Volume (vph)	39	241	369	248	614	365	568	908	74	444	1517	71
Future Volume (vph)	39	241	369	248	614	365	568	908	74	444	1517	71
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	6.0	5.0	5.0	5.5	5.0	5.0	5.5	5.0	5.0	5.5	
Lane Util. Factor	0.97	0.91	0.88	0.94	0.91	1.00	0.94	0.91	0.88	0.97	0.86	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	3433	5085	2787	4990	5085	1583	4990	5085	2787	3433	6365	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	3433	5085	2787	4990	5085	1583	4990	5085	2787	3433	6365	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	42	262	401	270	667	397	617	987	80	483	1649	77
RTOR Reduction (vph)	0	0	85	0	0	106	0	0	43	0	3	0
Lane Group Flow (vph)	42	262	316	270	667	291	617	987	37	483	1723	0
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	
Protected Phases	5	2	3	1	6	7	3	8	1	7	4	
Permitted Phases			2			6			8			
Actuated Green, G (s)	11.5	24.9	46.8	15.3	29.2	52.8	21.9	44.9	60.2	23.6	46.6	
Effective Green, g (s)	11.5	24.9	46.8	15.3	29.2	52.8	21.9	44.9	60.2	23.6	46.6	
Actuated g/C Ratio	0.09	0.19	0.36	0.12	0.22	0.41	0.17	0.34	0.46	0.18	0.36	
Clearance Time (s)	5.0	6.0	5.0	5.0	5.5	5.0	5.0	5.5	5.0	5.0	5.5	
Vehicle Extension (s)	2.0	4.5	2.0	2.0	4.5	2.0	2.0	4.5	2.0	2.0	4.5	
Lane Grp Cap (vph)	303	972	1001	586	1140	641	839	1753	1288	622	2278	
v/s Ratio Prot	0.01	0.05	0.05	c0.05	c0.13	0.08	0.12	0.19	0.00	c0.14	c0.27	
v/s Ratio Perm			0.06			0.10			0.01			
v/c Ratio	0.14	0.27	0.32	0.46	0.59	0.45	0.74	0.56	0.03	0.78	0.76	
Uniform Delay, d1	54.8	44.9	30.1	53.6	45.1	28.2	51.4	34.7	19.1	50.8	36.8	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.1	0.3	0.1	0.2	1.1	0.2	2.9	0.6	0.0	5.5	1.7	
Delay (s)	54.9	45.2	30.2	53.8	46.1	28.4	54.3	35.3	19.1	56.3	38.5	
Level of Service	D	D	C	D	D	C	D	D	B	E	D	
Approach Delay (s)		37.2			42.4			41.5			42.4	
Approach LOS		D			D			D			D	

Intersection Summary

HCM 2000 Control Delay	41.5	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.71		
Actuated Cycle Length (s)	130.2	Sum of lost time (s)	21.5
Intersection Capacity Utilization	78.4%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

3: Dougherty Rd & I-580 WB Ramps

BART to Livermore Extension Project
2013 Existing AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↔↔		↔↔		↑↑↑			↑↑↑	↔
Traffic Volume (vph)	0	0	0	390	0	637	0	1033	0	0	1450	0
Future Volume (vph)	0	0	0	390	0	637	0	1033	0	0	1450	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0		4.0		4.0			4.0	
Lane Util. Factor				0.97		0.88		0.91			0.86	
Frt				1.00		0.85		1.00			1.00	
Flt Protected				0.95		1.00		1.00			1.00	
Satd. Flow (prot)				3433		2787		5085			4806	
Flt Permitted				0.95		1.00		1.00			1.00	
Satd. Flow (perm)				3433		2787		5085			4806	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	424	0	692	0	1123	0	0	1576	0
RTOR Reduction (vph)	0	0	0	0	0	118	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	424	0	574	0	1123	0	0	1576	0
Turn Type				Prot		Prot		NA			NA	Perm
Protected Phases				4		4		2			6	
Permitted Phases												6
Actuated Green, G (s)				14.5		14.5		34.7			34.7	
Effective Green, g (s)				15.9		15.9		36.1			36.1	
Actuated g/C Ratio				0.27		0.27		0.60			0.60	
Clearance Time (s)				5.4		5.4		5.4			5.4	
Vehicle Extension (s)				3.0		3.0		3.0			3.0	
Lane Grp Cap (vph)				909		738		3059			2891	
v/s Ratio Prot				0.12		c0.21		0.22			c0.33	
v/s Ratio Perm												
v/c Ratio				0.47		0.78		0.37			0.55	
Uniform Delay, d1				18.5		20.4		6.1			7.1	
Progression Factor				1.00		1.00		1.14			1.00	
Incremental Delay, d2				0.4		5.2		0.3			0.7	
Delay (s)				18.9		25.6		7.3			7.8	
Level of Service				B		C		A			A	
Approach Delay (s)		0.0			23.1			7.3			7.8	
Approach LOS		A			C			A			A	

Intersection Summary

HCM 2000 Control Delay	12.1	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.62		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	48.9%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
4: Hopyard Rd/Dougherty Rd & I-580 EB Ramps



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	613	0	1389	0	0	0	0	753	0	0	1420	0
Future Volume (vph)	613	0	1389	0	0	0	0	753	0	0	1420	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0					4.0			4.0	
Lane Util. Factor	0.97		0.88					0.91			0.86	
Frt	1.00		0.85					1.00			1.00	
Flt Protected	0.95		1.00					1.00			1.00	
Satd. Flow (prot)	3433		2787					5085			4806	
Flt Permitted	0.95		1.00					1.00			1.00	
Satd. Flow (perm)	3433		2787					5085			4806	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	666	0	1510	0	0	0	0	818	0	0	1543	0
RTOR Reduction (vph)	0	0	25	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	666	0	1485	0	0	0	0	818	0	0	1543	0
Turn Type	Prot		Prot					NA	Free		NA	Perm
Protected Phases	4		4					2			6	
Permitted Phases									Free			6
Actuated Green, G (s)	24.8		24.8					24.4			24.4	
Effective Green, g (s)	26.2		26.2					25.8			25.8	
Actuated g/C Ratio	0.44		0.44					0.43			0.43	
Clearance Time (s)	5.4		5.4					5.4			5.4	
Vehicle Extension (s)	3.0		3.0					3.0			3.0	
Lane Grp Cap (vph)	1499		1216					2186			2066	
v/s Ratio Prot	0.19		c0.53					0.16			c0.32	
v/s Ratio Perm												
v/c Ratio	0.44		1.22					0.37			0.75	
Uniform Delay, d1	11.8		16.9					11.6			14.4	
Progression Factor	1.00		1.00					0.92			0.90	
Incremental Delay, d2	0.2		107.2					0.5			2.2	
Delay (s)	12.0		124.1					11.2			15.1	
Level of Service	B		F					B			B	
Approach Delay (s)		89.8			0.0			11.2			15.1	
Approach LOS		F			A			B			B	

Intersection Summary

HCM 2000 Control Delay	50.2	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.99		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	82.7%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
5: Hopyard Rd & Owens Rd



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↔↗		↖	↗	↗	↖	↑↑↑	↗	↖↗	↑↑↗	
Traffic Volume (vph)	223	81	45	94	121	208	107	599	94	759	1513	586
Future Volume (vph)	223	81	45	94	121	208	107	599	94	759	1513	586
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	2.7	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	0.91	0.91		1.00	0.95	0.95	1.00	0.91	1.00	0.97	0.91	
Frt	1.00	0.97		1.00	0.95	0.85	1.00	1.00	0.85	1.00	0.96	
Flt Protected	0.95	0.98		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1610	3218		1770	1678	1504	1770	5085	1583	3433	4872	
Flt Permitted	0.95	0.98		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1610	3218		1770	1678	1504	1770	5085	1583	3433	4872	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	242	88	49	102	132	226	116	651	102	825	1645	637
RTOR Reduction (vph)	0	20	0	0	16	91	0	0	69	0	49	0
Lane Group Flow (vph)	133	226	0	102	186	65	116	651	33	825	2233	0
Turn Type	Split	NA		Split	NA	pm+ov	Prot	NA	Perm	Prot	NA	
Protected Phases	8	8		4	4	1	5	2		1	6	
Permitted Phases						4			2			
Actuated Green, G (s)	15.5	15.5		12.7	12.7	47.4	13.3	36.8	36.8	34.7	58.2	
Effective Green, g (s)	16.8	16.8		14.0	14.0	50.0	13.3	38.5	38.5	34.7	59.9	
Actuated g/C Ratio	0.14	0.14		0.12	0.12	0.42	0.11	0.32	0.32	0.29	0.50	
Clearance Time (s)	5.3	5.3		5.3	5.3	4.0	4.0	5.7	5.7	4.0	5.7	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	225	450		206	195	626	196	1631	507	992	2431	
v/s Ratio Prot	c0.08	0.07		0.06	c0.11	0.03	0.07	0.13		c0.24	c0.46	
v/s Ratio Perm						0.01			0.02			
v/c Ratio	0.59	0.50		0.50	0.95	0.10	0.59	0.40	0.06	0.83	0.92	
Uniform Delay, d1	48.4	47.7		49.7	52.7	21.3	50.8	31.7	28.3	39.9	27.8	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	0.98	0.99	
Incremental Delay, d2	4.1	0.9		1.9	51.0	0.1	4.7	0.7	0.2	1.9	2.4	
Delay (s)	52.5	48.6		51.6	103.7	21.4	55.5	32.5	28.5	40.9	29.9	
Level of Service	D	D		D	F	C	E	C	C	D	C	
Approach Delay (s)		50.0			64.2			35.1			32.8	
Approach LOS		D			E			D			C	

Intersection Summary

HCM 2000 Control Delay	37.6	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.87		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	79.0%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
6: Hopyard Rd & Stoneridge Dr



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	115	703	423	80	903	91	630	614	90	261	912	204
Future Volume (vph)	115	703	423	80	903	91	630	614	90	261	912	204
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.91	1.00	0.97	0.91	1.00	0.94	0.95	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5085	1583	3433	5085	1583	4990	3539	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5085	1583	3433	5085	1583	4990	3539	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	125	764	460	87	982	99	685	667	98	284	991	222
RTOR Reduction (vph)	0	0	232	0	0	73	0	0	70	0	0	122
Lane Group Flow (vph)	125	764	228	87	982	26	685	667	28	284	991	100
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8			2			6
Actuated Green, G (s)	3.1	15.5	15.5	3.1	15.5	15.5	8.1	16.5	16.5	7.1	15.5	15.5
Effective Green, g (s)	3.1	15.5	15.5	3.1	15.5	15.5	8.1	16.5	16.5	7.1	15.5	15.5
Actuated g/C Ratio	0.05	0.27	0.27	0.05	0.27	0.27	0.14	0.28	0.28	0.12	0.27	0.27
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	182	1354	421	182	1354	421	694	1003	448	418	1354	421
v/s Ratio Prot	c0.04	0.15		0.03	c0.19		c0.14	0.19		0.08	c0.19	
v/s Ratio Perm			0.14			0.02			0.02			0.06
v/c Ratio	0.69	0.56	0.54	0.48	0.73	0.06	0.99	0.67	0.06	0.68	0.73	0.24
Uniform Delay, d1	27.1	18.4	18.3	26.8	19.4	15.9	25.0	18.4	15.2	24.5	19.5	16.7
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	10.3	0.5	1.4	2.0	2.0	0.1	30.6	1.7	0.1	4.4	2.1	0.3
Delay (s)	37.3	19.0	19.7	28.7	21.4	16.0	55.6	20.1	15.3	28.8	21.5	17.0
Level of Service	D	B	B	C	C	B	E	C	B	C	C	B
Approach Delay (s)		20.9			21.5			36.5			22.2	
Approach LOS		C			C			D			C	

Intersection Summary

HCM 2000 Control Delay	25.5	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.77		
Actuated Cycle Length (s)	58.2	Sum of lost time (s)	16.0
Intersection Capacity Utilization	63.7%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
7: Hopyard Rd & Las Positas Blvd

BART to Livermore Extension Project
2013 Existing AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↕	↖	↖↗	↕	↖	↖↗	↕↕↕	↖	↖↗	↕↕↕	↖
Traffic Volume (vph)	145	439	362	350	448	56	408	1121	353	106	988	88
Future Volume (vph)	145	439	362	350	448	56	408	1121	353	106	988	88
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.95	1.00	0.97	0.95	1.00	0.97	0.91	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	3433	3539	1583	3433	5085	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	3433	3539	1583	3433	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	158	477	393	380	487	61	443	1218	384	115	1074	96
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	71
Lane Group Flow (vph)	158	477	393	380	487	61	443	1218	384	115	1074	25
Turn Type	Prot	NA	Free	Prot	NA	Free	Prot	NA	Free	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1		6
Permitted Phases			Free			Free			Free			6
Actuated Green, G (s)	4.7	14.4	64.3	8.0	17.7	64.3	9.0	22.7	64.3	3.2	16.9	16.9
Effective Green, g (s)	4.7	14.4	64.3	8.0	17.7	64.3	9.0	22.7	64.3	3.2	16.9	16.9
Actuated g/C Ratio	0.07	0.22	1.00	0.12	0.28	1.00	0.14	0.35	1.00	0.05	0.26	0.26
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	250	792	1583	427	974	1583	480	1795	1583	170	1336	416
v/s Ratio Prot	0.05	c0.13		c0.11	0.14		c0.13	0.24		0.03	c0.21	
v/s Ratio Perm			c0.25			0.04			0.24			0.02
v/c Ratio	0.63	0.60	0.25	0.89	0.50	0.04	0.92	0.68	0.24	0.68	0.80	0.06
Uniform Delay, d1	29.0	22.4	0.0	27.7	19.6	0.0	27.3	17.7	0.0	30.0	22.2	17.8
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	5.1	1.3	0.4	19.7	0.4	0.0	23.4	1.0	0.4	10.2	3.6	0.1
Delay (s)	34.1	23.7	0.4	47.4	20.0	0.0	50.7	18.7	0.4	40.2	25.8	17.8
Level of Service	C	C	A	D	B	A	D	B	A	D	C	B
Approach Delay (s)		16.4			29.9			22.2			26.5	
Approach LOS		B			C			C			C	

Intersection Summary

HCM 2000 Control Delay	23.5	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.76		
Actuated Cycle Length (s)	64.3	Sum of lost time (s)	16.0
Intersection Capacity Utilization	66.2%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
8: Willow Rd & Owens Rd

BART to Livermore Extension Project
2013 Existing AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↖↗↘		↖↗	↖↗↘	↖	↖	↖↗	↖	↖	↖	↖
Traffic Volume (vph)	102	284	176	117	317	96	77	84	0	90	84	74
Future Volume (vph)	102	284	176	117	317	96	77	84	0	90	84	74
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	5.3	4.0		5.3	4.0	4.0
Lane Util. Factor	0.97	0.91		0.97	0.91	1.00	1.00	0.95		1.00	1.00	1.00
Frt	1.00	0.94		1.00	1.00	0.85	1.00	1.00		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	4794		3433	5085	1583	1770	3539		1770	1863	1583
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.70	1.00		0.69	1.00	1.00
Satd. Flow (perm)	3433	4794		3433	5085	1583	1300	3539		1295	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	111	309	191	127	345	104	84	91	0	98	91	80
RTOR Reduction (vph)	0	118	0	0	0	61	0	0	0	0	0	64
Lane Group Flow (vph)	111	382	0	127	345	43	84	91	0	98	91	16
Turn Type	Prot	NA		Prot	NA	Perm	Perm	NA	Perm	Perm	NA	Perm
Protected Phases	1	6		5	2			4			8	
Permitted Phases						2	4		4	8		8
Actuated Green, G (s)	4.0	14.3		5.5	15.8	15.8	7.1	7.1		7.1	7.1	7.1
Effective Green, g (s)	4.0	16.0		5.5	17.5	17.5	7.1	8.4		7.1	8.4	8.4
Actuated g/C Ratio	0.10	0.38		0.13	0.42	0.42	0.17	0.20		0.17	0.20	0.20
Clearance Time (s)	4.0	5.7		4.0	5.7	5.7	5.3	5.3		5.3	5.3	5.3
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	327	1830		450	2123	661	220	709		219	373	317
v/s Ratio Prot	0.03	c0.08		c0.04	0.07			0.03			0.05	
v/s Ratio Perm						0.03	0.06			c0.08		0.01
v/c Ratio	0.34	0.21		0.28	0.16	0.07	0.38	0.13		0.45	0.24	0.05
Uniform Delay, d1	17.7	8.7		16.4	7.6	7.3	15.5	13.7		15.6	14.1	13.5
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	0.6	0.1		0.3	0.0	0.0	1.1	0.1		1.5	0.3	0.1
Delay (s)	18.3	8.8		16.8	7.7	7.3	16.6	13.8		17.1	14.4	13.6
Level of Service	B	A		B	A	A	B	B		B	B	B
Approach Delay (s)		10.5			9.6			15.1			15.1	
Approach LOS		B			A			B			B	

Intersection Summary

HCM 2000 Control Delay	11.4	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.27		
Actuated Cycle Length (s)	41.9	Sum of lost time (s)	12.0
Intersection Capacity Utilization	34.4%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
9: Hacienda Dr & Dublin Blvd

BART to Livermore Extension Project
2013 Existing AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	57	302	77	263	728	74	145	552	115	13	387	132
Future Volume (vph)	57	302	77	263	728	74	145	552	115	13	387	132
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	6.0	5.0	4.5	6.0		5.0	6.0	6.0	4.5	5.5	5.5
Lane Util. Factor	0.97	0.91	0.88	0.97	0.91		0.94	0.95	0.88	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5085	2787	3433	5015		4990	3539	2787	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5085	2787	3433	5015		4990	3539	2787	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	62	328	84	286	791	80	158	600	125	14	421	143
RTOR Reduction (vph)	0	0	57	0	8	0	0	0	83	0	0	107
Lane Group Flow (vph)	62	328	27	286	863	0	158	600	42	14	421	36
Turn Type	Prot	NA	pm+ov	Prot	NA		Prot	NA	Perm	Prot	NA	Perm
Protected Phases	5	2	3	1	6		3	8		7	NA	4
Permitted Phases			2						8			4
Actuated Green, G (s)	5.0	17.6	25.0	11.8	24.4		7.4	25.6	25.6	0.9	19.1	19.1
Effective Green, g (s)	5.0	17.6	25.0	11.8	24.4		7.4	25.6	25.6	0.9	19.1	19.1
Actuated g/C Ratio	0.07	0.23	0.33	0.15	0.32		0.10	0.33	0.33	0.01	0.25	0.25
Clearance Time (s)	4.5	6.0	5.0	4.5	6.0		5.0	6.0	6.0	4.5	5.5	5.5
Vehicle Extension (s)	2.0	3.5	2.0	2.0	3.5		2.0	3.5	3.5	2.0	3.5	3.5
Lane Grp Cap (vph)	223	1163	906	526	1591		480	1178	927	40	1262	393
v/s Ratio Prot	0.02	0.06	0.00	c0.08	c0.17		c0.03	c0.17		0.00	0.08	
v/s Ratio Perm			0.01						0.01			0.02
v/c Ratio	0.28	0.28	0.03	0.54	0.54		0.33	0.51	0.04	0.35	0.33	0.09
Uniform Delay, d1	34.2	24.4	17.7	30.1	21.6		32.4	20.6	17.4	37.7	23.7	22.2
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.2	0.2	0.0	0.6	0.4		0.1	0.4	0.0	1.9	0.2	0.1
Delay (s)	34.5	24.6	17.7	30.7	22.1		32.6	21.0	17.4	39.6	23.9	22.3
Level of Service	C	C	B	C	C		C	C	B	D	C	C
Approach Delay (s)		24.7			24.2			22.6			23.9	
Approach LOS		C			C			C			C	

Intersection Summary

HCM 2000 Control Delay	23.7	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.56		
Actuated Cycle Length (s)	76.9	Sum of lost time (s)	21.0
Intersection Capacity Utilization	55.1%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 10: Hacienda Dr & Martinelli Blvd/Hacienda Crossings



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗	↘	↙	↘		↖↗↘	↖↗↘	↗	↙↘	↖↗↘	
Traffic Volume (vph)	7	6	137	112	11	7	235	780	115	16	721	44
Future Volume (vph)	7	6	137	112	11	7	235	780	115	16	721	44
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	3.0	3.0	4.5	3.0		3.5	3.0	3.0	4.0	3.5	
Lane Util. Factor	1.00	0.91	0.91	0.97	1.00		0.94	0.91	1.00	0.97	0.86	
Frt	1.00	0.90	0.85	1.00	0.94		1.00	1.00	0.85	1.00	0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1770	1522	2882	3433	1751		4990	5085	1583	3433	6352	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1770	1522	2882	3433	1751		4990	5085	1583	3433	6352	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	8	7	149	122	12	8	255	848	125	17	784	48
RTOR Reduction (vph)	0	11	102	0	5	0	0	0	54	0	5	0
Lane Group Flow (vph)	8	11	32	122	15	0	255	848	71	17	827	0
Turn Type	Prot	NA	Perm	Prot	NA		Prot	NA	pm+ov	Prot	NA	
Protected Phases	5	2		1	6		3	8	1	7	4	
Permitted Phases			2						8			
Actuated Green, G (s)	1.2	15.9	15.9	7.3	22.5		9.4	31.7	39.0	1.2	23.5	
Effective Green, g (s)	1.7	17.9	17.9	7.8	24.5		10.4	33.7	43.0	1.7	25.0	
Actuated g/C Ratio	0.02	0.24	0.24	0.10	0.32		0.14	0.45	0.57	0.02	0.33	
Clearance Time (s)	4.5	5.0	5.0	5.0	5.0		4.5	5.0	5.0	4.5	5.0	
Vehicle Extension (s)	3.0	4.0	4.0	2.0	4.0		3.0	4.0	2.0	3.0	4.0	
Lane Grp Cap (vph)	39	360	682	354	567		686	2266	963	77	2100	
v/s Ratio Prot	0.00	0.01		c0.04	0.01		c0.05	c0.17	0.01	0.00	0.13	
v/s Ratio Perm			c0.01						0.04			
v/c Ratio	0.21	0.03	0.05	0.34	0.03		0.37	0.37	0.07	0.22	0.39	
Uniform Delay, d1	36.3	22.2	22.3	31.5	17.4		29.6	13.9	7.3	36.3	19.5	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	2.6	0.0	0.0	0.2	0.0		0.3	0.1	0.0	1.5	0.2	
Delay (s)	38.9	22.2	22.3	31.7	17.4		30.0	14.1	7.3	37.8	19.6	
Level of Service	D	C	C	C	B		C	B	A	D	B	
Approach Delay (s)		23.1			29.7			16.7			20.0	
Approach LOS		C			C			B			B	

Intersection Summary

HCM 2000 Control Delay	19.1	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.29		
Actuated Cycle Length (s)	75.6	Sum of lost time (s)	14.5
Intersection Capacity Utilization	40.1%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 11: Hacienda Dr & I-580 WB Ramps

BART to Livermore Extension Project
 2013 Existing AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↔↔		↔↔		↑↑↑			↑↑↑	↔
Traffic Volume (vph)	0	0	0	186	0	446	0	918	183	0	557	416
Future Volume (vph)	0	0	0	186	0	446	0	918	183	0	557	416
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0		4.0		4.0			4.0	4.0
Lane Util. Factor				0.97		0.88		0.91			0.86	0.86
Frt				1.00		0.85		0.98			0.96	0.85
Flt Protected				0.95		1.00		1.00			1.00	1.00
Satd. Flow (prot)				3433		2787		4958			4610	1362
Flt Permitted				0.95		1.00		1.00			1.00	1.00
Satd. Flow (perm)				3433		2787		4958			4610	1362
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	202	0	485	0	998	199	0	605	452
RTOR Reduction (vph)	0	0	0	0	0	107	0	48	0	0	109	110
Lane Group Flow (vph)	0	0	0	202	0	378	0	1149	0	0	722	116
Turn Type				Prot		Prot		NA			NA	Perm
Protected Phases				4		4		2			6	
Permitted Phases												6
Actuated Green, G (s)				11.6		11.6		20.4			20.4	20.4
Effective Green, g (s)				13.0		13.0		22.3			22.3	22.3
Actuated g/C Ratio				0.30		0.30		0.52			0.52	0.52
Clearance Time (s)				5.4		5.4		5.9			5.9	5.9
Vehicle Extension (s)				3.0		3.0		3.0			3.0	3.0
Lane Grp Cap (vph)				1030		836		2553			2374	701
v/s Ratio Prot				0.06		c0.14		c0.23			0.16	
v/s Ratio Perm												0.09
v/c Ratio				0.20		0.45		0.45			0.30	0.17
Uniform Delay, d1				11.3		12.3		6.6			6.0	5.6
Progression Factor				1.00		1.00		1.00			1.00	1.00
Incremental Delay, d2				0.1		0.4		0.1			0.1	0.1
Delay (s)				11.4		12.7		6.8			6.1	5.7
Level of Service				B		B		A			A	A
Approach Delay (s)		0.0			12.3			6.8			6.0	
Approach LOS		A			B			A			A	

Intersection Summary			
HCM 2000 Control Delay	7.8	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.45		
Actuated Cycle Length (s)	43.3	Sum of lost time (s)	8.0
Intersection Capacity Utilization	44.1%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 12: Hacienda Dr & I-580 EB Ramps



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔↔		↔↔					↑↑↑	↔		↑↑↑	
Traffic Volume (vph)	688	0	1003	0	0	0	0	372	166	0	876	122
Future Volume (vph)	688	0	1003	0	0	0	0	372	166	0	876	122
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0					4.0	4.0		4.0	
Lane Util. Factor	0.97		0.88					0.86	0.86		0.91	
Frt	1.00		0.85					0.98	0.85		0.98	
Flt Protected	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (prot)	3433		2787					4718	1362		4992	
Flt Permitted	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (perm)	3433		2787					4718	1362		4992	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	748	0	1090	0	0	0	0	404	180	0	952	133
RTOR Reduction (vph)	0	0	144	0	0	0	0	33	73	0	45	0
Lane Group Flow (vph)	748	0	946	0	0	0	0	427	51	0	1040	0
Turn Type	Prot		Prot					NA	Perm		NA	
Protected Phases	4		4					2			6	
Permitted Phases									2			
Actuated Green, G (s)	14.7		14.7					14.9	14.9		14.9	
Effective Green, g (s)	16.1		16.1					16.8	16.8		16.8	
Actuated g/C Ratio	0.39		0.39					0.41	0.41		0.41	
Clearance Time (s)	5.4		5.4					5.9	5.9		5.9	
Vehicle Extension (s)	2.0		2.0					2.0	2.0		2.0	
Lane Grp Cap (vph)	1351		1097					1937	559		2050	
v/s Ratio Prot	0.22		c0.34					0.09			c0.21	
v/s Ratio Perm									0.04			
v/c Ratio	0.55		0.86					0.22	0.09		0.51	
Uniform Delay, d1	9.6		11.4					7.8	7.4		9.0	
Progression Factor	1.00		1.00					1.00	1.00		1.00	
Incremental Delay, d2	0.3		6.9					0.0	0.0		0.1	
Delay (s)	9.9		18.3					7.8	7.4		9.0	
Level of Service	A		B					A	A		A	
Approach Delay (s)		14.9			0.0			7.7			9.0	
Approach LOS		B			A			A			A	

Intersection Summary

HCM 2000 Control Delay	11.9	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.68		
Actuated Cycle Length (s)	40.9	Sum of lost time (s)	8.0
Intersection Capacity Utilization	61.4%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group






































HCM Signalized Intersection Capacity Analysis
13: Hacienda Dr & Owens Rd

BART to Livermore Extension Project
2013 Existing AM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	95	156	23	109	380	218	34	219	93	384	834	634
Future Volume (vph)	95	156	23	109	380	218	34	219	93	384	834	634
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	2.3	4.0	4.0	2.3	4.0	4.0	2.7	4.0	4.0	2.7
Lane Util. Factor	0.97	0.91	1.00	0.97	0.91	1.00	0.97	0.91	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5085	1583	3433	5085	1583	3433	5085	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5085	1583	3433	5085	1583	3433	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	103	170	25	118	413	237	37	238	101	417	907	689
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	103	170	25	118	413	237	37	238	101	417	907	689
Turn Type	Prot	NA	Free	Prot	NA	Free	Prot	NA	Free	Prot	NA	Free
Protected Phases	1	6		5	2		7	4		3	8	
Permitted Phases			Free			Free			Free			Free
Actuated Green, G (s)	9.8	76.1	146.0	10.4	76.7	146.0	5.9	17.5	146.0	23.0	34.6	146.0
Effective Green, g (s)	9.8	77.8	146.0	10.4	78.4	146.0	5.9	18.8	146.0	23.0	35.9	146.0
Actuated g/C Ratio	0.07	0.53	1.00	0.07	0.54	1.00	0.04	0.13	1.00	0.16	0.25	1.00
Clearance Time (s)	4.0	5.7		4.0	5.7		4.0	5.3		4.0	5.3	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	230	2709	1583	244	2730	1583	138	654	1583	540	1250	1583
v/s Ratio Prot	0.03	0.03		0.03	0.08		0.01	0.05		c0.12	c0.18	
v/s Ratio Perm			0.02			0.15			0.06			c0.44
v/c Ratio	0.45	0.06	0.02	0.48	0.15	0.15	0.27	0.36	0.06	0.77	0.73	0.44
Uniform Delay, d1	65.5	16.5	0.0	65.2	17.0	0.0	68.0	58.1	0.0	59.0	50.5	0.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.4	0.0	0.0	1.5	0.1	0.2	1.0	0.3	0.1	6.8	2.1	0.9
Delay (s)	66.9	16.5	0.0	66.7	17.2	0.2	69.0	58.5	0.1	65.8	52.7	0.9
Level of Service	E	B	A	E	B	A	E	E	A	E	D	A
Approach Delay (s)		32.5			19.5			43.8			37.6	
Approach LOS		C			B			D			D	
Intersection Summary												
HCM 2000 Control Delay			33.9				HCM 2000 Level of Service				C	
HCM 2000 Volume to Capacity ratio			0.58									
Actuated Cycle Length (s)			146.0			Sum of lost time (s)				16.0		
Intersection Capacity Utilization			43.5%			ICU Level of Service				A		
Analysis Period (min)			15									

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
14: Tassajara Rd & Dublin Blvd

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 	 	 	  	 		  	 		 	   	 
Traffic Volume (vph)	92	122	160	437	577	36	232	500	117	20	1228	238
Future Volume (vph)	92	122	160	437	577	36	232	500	117	20	1228	238
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	6.0	6.0	5.0	6.0		5.0	6.0	6.0	5.0	6.0	6.0
Lane Util. Factor	0.97	0.95	0.88	0.94	0.95		0.94	0.95	1.00	0.97	0.86	0.88
Frt	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	2787	4990	3508		4990	3539	1583	3433	6408	2787
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	2787	4990	3508		4990	3539	1583	3433	6408	2787
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	100	133	174	475	627	39	252	543	127	22	1335	259
RTOR Reduction (vph)	0	0	135	0	2	0	0	0	73	0	0	133
Lane Group Flow (vph)	100	133	39	475	664	0	252	543	54	22	1335	126
Turn Type	Prot	NA	Perm	Prot	NA		Prot	NA	Perm	Prot	NA	Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases			2						8			4
Actuated Green, G (s)	16.2	30.9	30.9	18.9	33.6		16.2	56.5	56.5	8.4	48.7	48.7
Effective Green, g (s)	16.2	30.9	30.9	18.9	33.6		16.2	56.5	56.5	8.4	48.7	48.7
Actuated g/C Ratio	0.12	0.23	0.23	0.14	0.25		0.12	0.41	0.41	0.06	0.36	0.36
Clearance Time (s)	5.0	6.0	6.0	5.0	6.0		5.0	6.0	6.0	5.0	6.0	6.0
Vehicle Extension (s)	2.0	3.0	3.0	2.0	3.0		2.0	4.0	4.0	2.0	4.0	4.0
Lane Grp Cap (vph)	406	799	629	689	862		591	1462	654	210	2282	992
v/s Ratio Prot	0.03	0.04		c0.10	c0.19		c0.05	0.15		0.01	c0.21	
v/s Ratio Perm			0.01						0.03			0.05
v/c Ratio	0.25	0.17	0.06	0.69	0.77		0.43	0.37	0.08	0.10	0.59	0.13
Uniform Delay, d1	54.7	42.5	41.5	56.1	48.0		55.9	27.8	24.4	60.6	35.8	29.7
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.1	0.1	0.0	2.3	4.2		0.2	0.2	0.1	0.1	0.5	0.1
Delay (s)	54.8	42.6	41.6	58.4	52.1		56.1	28.0	24.4	60.7	36.2	29.8
Level of Service	D	D	D	E	D		E	C	C	E	D	C
Approach Delay (s)		45.2			54.8			35.2			35.5	
Approach LOS		D			D			D			D	
Intersection Summary												
HCM 2000 Control Delay			41.8			HCM 2000 Level of Service				D		
HCM 2000 Volume to Capacity ratio			0.65									
Actuated Cycle Length (s)			136.7			Sum of lost time (s)			22.0			
Intersection Capacity Utilization			79.9%			ICU Level of Service				D		
Analysis Period (min)			15									

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 15: Tassajara Rd & I-580 WB Ramps































Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↔↔		↔↔		↑↑	↔		↑↑↔	↔
Traffic Volume (vph)	0	0	0	488	0	290	0	1012	450	0	925	935
Future Volume (vph)	0	0	0	488	0	290	0	1012	450	0	925	935
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0		4.0		4.0	4.0		4.0	4.0
Lane Util. Factor				0.97		0.88		0.95	1.00		0.86	0.86
Frt				1.00		0.85		1.00	0.85		0.95	0.85
Flt Protected				0.95		1.00		1.00	1.00		1.00	1.00
Satd. Flow (prot)				3433		2787		3539	1583		4564	1362
Flt Permitted				0.95		1.00		1.00	1.00		1.00	1.00
Satd. Flow (perm)				3433		2787		3539	1583		4564	1362
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	530	0	315	0	1100	489	0	1005	1016
RTOR Reduction (vph)	0	0	0	0	0	121	0	0	172	0	110	179
Lane Group Flow (vph)	0	0	0	530	0	194	0	1100	317	0	1403	329
Turn Type				Perm		Perm		NA	Perm		NA	Perm
Protected Phases								2			6	
Permitted Phases				8		8			2			6
Actuated Green, G (s)				16.6		16.6		45.4	45.4		45.4	45.4
Effective Green, g (s)				16.6		16.6		45.4	45.4		45.4	45.4
Actuated g/C Ratio				0.24		0.24		0.65	0.65		0.65	0.65
Clearance Time (s)				4.0		4.0		4.0	4.0		4.0	4.0
Vehicle Extension (s)				3.0		3.0		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)				814		660		2295	1026		2960	883
v/s Ratio Prot								c0.31			0.31	
v/s Ratio Perm				c0.15		0.07			0.20			0.24
v/c Ratio				0.65		0.29		0.48	0.31		0.47	0.37
Uniform Delay, d1				24.1		21.9		6.3	5.4		6.2	5.7
Progression Factor				1.00		1.00		1.00	1.00		1.00	1.00
Incremental Delay, d2				1.9		0.3		0.7	0.8		0.5	1.2
Delay (s)				26.0		22.1		7.0	6.2		6.8	6.9
Level of Service				C		C		A	A		A	A
Approach Delay (s)		0.0			24.5			6.7			6.8	
Approach LOS		A			C			A			A	

Intersection Summary			
HCM 2000 Control Delay	10.2	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.53		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	48.6%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 16: Santa Rita Rd & I-580 EB Ramps/Pimilco Dr

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 		 	 		 		  			 	
Traffic Volume (vph)	556	109	607	169	0	205	0	657	84	171	1093	0
Future Volume (vph)	556	109	607	169	0	205	0	657	84	171	1093	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0		4.0		4.0		4.0	4.0	
Lane Util. Factor	0.97	1.00	1.00	0.97		0.88		0.86		1.00	0.95	
Frt	1.00	1.00	0.85	1.00		0.85		0.98		1.00	1.00	
Flt Protected	0.95	1.00	1.00	0.95		1.00		1.00		0.95	1.00	
Satd. Flow (prot)	3433	1863	1583	3433		2787		6299		1770	3539	
Flt Permitted	0.95	1.00	1.00	0.95		1.00		1.00		0.95	1.00	
Satd. Flow (perm)	3433	1863	1583	3433		2787		6299		1770	3539	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	604	118	660	184	0	223	0	714	91	186	1188	0
RTOR Reduction (vph)	0	0	90	0	0	111	0	33	0	0	0	0
Lane Group Flow (vph)	604	118	570	184	0	112	0	772	0	186	1188	0
Turn Type	Perm	NA	Perm	Prot		pm+ov		NA		Prot	NA	Perm
Protected Phases		4		3		1		2		1	6	
Permitted Phases	4		4			3						6
Actuated Green, G (s)	25.0	25.0	25.0	4.8		12.8		16.2		8.0	28.2	
Effective Green, g (s)	25.0	25.0	25.0	4.8		12.8		16.2		8.0	28.2	
Actuated g/C Ratio	0.36	0.36	0.36	0.07		0.18		0.23		0.11	0.40	
Clearance Time (s)	4.0	4.0	4.0	4.0		4.0		4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0		3.0		3.0		3.0	3.0	
Lane Grp Cap (vph)	1226	665	565	235		509		1457		202	1425	
v/s Ratio Prot		0.06		c0.05		0.03		0.12		0.11	c0.34	
v/s Ratio Perm	0.18		c0.36			0.02						
v/c Ratio	0.49	0.18	1.01	0.78		0.22		0.53		0.92	0.83	
Uniform Delay, d1	17.6	15.4	22.5	32.1		24.3		23.6		30.7	18.8	
Progression Factor	1.00	1.00	1.00	1.00		1.00		1.00		1.00	1.00	
Incremental Delay, d2	0.3	0.1	40.1	15.5		0.2		1.4		41.7	5.9	
Delay (s)	17.9	15.6	62.6	47.6		24.6		24.9		72.3	24.7	
Level of Service	B	B	E	D		C		C		E	C	
Approach Delay (s)		39.0			35.0			24.9			31.1	
Approach LOS		D			C			C			C	































Intersection Summary

HCM 2000 Control Delay	33.0	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.97		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	82.6%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 17: Santa Rita Rd & Valley Ave

BART to Livermore Extension Project
 2013 Existing AM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 	 			 		 	 		 	 	
Traffic Volume (vph)	170	213	76	184	349	799	80	376	60	521	846	147
Future Volume (vph)	170	213	76	184	349	799	80	376	60	521	846	147
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.97	0.95		0.97	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.98		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	3433	3466		3433	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	3433	3466		3433	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	185	232	83	200	379	868	87	409	65	566	920	160
RTOR Reduction (vph)	0	0	69	0	0	0	0	18	0	0	0	98
Lane Group Flow (vph)	185	232	14	200	379	868	87	456	0	566	920	62
Turn Type	Prot	NA	Perm	Prot	NA	Free	Prot	NA		Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			Free						6
Actuated Green, G (s)	7.6	11.0	11.0	9.1	12.5	63.7	3.1	15.5		12.1	24.5	24.5
Effective Green, g (s)	7.6	11.0	11.0	9.1	12.5	63.7	3.1	15.5		12.1	24.5	24.5
Actuated g/C Ratio	0.12	0.17	0.17	0.14	0.20	1.00	0.05	0.24		0.19	0.38	0.38
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	409	611	273	252	694	1583	167	843		652	1361	608
v/s Ratio Prot	0.05	0.07		c0.11	0.11		0.03	0.13		c0.16	c0.26	
v/s Ratio Perm			0.01			c0.55						0.04
v/c Ratio	0.45	0.38	0.05	0.79	0.55	0.55	0.52	0.54		0.87	0.68	0.10
Uniform Delay, d1	26.1	23.3	22.0	26.4	23.0	0.0	29.6	21.0		25.0	16.3	12.6
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	0.8	0.4	0.1	15.7	0.9	1.4	2.9	0.7		11.8	1.3	0.1
Delay (s)	26.9	23.7	22.1	42.0	23.9	1.4	32.5	21.7		36.8	17.6	12.6
Level of Service	C	C	C	D	C	A	C	C		D	B	B
Approach Delay (s)		24.6			12.9			23.4			23.7	
Approach LOS		C			B			C			C	
Intersection Summary												
HCM 2000 Control Delay			20.0	HCM 2000 Level of Service				C				
HCM 2000 Volume to Capacity ratio			0.82									
Actuated Cycle Length (s)			63.7	Sum of lost time (s)				16.0				
Intersection Capacity Utilization			56.6%	ICU Level of Service				B				
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis
18: Bernal Ave/Valley Ave & Stanley Blvd



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	188	196	49	254	896	949	172	472	111	140	334	111
Future Volume (vph)	188	196	49	254	896	949	172	472	111	140	334	111
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.95	1.00	0.97	0.91	0.91	1.00	0.95	1.00	0.97	0.95	0.95
Frt	1.00	1.00	0.85	1.00	0.96	0.85	1.00	1.00	0.85	1.00	0.96	0.96
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	3433	3239	1441	1770	3539	1583	3433	3406	3406
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	3433	3239	1441	1770	3539	1583	3433	3406	3406
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	204	213	53	276	974	1032	187	513	121	152	363	121
RTOR Reduction (vph)	0	0	26	0	46	27	0	0	97	0	37	0
Lane Group Flow (vph)	204	213	27	276	1341	592	187	513	24	152	447	0
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	NA
Protected Phases	7	4	5	3	8	1	5	2		1	6	
Permitted Phases			4			8			2			
Actuated Green, G (s)	6.0	33.0	45.2	11.1	38.1	48.2	12.2	17.5	17.5	10.1	15.4	
Effective Green, g (s)	6.0	33.0	45.2	11.1	38.1	48.2	12.2	17.5	17.5	10.1	15.4	
Actuated g/C Ratio	0.07	0.38	0.52	0.13	0.43	0.55	0.14	0.20	0.20	0.12	0.18	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	234	1331	888	434	1407	857	246	706	315	395	598	
v/s Ratio Prot	c0.06	0.06	0.00	0.08	c0.41	0.08	c0.11	c0.14		0.04	0.13	
v/s Ratio Perm			0.01			0.33			0.02			
v/c Ratio	0.87	0.16	0.03	0.64	0.95	0.69	0.76	0.73	0.08	0.38	0.75	
Uniform Delay, d1	40.5	18.2	10.5	36.4	23.9	14.3	36.3	32.9	28.5	35.9	34.3	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	27.9	0.1	0.0	3.0	14.2	2.4	12.9	3.7	0.1	0.6	5.1	
Delay (s)	68.4	18.2	10.5	39.4	38.2	16.7	49.3	36.6	28.6	36.5	39.4	
Level of Service	E	B	B	D	D	B	D	D	C	D	D	
Approach Delay (s)		39.1			32.5			38.3			38.7	
Approach LOS		D			C			D			D	

Intersection Summary

HCM 2000 Control Delay	35.3	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.88		
Actuated Cycle Length (s)	87.7	Sum of lost time (s)	16.0
Intersection Capacity Utilization	75.9%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
19: Fallon Rd & Dublin Blvd/Croak Rd

BART to Livermore Extension Project
2013 Existing AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	46	0	104	0	0	0	468	482	0	0	797	99
Future Volume (vph)	46	0	104	0	0	0	468	482	0	0	797	99
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.3		5.3				5.3	4.9			4.9	4.9
Lane Util. Factor	1.00		0.88				1.00	0.95			0.95	1.00
Frt	1.00		0.85				1.00	1.00			1.00	0.85
Flt Protected	0.95		1.00				0.95	1.00			1.00	1.00
Satd. Flow (prot)	1770		2787				1770	3539			3539	1583
Flt Permitted	0.95		1.00				0.95	1.00			1.00	1.00
Satd. Flow (perm)	1770		2787				1770	3539			3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	50	0	113	0	0	0	509	524	0	0	866	108
RTOR Reduction (vph)	0	0	69	0	0	0	0	0	0	0	0	66
Lane Group Flow (vph)	50	0	44	0	0	0	509	524	0	0	866	42
Turn Type	Prot		pm+ov	Prot			Prot	NA		Prot	NA	Perm
Protected Phases	5	2	3	1	6		3	8		7	4	
Permitted Phases			2									4
Actuated Green, G (s)	6.2		27.2				21.0	53.3			27.0	27.0
Effective Green, g (s)	6.2		27.2				21.0	53.3			27.0	27.0
Actuated g/C Ratio	0.09		0.39				0.30	0.76			0.39	0.39
Clearance Time (s)	5.3		5.3				5.3	4.9			4.9	4.9
Vehicle Extension (s)	2.0		2.0				2.0	4.0			4.0	4.0
Lane Grp Cap (vph)	157		1299				533	2706			1370	613
v/s Ratio Prot	c0.03		0.01				c0.29	0.15			c0.24	
v/s Ratio Perm			0.01									0.03
v/c Ratio	0.32		0.03				0.95	0.19			0.63	0.07
Uniform Delay, d1	29.8		13.1				23.9	2.3			17.3	13.4
Progression Factor	1.00		1.00				1.00	1.00			1.00	1.00
Incremental Delay, d2	0.4		0.0				27.6	0.0			1.1	0.1
Delay (s)	30.2		13.1				51.5	2.3			18.4	13.5
Level of Service	C		B				D	A			B	B
Approach Delay (s)		18.4			0.0			26.5			17.9	
Approach LOS		B			A			C			B	

Intersection Summary

HCM 2000 Control Delay	22.0	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.78		
Actuated Cycle Length (s)	69.7	Sum of lost time (s)	19.5
Intersection Capacity Utilization	70.5%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 20: El Charro Rd/Fallon Rd & I-580 WB Ramps



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↙	↖	↗		↖	↗		↖↖	↗
Traffic Volume (vph)	0	0	0	99	0	601	0	562	478	0	475	399
Future Volume (vph)	0	0	0	99	0	601	0	562	478	0	475	399
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0	4.0	4.0		4.0	4.0		4.0	4.0
Lane Util. Factor				0.95	0.95	0.88		0.95	0.95		0.95	1.00
Frt				1.00	1.00	0.85		0.99	0.85		1.00	0.85
Flt Protected				0.95	0.95	1.00		1.00	1.00		1.00	1.00
Satd. Flow (prot)				1681	1681	2787		1749	1504		3539	1583
Flt Permitted				0.95	0.95	1.00		1.00	1.00		1.00	1.00
Satd. Flow (perm)				1681	1681	2787		1749	1504		3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	108	0	653	0	611	520	0	516	434
RTOR Reduction (vph)	0	0	0	0	0	329	0	5	231	0	0	214
Lane Group Flow (vph)	0	0	0	55	53	324	0	658	237	0	516	220
Turn Type				Perm	NA	Perm		NA	Perm		NA	Perm
Protected Phases					8			2			6	
Permitted Phases				8		8			2			6
Actuated Green, G (s)				11.9	11.9	11.9		19.9	19.9		19.9	19.9
Effective Green, g (s)				11.4	11.4	11.4		19.9	19.9		19.9	19.9
Actuated g/C Ratio				0.29	0.29	0.29		0.51	0.51		0.51	0.51
Clearance Time (s)				3.5	3.5	3.5		4.0	4.0		4.0	4.0
Vehicle Extension (s)				2.0	2.0	2.0		2.0	2.0		2.0	2.0
Lane Grp Cap (vph)				487	487	808		885	761		1792	801
v/s Ratio Prot								c0.38			0.15	
v/s Ratio Perm				0.03	0.03	c0.12			0.16			0.14
v/c Ratio				0.11	0.11	0.40		0.74	0.31		0.29	0.27
Uniform Delay, d1				10.2	10.2	11.2		7.7	5.7		5.6	5.6
Progression Factor				1.00	1.00	1.00		1.00	1.00		1.00	1.00
Incremental Delay, d2				0.0	0.0	0.1		3.0	0.1		0.0	0.1
Delay (s)				10.3	10.3	11.3		10.7	5.8		5.6	5.6
Level of Service				B	B	B		B	A		A	A
Approach Delay (s)		0.0			11.2			8.6			5.6	
Approach LOS		A			B			A			A	

Intersection Summary

HCM 2000 Control Delay	8.3	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.62		
Actuated Cycle Length (s)	39.3	Sum of lost time (s)	8.0
Intersection Capacity Utilization	67.0%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
21: El Charro Rd & I-580 EB Ramps

BART to Livermore Extension Project
2013 Existing AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔↔		↔↔					↕↕	↔		↕↕	↔
Traffic Volume (vph)	222	0	172	0	0	0	0	729	100	0	254	0
Future Volume (vph)	222	0	172	0	0	0	0	729	100	0	254	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0					4.0	4.0		4.0	
Lane Util. Factor	0.97		0.88					0.91	0.91		0.91	
Frt	1.00		0.85					1.00	0.85		1.00	
Flt Protected	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (prot)	3433		2787					3382	1441		3390	
Flt Permitted	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (perm)	3433		2787					3382	1441		3390	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	241	0	187	0	0	0	0	792	109	0	276	0
RTOR Reduction (vph)	0	0	142	0	0	0	0	2	50	0	0	0
Lane Group Flow (vph)	241	0	45	0	0	0	0	803	46	0	276	0
Turn Type	Prot		Perm					NA	Perm		NA	Perm
Protected Phases	4							2			6	
Permitted Phases			4						2			6
Actuated Green, G (s)	6.8		6.8					13.7	13.7		13.7	
Effective Green, g (s)	6.8		6.8					13.7	13.7		13.7	
Actuated g/C Ratio	0.24		0.24					0.48	0.48		0.48	
Clearance Time (s)	4.0		4.0					4.0	4.0		4.0	
Vehicle Extension (s)	2.0		2.0					3.0	3.0		3.0	
Lane Grp Cap (vph)	819		664					1625	692		1629	
v/s Ratio Prot	c0.07							c0.24			0.08	
v/s Ratio Perm			0.02						0.03			
v/c Ratio	0.29		0.07					0.49	0.07		0.17	
Uniform Delay, d1	8.9		8.4					5.0	4.0		4.2	
Progression Factor	1.00		1.00					1.00	1.00		1.00	
Incremental Delay, d2	0.1		0.0					0.2	0.0		0.0	
Delay (s)	9.0		8.4					5.3	4.0		4.2	
Level of Service	A		A					A	A		A	
Approach Delay (s)		8.7			0.0			5.1			4.2	
Approach LOS		A			A			A			A	

Intersection Summary

HCM 2000 Control Delay	5.9	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.43		
Actuated Cycle Length (s)	28.5	Sum of lost time (s)	8.0
Intersection Capacity Utilization	34.2%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 22: El Charro Rd & Stoneridge Dr/Jack London Blvd

BART to Livermore Extension Project
 2013 Existing AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔↔↔	↑↑	↗	↖	↑	↗↗	↖	↑↑		↖↖↖	↑	↗
Traffic Volume (vph)	114	38	5	14	561	668	5	82	1	121	86	182
Future Volume (vph)	114	38	5	14	561	668	5	82	1	121	86	182
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	0.94	0.95	1.00	1.00	1.00	0.88	1.00	0.95		0.94	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	4491	3185	1425	1593	1676	2508	1593	3180		4491	1676	1425
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	4491	3185	1425	1593	1676	2508	1593	3180		4491	1676	1425
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	124	41	5	15	610	726	5	89	1	132	93	198
RTOR Reduction (vph)	0	0	3	0	0	314	0	1	0	0	0	146
Lane Group Flow (vph)	124	41	2	15	610	412	5	89	0	132	93	52
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Prot	NA		Prot	NA	Perm
Protected Phases	7	4		3	8	1	5	2		1	6	
Permitted Phases			4			8						6
Actuated Green, G (s)	3.7	35.9	35.9	0.6	32.8	41.0	0.6	11.5		8.2	19.1	19.1
Effective Green, g (s)	3.7	35.9	35.9	0.6	32.8	41.0	0.6	11.5		8.2	19.1	19.1
Actuated g/C Ratio	0.05	0.50	0.50	0.01	0.45	0.57	0.01	0.16		0.11	0.26	0.26
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	230	1583	708	13	761	1563	13	506		510	443	376
v/s Ratio Prot	c0.03	c0.01		0.01	c0.36	c0.03	0.00	0.03		0.03	c0.06	
v/s Ratio Perm			0.00			0.13						0.04
v/c Ratio	0.54	0.03	0.00	1.15	0.80	0.26	0.38	0.18		0.26	0.21	0.14
Uniform Delay, d1	33.4	9.2	9.1	35.8	16.9	7.9	35.6	26.3		29.2	20.7	20.3
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	2.4	0.0	0.0	305.0	6.1	0.1	17.9	0.2		0.3	0.2	0.2
Delay (s)	35.8	9.3	9.1	340.8	23.0	8.0	53.5	26.4		29.5	20.9	20.4
Level of Service	D	A	A	F	C	A	D	C		C	C	C
Approach Delay (s)		28.6			18.5			27.8			23.4	
Approach LOS		C			B			C			C	

Intersection Summary

HCM 2000 Control Delay	20.8	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.59		
Actuated Cycle Length (s)	72.2	Sum of lost time (s)	16.0
Intersection Capacity Utilization	58.7%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
24: Airway Blvd/Driveway & N Canyons Pkwy



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑	↑	↑↑	↑	↑		↑	↑↑		↑	
Traffic Volume (vph)	0	4	12	721	11	0	49	0	836	0	0	0
Future Volume (vph)	0	4	12	721	11	0	49	0	836	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0	4.0	4.0			4.0	4.0			
Lane Util. Factor		0.95	1.00	0.97	1.00			1.00	0.88			
Frt		1.00	0.85	1.00	1.00			1.00	0.85			
Flt Protected		1.00	1.00	0.95	1.00			0.95	1.00			
Satd. Flow (prot)		3539	1583	3433	1863			1770	2787			
Flt Permitted		1.00	1.00	0.95	1.00			0.95	1.00			
Satd. Flow (perm)		3539	1583	3433	1863			1770	2787			
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	4	13	784	12	0	53	0	909	0	0	0
RTOR Reduction (vph)	0	0	12	0	0	0	0	0	160	0	0	0
Lane Group Flow (vph)	0	4	1	784	12	0	0	53	749	0	0	0
Turn Type		NA	Perm	Prot	NA	Perm	Split	NA	pm+ov			
Protected Phases		2		1	6		8	8	1	4	4	
Permitted Phases			2			6			8			
Actuated Green, G (s)		13.6	13.6	108.6	128.2			8.6	117.2			
Effective Green, g (s)		15.6	15.6	110.6	130.2			8.8	121.2			
Actuated g/C Ratio		0.11	0.11	0.75	0.89			0.06	0.82			
Clearance Time (s)		6.0	6.0	6.0	6.0			4.2	6.0			
Vehicle Extension (s)		3.0	3.0	3.0	3.0			3.0	3.0			
Lane Grp Cap (vph)		375	167	2582	1650			105	2297			
v/s Ratio Prot		c0.00		0.23	0.01			c0.03	c0.25			
v/s Ratio Perm			0.00						0.02			
v/c Ratio		0.01	0.01	0.30	0.01			0.50	0.33			
Uniform Delay, d1		58.8	58.8	5.8	1.0			67.0	3.1			
Progression Factor		1.00	1.00	1.00	1.00			1.00	1.00			
Incremental Delay, d2		0.0	0.0	0.3	0.0			3.8	0.1			
Delay (s)		58.8	58.8	6.1	1.0			70.8	3.2			
Level of Service		E	E	A	A			E	A			
Approach Delay (s)		58.8			6.1			6.9			0.0	
Approach LOS		E			A			A			A	

Intersection Summary

HCM 2000 Control Delay	7.0	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.31		
Actuated Cycle Length (s)	147.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	44.2%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
25: Airway Blvd & I-580 WB Ramps



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↙	↖	↗		↑↑	↗		↑↑↑	
Traffic Volume (vph)	0	0	0	34	25	50	0	905	343	0	267	571
Future Volume (vph)	0	0	0	34	25	50	0	905	343	0	267	571
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0	4.0	4.0		4.0	4.0		4.0	
Lane Util. Factor				0.95	0.95	0.88		0.95	1.00		0.91	
Frt				1.00	1.00	0.85		1.00	0.85		0.90	
Flt Protected				0.95	0.98	1.00		1.00	1.00		1.00	
Satd. Flow (prot)				1681	1736	2787		3539	1583		4565	
Flt Permitted				0.95	0.98	1.00		1.00	1.00		1.00	
Satd. Flow (perm)				1681	1736	2787		3539	1583		4565	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	37	27	54	0	984	373	0	290	621
RTOR Reduction (vph)	0	0	0	0	0	50	0	0	77	0	128	0
Lane Group Flow (vph)	0	0	0	20	44	4	0	984	296	0	783	0
Turn Type				Split	NA	Perm		NA	Perm		NA	
Protected Phases				8	8			2			6	
Permitted Phases						8			2			
Actuated Green, G (s)				4.2	4.2	4.2		45.8	45.8		45.8	
Effective Green, g (s)				4.2	4.2	4.2		47.1	47.1		47.1	
Actuated g/C Ratio				0.07	0.07	0.07		0.79	0.79		0.79	
Clearance Time (s)				4.0	4.0	4.0		5.3	5.3		5.3	
Vehicle Extension (s)				2.0	2.0	2.0		4.0	4.0		4.0	
Lane Grp Cap (vph)				119	122	197		2810	1257		3625	
v/s Ratio Prot				0.01	c0.03			c0.28			0.17	
v/s Ratio Perm						0.00			0.19			
v/c Ratio				0.17	0.36	0.02		0.35	0.24		0.22	
Uniform Delay, d1				25.9	26.3	25.6		1.7	1.5		1.5	
Progression Factor				1.00	1.00	1.00		1.00	1.00		1.00	
Incremental Delay, d2				0.2	0.7	0.0		0.3	0.4		0.1	
Delay (s)				26.2	26.9	25.6		2.1	2.0		1.7	
Level of Service				C	C	C		A	A		A	
Approach Delay (s)		0.0			26.2			2.1			1.7	
Approach LOS		A			C			A			A	

Intersection Summary

HCM 2000 Control Delay	3.1	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.35		
Actuated Cycle Length (s)	59.3	Sum of lost time (s)	8.0
Intersection Capacity Utilization	35.0%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 26: Airway Blvd & I-580 EB Ramps/Kitty Hawk Rd



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↑	↖	↖	↑	↖	↖	↑↘		↖	↑↘	
Traffic Volume (vph)	643	194	161	22	32	103	24	506	160	78	108	132
Future Volume (vph)	643	194	161	22	32	103	24	506	160	78	108	132
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	3.6	3.6	3.6	4.0	4.0		4.0	4.0	
Lane Util. Factor	0.97	1.00	1.00	1.00	1.00	1.00	1.00	0.95		1.00	0.95	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.96		1.00	0.92	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	3433	1863	1583	1770	1863	1583	1770	3412		1770	3247	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	3433	1863	1583	1770	1863	1583	1770	3412		1770	3247	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	699	211	175	24	35	112	26	550	174	85	117	143
RTOR Reduction (vph)	0	0	134	0	0	49	0	21	0	0	73	0
Lane Group Flow (vph)	699	211	41	24	35	63	26	703	0	85	187	0
Turn Type	Split	NA	Perm	Split	NA	pm+ov	Prot	NA		Prot	NA	
Protected Phases	7	7		8	8	1	5	2		1	6	
Permitted Phases			7			8						
Actuated Green, G (s)	26.6	26.6	26.6	11.2	11.2	21.0	4.3	47.8		9.8	53.8	
Effective Green, g (s)	26.6	26.6	26.6	11.6	11.6	21.8	3.8	49.1		9.8	55.1	
Actuated g/C Ratio	0.24	0.24	0.24	0.10	0.10	0.19	0.03	0.44		0.09	0.49	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	3.5	5.3		4.0	5.3	
Vehicle Extension (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	3.5		2.0	4.0	
Lane Grp Cap (vph)	810	439	373	182	191	356	59	1486		153	1587	
v/s Ratio Prot	c0.20	0.11		0.01	0.02	c0.02	0.01	c0.21		c0.05	0.06	
v/s Ratio Perm			0.03			0.02						
v/c Ratio	0.86	0.48	0.11	0.13	0.18	0.18	0.44	0.47		0.56	0.12	
Uniform Delay, d1	41.3	37.1	33.8	46.0	46.2	38.0	53.4	22.6		49.4	15.6	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	9.1	0.3	0.0	0.1	0.2	0.1	1.9	1.1		2.5	0.2	
Delay (s)	50.4	37.4	33.8	46.1	46.4	38.0	55.3	23.7		51.8	15.8	
Level of Service	D	D	C	D	D	D	E	C		D	B	
Approach Delay (s)		45.2			40.9			24.8			24.7	
Approach LOS		D			D			C			C	

Intersection Summary

HCM 2000 Control Delay	35.4	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.55		
Actuated Cycle Length (s)	112.7	Sum of lost time (s)	15.6
Intersection Capacity Utilization	58.4%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 27: Collier Canyon Rd & N Canyons Pkwy/Portola Ave

BART to Livermore Extension Project
 2013 Existing AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↖↖	↖	↖	↖↖	↖	↖	↖		↖	↖	↖
Traffic Volume (vph)	151	255	54	184	793	73	7	1	31	61	6	65
Future Volume (vph)	151	255	54	184	793	73	7	1	31	61	6	65
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.85		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	1770	1591		1770	1863	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	1770	1591		1770	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	164	277	59	200	862	79	8	1	34	66	7	71
RTOR Reduction (vph)	0	0	31	0	0	35	0	30	0	0	0	58
Lane Group Flow (vph)	164	277	28	200	862	44	8	5	0	66	7	13
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA		Prot	NA	Perm
Protected Phases	1	6		5	2		3	8		7	NA	4
Permitted Phases			6			2						4
Actuated Green, G (s)	10.3	48.1	48.1	19.4	57.2	57.2	1.4	10.5		8.7	18.2	18.2
Effective Green, g (s)	10.3	49.4	49.4	19.4	58.5	58.5	1.4	11.5		8.7	18.8	18.8
Actuated g/C Ratio	0.10	0.47	0.47	0.18	0.56	0.56	0.01	0.11		0.08	0.18	0.18
Clearance Time (s)	4.0	5.3	5.3	4.0	5.3	5.3	4.0	5.0		4.0	4.6	4.6
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	336	1665	744	327	1971	881	23	174		146	333	283
v/s Ratio Prot	0.05	0.08		c0.11	c0.24		0.00	0.00		c0.04	0.00	
v/s Ratio Perm			0.02			0.03						c0.01
v/c Ratio	0.49	0.17	0.04	0.61	0.44	0.05	0.35	0.03		0.45	0.02	0.04
Uniform Delay, d1	44.9	16.0	15.0	39.3	13.6	10.6	51.3	41.8		45.9	35.5	35.7
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	1.1	0.2	0.1	3.4	0.7	0.1	8.9	0.1		2.2	0.0	0.1
Delay (s)	46.0	16.2	15.1	42.7	14.3	10.7	60.3	41.8		48.1	35.5	35.7
Level of Service	D	B	B	D	B	B	E	D		D	D	D
Approach Delay (s)		25.8			19.0			45.2			41.4	
Approach LOS		C			B			D			D	

Intersection Summary

HCM 2000 Control Delay	23.3	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.44		
Actuated Cycle Length (s)	105.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	46.3%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
28: Isabel Ave/Campus Hill Dr & Portola Ave

BART to Livermore Extension Project
2013 Existing AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	2	194	227	288	568	138	491	302	47	33	103	2
Future Volume (vph)	2	194	227	288	568	138	491	302	47	33	103	2
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	0.88	0.94	0.95		0.97	0.95	1.00	1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	0.97		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	1863	2787	4990	3435		3433	3539	1583	1770	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	1863	2787	4990	3435		3433	3539	1583	1770	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	2	211	247	313	617	150	534	328	51	36	112	2
RTOR Reduction (vph)	0	0	182	0	13	0	0	0	33	0	0	2
Lane Group Flow (vph)	2	211	65	313	754	0	534	328	18	36	112	0
Turn Type	Prot	NA	Perm	Prot	NA		Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4						2			6
Actuated Green, G (s)	1.5	20.3	20.3	9.9	28.7		20.3	28.6	28.6	5.2	13.9	13.9
Effective Green, g (s)	1.5	21.6	21.6	9.9	30.0		20.3	29.9	29.9	5.2	14.8	14.8
Actuated g/C Ratio	0.02	0.26	0.26	0.12	0.36		0.25	0.36	0.36	0.06	0.18	0.18
Clearance Time (s)	4.0	5.3	5.3	4.0	5.3		4.0	5.3	5.3	4.0	4.9	4.9
Vehicle Extension (s)	2.0	3.0	3.0	2.0	3.0		2.0	3.0	3.0	2.0	3.0	3.0
Lane Grp Cap (vph)	32	487	728	598	1247		843	1281	573	111	634	283
v/s Ratio Prot	0.00	0.11		c0.06	c0.22		c0.16	c0.09		0.02	0.03	
v/s Ratio Perm			0.02						0.01			0.00
v/c Ratio	0.06	0.43	0.09	0.52	0.60		0.63	0.26	0.03	0.32	0.18	0.00
Uniform Delay, d1	39.9	25.4	23.1	34.1	21.5		27.8	18.5	17.0	37.0	28.7	27.8
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.3	0.6	0.1	0.4	0.8		1.2	0.1	0.0	0.6	0.1	0.0
Delay (s)	40.2	26.0	23.1	34.5	22.3		29.0	18.6	17.0	37.6	28.9	27.8
Level of Service	D	C	C	C	C		C	B	B	D	C	C
Approach Delay (s)		24.5			25.8			24.6			31.0	
Approach LOS		C			C			C			C	



















Intersection Summary

HCM 2000 Control Delay	25.5	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.56		
Actuated Cycle Length (s)	82.6	Sum of lost time (s)	16.0
Intersection Capacity Utilization	64.9%	ICU Level of Service	C
Analysis Period (min)	15		























c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
29: Isabel Ave & I-580 WB Ramps

BART to Livermore Extension Project
2013 Existing AM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	652	0	302	0	494	0	0	373	288
Future Volume (vph)	0	0	0	652	0	302	0	494	0	0	373	288
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0		4.0		4.0			4.0	4.0
Lane Util. Factor				0.97		1.00		0.95			0.95	1.00
Frt				1.00		0.85		1.00			1.00	0.85
Flt Protected				0.95		1.00		1.00			1.00	1.00
Satd. Flow (prot)				3433		1583		3539			3539	1583
Flt Permitted				0.95		1.00		1.00			1.00	1.00
Satd. Flow (perm)				3433		1583		3539			3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	709	0	328	0	537	0	0	405	313
RTOR Reduction (vph)	0	0	0	0	0	151	0	0	0	0	0	185
Lane Group Flow (vph)	0	0	0	709	0	177	0	537	0	0	405	128
Turn Type				Prot		Prot		NA	Free		NA	Prot
Protected Phases				8		8		2			6	6
Permitted Phases									Free			
Actuated Green, G (s)				11.7		11.7		12.8			12.8	12.8
Effective Green, g (s)				11.7		11.7		13.6			13.6	13.6
Actuated g/C Ratio				0.35		0.35		0.41			0.41	0.41
Clearance Time (s)				4.0		4.0		4.8			4.8	4.8
Vehicle Extension (s)				2.0		2.0		4.0			4.0	4.0
Lane Grp Cap (vph)				1206		556		1445			1445	646
v/s Ratio Prot				c0.21		0.11		c0.15			0.11	0.08
v/s Ratio Perm												
v/c Ratio				0.59		0.32		0.37			0.28	0.20
Uniform Delay, d1				8.8		7.9		6.9			6.6	6.3
Progression Factor				1.00		1.00		1.00			1.00	1.00
Incremental Delay, d2				0.5		0.1		0.2			0.1	0.2
Delay (s)				9.3		8.0		7.1			6.7	6.5
Level of Service				A		A		A			A	A
Approach Delay (s)		0.0			8.9			7.1			6.6	
Approach LOS		A			A			A			A	
Intersection Summary												
HCM 2000 Control Delay			7.8	HCM 2000 Level of Service					A			
HCM 2000 Volume to Capacity ratio			0.47									
Actuated Cycle Length (s)			33.3	Sum of lost time (s)					8.0			
Intersection Capacity Utilization			39.0%	ICU Level of Service					A			
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis
30: Isabel Ave & I-580 EB Ramps

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations	 		 					 			 		
Traffic Volume (vph)	200	0	385	0	0	0	0	726	447	0	928	116	
Future Volume (vph)	200	0	385	0	0	0	0	726	447	0	928	116	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)	4.0		4.0					4.0	4.0		4.0	4.0	
Lane Util. Factor	0.97		0.88					0.95	1.00		0.95	1.00	
Frt	1.00		0.85					1.00	0.85		1.00	0.85	
Flt Protected	0.95		1.00					1.00	1.00		1.00	1.00	
Satd. Flow (prot)	3433		2787					3539	1583		3539	1583	
Flt Permitted	0.95		1.00					1.00	1.00		1.00	1.00	
Satd. Flow (perm)	3433		2787					3539	1583		3539	1583	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	
Adj. Flow (vph)	217	0	418	0	0	0	0	789	486	0	1009	126	
RTOR Reduction (vph)	0	0	79	0	0	0	0	0	0	0	0	0	
Lane Group Flow (vph)	217	0	339	0	0	0	0	789	486	0	1009	126	
Turn Type	Prot		Perm					NA	Free		NA	Free	
Protected Phases	4							2			6		
Permitted Phases			4						Free			Free	
Actuated Green, G (s)	11.0		11.0					21.5	41.5		21.5	41.5	
Effective Green, g (s)	11.0		11.0					22.5	41.5		22.5	41.5	
Actuated g/C Ratio	0.27		0.27					0.54	1.00		0.54	1.00	
Clearance Time (s)	4.0		4.0					5.0			5.0		
Vehicle Extension (s)	2.0		2.0					4.0			4.0		
Lane Grp Cap (vph)	909		738					1918	1583		1918	1583	
v/s Ratio Prot	0.06							0.22			c0.29		
v/s Ratio Perm			c0.12						0.31			0.08	
v/c Ratio	0.24		0.46					0.41	0.31		0.53	0.08	
Uniform Delay, d1	12.0		12.8					5.6	0.0		6.1	0.0	
Progression Factor	1.00		1.00					1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.0		0.2					0.2	0.5		0.3	0.1	
Delay (s)	12.0		12.9					5.8	0.5		6.4	0.1	
Level of Service	B		B					A	A		A	A	
Approach Delay (s)		12.6			0.0			3.8			5.7		
Approach LOS		B			A			A			A		
Intersection Summary													
HCM 2000 Control Delay			6.3									HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio			0.50										
Actuated Cycle Length (s)			41.5									Sum of lost time (s)	8.0
Intersection Capacity Utilization			45.8%									ICU Level of Service	A
Analysis Period (min)			15										
c Critical Lane Group													

HCM Signalized Intersection Capacity Analysis
31: Isabel Ave & Airway Blvd

BART to Livermore Extension Project
2013 Existing AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↑	↗	↖	↑	↗	↖	↑↑↑	↗	↖↗	↑↑↑	↗
Traffic Volume (vph)	0	56	174	128	210	100	318	1075	22	231	1142	15
Future Volume (vph)	0	56	174	128	210	100	318	1075	22	231	1142	15
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.4	4.0	4.0	4.4	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor		1.00	1.00	1.00	1.00	1.00	1.00	0.91	1.00	0.97	0.91	1.00
Frt		1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1863	1583	1770	1863	1583	1770	5085	1583	3433	5085	1583
Flt Permitted		1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)		1863	1583	1770	1863	1583	1770	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	61	189	139	228	109	346	1168	24	251	1241	16
RTOR Reduction (vph)	0	0	75	0	0	64	0	0	13	0	0	16
Lane Group Flow (vph)	0	61	114	139	228	45	346	1168	11	251	1241	0
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	NA
Protected Phases	7	4	5	3	8	1	5	2		1	6	
Permitted Phases			4			8			2			
Actuated Green, G (s)		7.2	27.7	13.8	25.6	38.2	20.5	42.4	42.4	12.6	34.5	0.0
Effective Green, g (s)		7.8	28.9	14.4	26.2	39.4	21.5	43.4	43.4	13.6	35.5	0.0
Actuated g/C Ratio		0.08	0.30	0.15	0.28	0.41	0.23	0.46	0.46	0.14	0.37	0.00
Clearance Time (s)		4.6	5.0	4.6	4.6	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Extension (s)		3.0	3.0	3.0	3.0	3.0	3.0	5.0	5.0	3.0	5.0	
Lane Grp Cap (vph)		152	480	267	512	655	399	2318	721	490	1896	0
v/s Ratio Prot		0.03	0.05	c0.08	c0.12	0.01	c0.20	0.23		0.07	c0.24	
v/s Ratio Perm			0.02			0.02			0.01			
v/c Ratio		0.40	0.24	0.52	0.45	0.07	0.87	0.50	0.02	0.51	0.65	0.00
Uniform Delay, d1		41.5	24.9	37.2	28.5	16.8	35.5	18.3	14.2	37.7	24.8	47.6
Progression Factor		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2		1.7	0.3	1.8	0.6	0.0	17.6	0.4	0.0	0.9	1.1	0.0
Delay (s)		43.2	25.1	39.0	29.1	16.9	53.1	18.7	14.2	38.6	25.9	47.6
Level of Service		D	C	D	C	B	D	B	B	D	C	D
Approach Delay (s)		29.6			29.2			26.3			28.2	
Approach LOS		C			C			C			C	

































Intersection Summary

HCM 2000 Control Delay	27.7	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.68		
Actuated Cycle Length (s)	95.2	Sum of lost time (s)	16.4
Intersection Capacity Utilization	63.4%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
32: Isabel Ave & Jack London Blvd

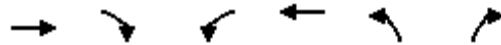
BART to Livermore Extension Project
2013 Existing AM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 	 		 			 	  		 	 	
Traffic Volume (vph)	30	47	35	135	677	340	259	785	69	166	906	309
Future Volume (vph)	30	47	35	135	677	340	259	785	69	166	906	309
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3
Lane Util. Factor	0.97	0.95	1.00	0.97	1.00	1.00	0.97	0.91	1.00	0.97	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	3433	1863	1583	3433	5085	1583	3433	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	3433	1863	1583	3433	5085	1583	3433	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	33	51	38	147	736	370	282	853	75	180	985	336
RTOR Reduction (vph)	0	0	27	0	0	54	0	0	53	0	0	134
Lane Group Flow (vph)	33	51	11	147	736	316	282	853	22	180	985	202
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8	1	5	2		1	6	
Permitted Phases			4			8			2			6
Actuated Green, G (s)	4.0	33.3	33.3	17.5	46.8	57.3	10.4	34.7	34.7	10.5	34.8	34.8
Effective Green, g (s)	4.0	33.3	33.3	17.5	46.8	57.3	10.4	34.7	34.7	10.5	34.8	34.8
Actuated g/C Ratio	0.03	0.28	0.28	0.15	0.40	0.49	0.09	0.30	0.30	0.09	0.30	0.30
Clearance Time (s)	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	117	1005	449	512	743	845	304	1505	468	307	1050	470
v/s Ratio Prot	0.01	0.01		c0.04	c0.40	0.03	c0.08	0.17		0.05	c0.28	
v/s Ratio Perm			0.01			0.17			0.01			0.13
v/c Ratio	0.28	0.05	0.02	0.29	0.99	0.37	0.93	0.57	0.05	0.59	0.94	0.43
Uniform Delay, d1	55.2	30.5	30.2	44.3	35.0	18.7	53.0	34.9	29.5	51.3	40.2	33.2
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.3	0.0	0.0	0.3	30.5	0.3	32.9	0.5	0.0	2.8	15.0	0.6
Delay (s)	56.5	30.5	30.3	44.6	65.5	19.0	85.9	35.4	29.5	54.1	55.1	33.8
Level of Service	E	C	C	D	E	B	F	D	C	D	E	C
Approach Delay (s)		37.5			49.3			46.8			50.3	
Approach LOS		D			D			D			D	

Intersection Summary

HCM 2000 Control Delay	48.6	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.94		
Actuated Cycle Length (s)	117.2	Sum of lost time (s)	21.2
Intersection Capacity Utilization	81.3%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑	↑	↔	↑↑	↔	↔
Traffic Volume (vph)	299	147	305	1962	372	186
Future Volume (vph)	299	147	305	1962	372	186
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	2.5
Lane Util. Factor	0.95	1.00	0.97	0.95	0.97	0.88
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	3539	1583	3433	3539	3433	2787
Flt Permitted	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (perm)	3539	1583	3433	3539	3433	2787
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	325	160	332	2133	404	202
RTOR Reduction (vph)	0	67	0	0	0	137
Lane Group Flow (vph)	325	93	332	2133	404	65
Turn Type	NA	Perm	Prot	NA	Prot	pm+ov
Protected Phases	2		1	6	8	1
Permitted Phases		2				8
Actuated Green, G (s)	59.3	59.3	14.1	77.4	16.6	30.7
Effective Green, g (s)	61.0	61.0	14.1	79.1	18.1	33.7
Actuated g/C Ratio	0.58	0.58	0.13	0.75	0.17	0.32
Clearance Time (s)	5.7	5.7	4.0	5.7	5.5	4.0
Vehicle Extension (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Grp Cap (vph)	2052	917	460	2660	590	892
v/s Ratio Prot	0.09		0.10	c0.60	c0.12	0.01
v/s Ratio Perm		0.06				0.01
v/c Ratio	0.16	0.10	0.72	0.80	0.68	0.07
Uniform Delay, d1	10.2	9.9	43.7	8.2	40.9	24.9
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.0	0.0	4.7	1.7	2.6	0.0
Delay (s)	10.2	9.9	48.4	9.9	43.5	24.9
Level of Service	B	A	D	A	D	C
Approach Delay (s)	10.1			15.1	37.3	
Approach LOS	B			B	D	

Intersection Summary

HCM 2000 Control Delay	18.2	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.81		
Actuated Cycle Length (s)	105.2	Sum of lost time (s)	12.0
Intersection Capacity Utilization	71.5%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 34: Murrieta Blvd/Driveway & Portola Ave



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗		↖	↗		↖	↗	↗		↗	
Traffic Volume (vph)	0	332	86	272	1208	1	192	6	144	1	3	0
Future Volume (vph)	0	332	86	272	1208	1	192	6	144	1	3	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0		4.0	4.0		4.0	4.0	4.0		4.0	
Lane Util. Factor		0.95		1.00	0.95		0.95	0.95	1.00		1.00	
Frt		0.97		1.00	1.00		1.00	1.00	0.85		1.00	
Flt Protected		1.00		0.95	1.00		0.95	0.96	1.00		0.99	
Satd. Flow (prot)		3430		1770	3539		1681	1691	1583		1840	
Flt Permitted		1.00		0.95	1.00		0.95	0.96	1.00		0.99	
Satd. Flow (perm)		3430		1770	3539		1681	1691	1583		1840	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	361	93	296	1313	1	209	7	157	1	3	0
RTOR Reduction (vph)	0	11	0	0	0	0	0	0	141	0	0	0
Lane Group Flow (vph)	0	443	0	296	1314	0	109	107	16	0	4	0
Turn Type	Prot	NA		Prot	NA		Split	NA	Perm		Split	NA
Protected Phases	5	2		1	6		8	8			4	4
Permitted Phases									8			
Actuated Green, G (s)		81.7		28.4	114.1		13.8	13.8	13.8		1.1	
Effective Green, g (s)		82.6		28.4	115.0		14.4	14.4	14.4		1.1	
Actuated g/C Ratio		0.58		0.20	0.81		0.10	0.10	0.10		0.01	
Clearance Time (s)		4.9		4.0	4.9		4.6	4.6	4.6		4.0	
Vehicle Extension (s)		2.0		2.0	2.0		2.0	2.0	2.0		2.0	
Lane Grp Cap (vph)		1988		352	2856		169	170	159		14	
v/s Ratio Prot		0.13		c0.17	c0.37		c0.06	0.06			c0.00	
v/s Ratio Perm									0.01			
v/c Ratio		0.22		0.84	0.46		0.64	0.63	0.10		0.29	
Uniform Delay, d1		14.5		54.9	4.2		61.6	61.5	58.2		70.3	
Progression Factor		1.00		1.00	1.00		1.00	1.00	1.00		1.00	
Incremental Delay, d2		0.3		15.8	0.5		6.2	5.2	0.1		4.1	
Delay (s)		14.7		70.6	4.8		67.8	66.7	58.3		74.4	
Level of Service		B		E	A		E	E	E		E	
Approach Delay (s)		14.7			16.9			63.5			74.4	
Approach LOS		B			B			E			E	

Intersection Summary		
HCM 2000 Control Delay	23.7	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.57	C
Actuated Cycle Length (s)	142.5	Sum of lost time (s)
Intersection Capacity Utilization	58.9%	16.0
Analysis Period (min)	15	ICU Level of Service
		B

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 35: Murrieta Blvd & Jack London Blvd



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	76	255	623	206	244	167
Future Volume (vph)	76	255	623	206	244	167
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00	1.00	0.95	0.91	
Frt	1.00	0.85	1.00	1.00	0.94	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1770	1583	1770	3539	4775	
Flt Permitted	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	1770	1583	1770	3539	4775	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	83	277	677	224	265	182
RTOR Reduction (vph)	0	236	0	0	152	0
Lane Group Flow (vph)	83	41	677	224	295	0
Turn Type	Prot	Perm	Prot	NA	NA	
Protected Phases	4		5	2	6	
Permitted Phases		4				
Actuated Green, G (s)	8.5	8.5	27.3	40.7	9.4	
Effective Green, g (s)	8.5	8.5	27.3	40.7	9.4	
Actuated g/C Ratio	0.15	0.15	0.48	0.71	0.16	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	263	235	844	2518	784	
v/s Ratio Prot	c0.05		c0.38	0.06	c0.06	
v/s Ratio Perm		0.03				
v/c Ratio	0.32	0.18	0.80	0.09	0.38	
Uniform Delay, d1	21.8	21.3	12.7	2.5	21.3	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.7	0.4	5.5	0.0	0.3	
Delay (s)	22.4	21.6	18.2	2.6	21.6	
Level of Service	C	C	B	A	C	
Approach Delay (s)	21.8			14.3	21.6	
Approach LOS	C			B	C	

Intersection Summary

HCM 2000 Control Delay	17.8	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.62		
Actuated Cycle Length (s)	57.2	Sum of lost time (s)	12.0
Intersection Capacity Utilization	57.2%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
36: Murrieta Blvd & Stanley Blvd

BART to Livermore Extension Project
2013 Existing AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↘	↗↗	↘	↘	↗↗	↘	↘	↗↗			↗↗	↘
Traffic Volume (vph)	199	414	221	16	791	99	450	316	8	141	215	452
Future Volume (vph)	199	414	221	16	791	99	450	316	8	141	215	452
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0			4.0	4.9
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	0.91	0.91			0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00			1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	0.98			0.98	1.00
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583	1610	3318			3471	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	0.98			0.98	1.00
Satd. Flow (perm)	1770	3539	1583	1770	3539	1583	1610	3318			3471	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	216	450	240	17	860	108	489	343	9	153	234	491
RTOR Reduction (vph)	0	0	134	0	0	53	0	1	0	0	0	250
Lane Group Flow (vph)	216	450	106	17	860	55	269	571	0	0	387	241
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Split	NA		Split	NA	Perm
Protected Phases	1	6		5	2	4	3	3		4	4	
Permitted Phases			6			2						4
Actuated Green, G (s)	21.7	58.9	58.9	2.9	40.1	66.8	28.1	28.1			26.7	26.7
Effective Green, g (s)	21.7	59.8	59.8	2.9	41.0	68.6	29.0	29.0			27.6	26.7
Actuated g/C Ratio	0.16	0.44	0.44	0.02	0.30	0.51	0.21	0.21			0.20	0.20
Clearance Time (s)	4.0	4.9	4.9	4.0	4.9	4.9	4.9	4.9			4.9	4.9
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0			3.0	3.0
Lane Grp Cap (vph)	283	1564	699	37	1072	802	345	711			708	312
v/s Ratio Prot	c0.12	0.13		0.01	c0.24	0.01	0.17	c0.17			0.11	
v/s Ratio Perm			0.07			0.02						c0.15
v/c Ratio	0.76	0.29	0.15	0.46	0.80	0.07	0.78	0.80			0.55	0.77
Uniform Delay, d1	54.3	24.1	22.6	65.4	43.4	17.0	50.1	50.4			48.2	51.4
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00			1.00	1.00
Incremental Delay, d2	11.5	0.1	0.1	8.8	4.4	0.0	10.6	6.5			0.9	11.2
Delay (s)	65.9	24.2	22.7	74.2	47.8	17.1	60.8	57.0			49.1	62.6
Level of Service	E	C	C	E	D	B	E	E			D	E
Approach Delay (s)		33.8			44.9			58.2			56.6	
Approach LOS		C			D			E			E	

Intersection Summary

HCM 2000 Control Delay	48.1	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.78		
Actuated Cycle Length (s)	135.3	Sum of lost time (s)	16.0
Intersection Capacity Utilization	75.3%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
37: Livermore Ave & I-580 WB Ramps



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↖	↔		↗	↑			↕	
Traffic Volume (vph)	0	0	0	344	88	28	444	79	0	0	151	0
Future Volume (vph)	0	0	0	344	88	28	444	79	0	0	151	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)					4.0		4.0	4.0			4.0	
Lane Util. Factor					0.95		0.97	1.00			0.95	
Frt					0.99		1.00	1.00			1.00	
Flt Protected					0.96		0.95	1.00			1.00	
Satd. Flow (prot)					1690		3433	1863			3539	
Flt Permitted					0.96		0.95	1.00			1.00	
Satd. Flow (perm)					1690		3433	1863			3539	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	374	96	30	483	86	0	0	164	0
RTOR Reduction (vph)	0	0	0	0	4	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	0	496	0	483	86	0	0	164	0
Turn Type				Split	NA		Prot	NA			NA	
Protected Phases				8	8		5	2			6	
Permitted Phases												
Actuated Green, G (s)					16.7		12.4	30.6			14.7	
Effective Green, g (s)					16.7		11.9	32.3			16.4	
Actuated g/C Ratio					0.29		0.21	0.57			0.29	
Clearance Time (s)					4.0		3.5	5.7			5.7	
Vehicle Extension (s)					2.0		2.0	2.5			2.5	
Lane Grp Cap (vph)					495		716	1055			1018	
v/s Ratio Prot					c0.29		c0.14	0.05			c0.05	
v/s Ratio Perm												
v/c Ratio					1.00		0.67	0.08			0.16	
Uniform Delay, d1					20.1		20.8	5.6			15.2	
Progression Factor					1.00		0.64	0.72			1.00	
Incremental Delay, d2					41.2		1.9	0.1			0.3	
Delay (s)					61.3		15.2	4.2			15.5	
Level of Service					E		B	A			B	
Approach Delay (s)		0.0			61.3			13.5			15.5	
Approach LOS		A			E			B			B	

Intersection Summary

HCM 2000 Control Delay	33.2	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.61		
Actuated Cycle Length (s)	57.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	46.4%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
38: Livermore Ave & I-580 EB Ramps



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕	↗					↕		↘	↕	
Traffic Volume (vph)	15	1	576	0	0	0	0	506	198	17	482	0
Future Volume (vph)	15	1	576	0	0	0	0	506	198	17	482	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0					4.0		4.0	4.0	
Lane Util. Factor		0.95	0.95					0.95		1.00	0.95	
Frt		0.86	0.85					0.96		1.00	1.00	
Flt Protected		1.00	1.00					1.00		0.95	1.00	
Satd. Flow (prot)		1514	1504					3390		1770	3539	
Flt Permitted		1.00	1.00					1.00		0.95	1.00	
Satd. Flow (perm)		1514	1504					3390		1770	3539	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	16	1	626	0	0	0	0	550	215	18	524	0
RTOR Reduction (vph)	0	236	245	0	0	0	0	47	0	0	0	0
Lane Group Flow (vph)	0	88	74	0	0	0	0	718	0	18	524	0
Turn Type	Prot	NA	Perm					NA		Prot	NA	
Protected Phases	7	4						2		1	6	
Permitted Phases			4									
Actuated Green, G (s)		13.2	13.2					30.5		1.3	34.8	
Effective Green, g (s)		13.2	13.2					31.5		0.3	35.8	
Actuated g/C Ratio		0.23	0.23					0.55		0.01	0.63	
Clearance Time (s)		4.0	4.0					5.0		3.0	5.0	
Vehicle Extension (s)		2.0	2.0					2.5		2.0	2.5	
Lane Grp Cap (vph)		350	348					1873		9	2222	
v/s Ratio Prot								c0.21		c0.01	0.15	
v/s Ratio Perm		0.06	0.05									
v/c Ratio		0.25	0.21					0.38		2.00	0.24	
Uniform Delay, d1		17.9	17.7					7.2		28.4	4.6	
Progression Factor		1.00	1.00					1.00		1.25	0.31	
Incremental Delay, d2		0.1	0.1					0.6		634.9	0.2	
Delay (s)		18.0	17.8					7.8		670.3	1.6	
Level of Service		B	B					A		F	A	
Approach Delay (s)		17.9			0.0			7.8			23.8	
Approach LOS		B			A			A			C	

Intersection Summary

HCM 2000 Control Delay	15.6	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.35		
Actuated Cycle Length (s)	57.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	46.4%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
39: Livermore Ave & Portola Ave

BART to Livermore Extension Project
2013 Existing AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	225	254	79	31	704	85	214	396	72	120	549	320
Future Volume (vph)	225	254	79	31	704	85	214	396	72	120	549	320
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	3.1
Lane Util. Factor	0.97	0.95		1.00	0.95		1.00	0.95		1.00	0.95	1.00
Frt	1.00	0.96		1.00	0.98		1.00	0.98		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3413		1770	3482		1770	3458		1770	3539	1583
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3413		1770	3482		1770	3458		1770	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	245	276	86	34	765	92	233	430	78	130	597	348
RTOR Reduction (vph)	0	23	0	0	8	0	0	13	0	0	0	37
Lane Group Flow (vph)	245	339	0	34	849	0	233	495	0	130	597	311
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	pm+ov
Protected Phases	3	8		7	4		1	6		5	2	3
Permitted Phases												2
Actuated Green, G (s)	13.0	42.6		5.3	34.9		19.0	35.9		12.0	28.9	41.9
Effective Green, g (s)	13.0	43.9		5.3	36.2		19.0	36.8		12.0	29.8	43.7
Actuated g/C Ratio	0.11	0.39		0.05	0.32		0.17	0.32		0.11	0.26	0.38
Clearance Time (s)	4.0	5.3		4.0	5.3		4.0	4.9		4.0	4.9	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	391	1314		82	1105		295	1116		186	925	606
v/s Ratio Prot	c0.07	0.10		0.02	c0.24		c0.13	0.14		0.07	c0.17	0.06
v/s Ratio Perm												0.13
v/c Ratio	0.63	0.26		0.41	0.77		0.79	0.44		0.70	0.65	0.51
Uniform Delay, d1	48.2	23.9		52.8	35.1		45.6	30.5		49.3	37.4	27.0
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	3.1	0.1		3.4	3.3		13.1	1.3		10.9	3.5	0.7
Delay (s)	51.3	24.0		56.2	38.4		58.7	31.8		60.2	40.9	27.7
Level of Service	D	C		E	D		E	C		E	D	C
Approach Delay (s)		35.0			39.1			40.3			38.9	
Approach LOS		D			D			D			D	

Intersection Summary

HCM 2000 Control Delay	38.6	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.72		
Actuated Cycle Length (s)	114.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	69.0%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
40: First St/Springtown Blvd & I-580 WB Ramps

BART to Livermore Extension Project
2013 Existing AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations			↗↘			↗	↗↘	↑			↗↘	↗
Traffic Volume (vph)	0	0	443	0	0	0	341	375	0	0	875	466
Future Volume (vph)	0	0	443	0	0	0	341	375	0	0	875	466
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)			4.0				4.0	4.0			4.0	4.0
Lane Util. Factor			0.88				0.97	1.00			0.95	1.00
Frt			0.85				1.00	1.00			1.00	0.85
Flt Protected			1.00				0.95	1.00			1.00	1.00
Satd. Flow (prot)			2787				3433	1863			3539	1583
Flt Permitted			1.00				0.95	1.00			1.00	1.00
Satd. Flow (perm)			2787				3433	1863			3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	482	0	0	0	371	408	0	0	951	507
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	124
Lane Group Flow (vph)	0	0	482	0	0	0	371	408	0	0	951	383
Turn Type			Over			Free	Prot	NA			NA	Perm
Protected Phases			5				5	2			6	
Permitted Phases						Free						6
Actuated Green, G (s)			13.1				13.1	47.4			26.3	26.3
Effective Green, g (s)			12.6				12.6	47.4			26.8	26.8
Actuated g/C Ratio			0.27				0.27	1.00			0.57	0.57
Clearance Time (s)			3.5				3.5	4.0			4.5	4.5
Vehicle Extension (s)			2.0				2.0	0.2			4.0	4.0
Lane Grp Cap (vph)			740				912	1863			2000	895
v/s Ratio Prot			c0.17				0.11	0.22			c0.27	
v/s Ratio Perm												0.24
v/c Ratio			0.65				0.41	0.22			0.48	0.43
Uniform Delay, d1			15.4				14.3	0.0			6.1	5.9
Progression Factor			1.00				1.00	1.00			1.00	1.00
Incremental Delay, d2			1.6				0.1	0.0			0.2	0.4
Delay (s)			17.0				14.4	0.0			6.4	6.4
Level of Service			B				B	A			A	A
Approach Delay (s)		17.0			0.0			6.9			6.4	
Approach LOS		B			A			A			A	

Intersection Summary

HCM 2000 Control Delay	8.4	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.53		
Actuated Cycle Length (s)	47.4	Sum of lost time (s)	8.0
Intersection Capacity Utilization	46.4%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
41: First St & I-580 EB Ramps



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕	↗↗					↕↕	↗	↘	↕↕	
Traffic Volume (vph)	91	1	291	0	0	0	0	632	283	68	1219	0
Future Volume (vph)	91	1	291	0	0	0	0	632	283	68	1219	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0					4.0	4.0	4.0	4.0	
Lane Util. Factor		1.00	0.88					0.95	1.00	1.00	0.95	
Frt		1.00	0.85					1.00	0.85	1.00	1.00	
Flt Protected		0.95	1.00					1.00	1.00	0.95	1.00	
Satd. Flow (prot)		1775	2787					3539	1583	1770	3539	
Flt Permitted		0.95	1.00					1.00	1.00	0.95	1.00	
Satd. Flow (perm)		1775	2787					3539	1583	1770	3539	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	99	1	316	0	0	0	0	687	308	74	1325	0
RTOR Reduction (vph)	0	0	81	0	0	0	0	0	156	0	0	0
Lane Group Flow (vph)	0	100	235	0	0	0	0	687	152	74	1325	0
Turn Type	Perm	NA	Perm					NA	Perm	Prot	NA	
Protected Phases		4						2		1	6	
Permitted Phases	4		4						2			
Actuated Green, G (s)		9.3	9.3					22.8	22.8	4.2	30.0	
Effective Green, g (s)		8.8	8.8					23.3	23.3	3.2	30.5	
Actuated g/C Ratio		0.19	0.19					0.49	0.49	0.07	0.64	
Clearance Time (s)		3.5	3.5					4.5	4.5	3.0	4.5	
Vehicle Extension (s)		2.5	2.5					4.0	4.0	2.0	4.0	
Lane Grp Cap (vph)		330	518					1743	779	119	2282	
v/s Ratio Prot								0.19		0.04	c0.37	
v/s Ratio Perm		0.06	c0.08						0.10			
v/c Ratio		0.30	0.45					0.39	0.19	0.62	0.58	
Uniform Delay, d1		16.6	17.1					7.6	6.7	21.5	4.8	
Progression Factor		1.00	1.00					1.00	1.00	1.00	1.00	
Incremental Delay, d2		0.4	0.5					0.2	0.2	7.1	0.4	
Delay (s)		17.0	17.6					7.8	6.9	28.5	5.2	
Level of Service		B	B					A	A	C	A	
Approach Delay (s)		17.4			0.0			7.5			6.5	
Approach LOS		B			A			A			A	

Intersection Summary

HCM 2000 Control Delay	8.4	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.61		
Actuated Cycle Length (s)	47.3	Sum of lost time (s)	12.0
Intersection Capacity Utilization	50.5%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
42: 1st St & Mines Rd

BART to Livermore Extension Project
2013 Existing AM






















Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	32	69	43	551	109	319	17	751	278	202	1230	20
Future Volume (vph)	32	69	43	551	109	319	17	751	278	202	1230	20
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		0.97	1.00	1.00	1.00	0.91		0.97	0.91	
Frt	1.00	0.94		1.00	1.00	0.85	1.00	0.96		1.00	1.00	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1755		3433	1863	1583	1770	4879		3433	5073	
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	1755		3433	1863	1583	1770	4879		3433	5073	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	35	75	47	599	118	347	18	816	302	220	1337	22
RTOR Reduction (vph)	0	37	0	0	0	190	0	88	0	0	2	0
Lane Group Flow (vph)	35	85	0	599	118	157	18	1030	0	220	1357	0
Turn Type	Prot	NA		Prot	NA	Perm	Prot	NA		Prot	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases						8						
Actuated Green, G (s)	1.8	8.4		13.1	19.7	19.7	0.7	21.5		6.1	26.9	
Effective Green, g (s)	1.8	8.4		13.1	19.7	19.7	0.7	21.5		6.1	26.9	
Actuated g/C Ratio	0.03	0.13		0.20	0.30	0.30	0.01	0.33		0.09	0.41	
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	48	226		690	563	479	19	1611		321	2096	
v/s Ratio Prot	0.02	0.05		c0.17	0.06		0.01	0.21		c0.06	c0.27	
v/s Ratio Perm						c0.10						
v/c Ratio	0.73	0.38		0.87	0.21	0.33	0.95	0.64		0.69	0.65	
Uniform Delay, d1	31.4	26.0		25.2	16.9	17.6	32.2	18.5		28.6	15.3	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	42.5	1.1		11.2	0.2	0.4	179.6	0.8		6.0	0.7	
Delay (s)	73.9	27.0		36.4	17.1	18.0	211.8	19.4		34.5	16.0	
Level of Service	E	C		D	B	B	F	B		C	B	
Approach Delay (s)		37.5			28.2			22.4			18.6	
Approach LOS		D			C			C			B	

Intersection Summary




















HCM 2000 Control Delay	23.0	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.71		
Actuated Cycle Length (s)	65.1	Sum of lost time (s)	16.0
Intersection Capacity Utilization	59.9%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Unsignalized Intersection Capacity Analysis
43: Vasco Rd & I-580 WB Ramps

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations								 				
Traffic Volume (veh/h)	0	0	0	0	0	127	0	786	0	0	948	0
Future Volume (Veh/h)	0	0	0	0	0	127	0	786	0	0	948	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	0	0	0	138	0	854	0	0	1030	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage (veh)												
Upstream signal (ft)											487	
pX, platoon unblocked												
vC, conflicting volume	1595	1884	1030	1884	1884	427	1030			854		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1595	1884	1030	1884	1884	427	1030			854		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	100	100	76	100			100		
cM capacity (veh/h)	54	70	231	43	70	576	670			781		
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	SB 1	SB 2					
Volume Total	0	138	427	427	0	1030	0					
Volume Left	0	0	0	0	0	0	0					
Volume Right	0	138	0	0	0	0	0					
cSH	1700	576	1700	1700	1700	1700	1700					
Volume to Capacity	0.00	0.24	0.25	0.25	0.00	0.61	0.00					
Queue Length 95th (ft)	0	23	0	0	0	0	0					
Control Delay (s)	0.0	13.2	0.0	0.0	0.0	0.0	0.0					
Lane LOS	A	B										
Approach Delay (s)	0.0	13.2	0.0			0.0						
Approach LOS	A	B										
Intersection Summary												
Average Delay			0.9									
Intersection Capacity Utilization			53.2%	ICU Level of Service	A							
Analysis Period (min)			15									

HCM Unsignalized Intersection Capacity Analysis
44: Vasco Rd & I-580 EB Ramps

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	0	0	0	0	583	0	73	1252	0
Future Volume (Veh/h)	0	0	0	0	0	0	0	583	0	73	1252	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	0	0	0	0	0	634	0	79	1361	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1836	2153	1361	2153	2153	317	1361			634		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1836	2153	1361	2153	2153	317	1361			634		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	100	100	100	100			92		
cM capacity (veh/h)	44	43	138	25	43	679	501			945		
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2						
Volume Total	0	0	423	211	79	1361						
Volume Left	0	0	0	0	79	0						
Volume Right	0	0	0	0	0	0						
cSH	1700	1700	1700	1700	945	1700						
Volume to Capacity	0.00	0.00	0.25	0.12	0.08	0.80						
Queue Length 95th (ft)	0	0	0	0	7	0						
Control Delay (s)	0.0	0.0	0.0	0.0	9.2	0.0						
Lane LOS	A	A			A							
Approach Delay (s)	0.0	0.0	0.0		0.5							
Approach LOS	A	A										
Intersection Summary												
Average Delay			0.3									
Intersection Capacity Utilization			69.2%	ICU Level of Service	C							
Analysis Period (min)			15									

HCM Signalized Intersection Capacity Analysis
45: Vasco Rd & East Ave

BART to Livermore Extension Project
2013 Existing AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	233	253	43	6	14	11	61	246	166	213	287	271
Future Volume (vph)	233	253	43	6	14	11	61	246	166	213	287	271
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	0.95		0.97	1.00	1.00
Frt	1.00	0.98		1.00	0.93		1.00	0.94		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	3462		1770	3303		1770	3325		3433	1863	1583
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1770	3462		1770	3303		1770	3325		3433	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	253	275	47	7	15	12	66	267	180	232	312	295
RTOR Reduction (vph)	0	27	0	0	12	0	0	126	0	0	0	193
Lane Group Flow (vph)	253	295	0	7	15	0	66	321	0	232	312	102
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												6
Actuated Green, G (s)	8.8	9.5		0.6	1.3		2.2	12.9		4.2	14.9	14.9
Effective Green, g (s)	8.8	9.5		0.6	1.3		2.2	12.9		4.2	14.9	14.9
Actuated g/C Ratio	0.20	0.22		0.01	0.03		0.05	0.30		0.10	0.34	0.34
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	360	761		24	99		90	992		333	642	545
v/s Ratio Prot	c0.14	c0.09		0.00	0.00		0.04	0.10		c0.07	c0.17	
v/s Ratio Perm												0.06
v/c Ratio	0.70	0.39		0.29	0.16		0.73	0.32		0.70	0.49	0.19
Uniform Delay, d1	16.0	14.4		21.1	20.4		20.2	11.8		18.9	11.1	9.9
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	6.1	0.3		6.7	0.7		26.3	0.2		6.2	0.6	0.2
Delay (s)	22.1	14.7		27.7	21.1		46.5	12.0		25.1	11.7	10.1
Level of Service	C	B		C	C		D	B		C	B	B
Approach Delay (s)		17.9			22.5			16.4			14.8	
Approach LOS		B			C			B			B	

Intersection Summary

HCM 2000 Control Delay	16.3	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.64		
Actuated Cycle Length (s)	43.2	Sum of lost time (s)	16.0
Intersection Capacity Utilization	48.1%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Unsignalized Intersection Capacity Analysis
 46: I-580 WB Ramps & Northfront Rd/Northfront Road



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↻			↻	↻	↻
Traffic Volume (veh/h)	84	30	444	143	45	573
Future Volume (Veh/h)	84	30	444	143	45	573
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	91	33	483	155	49	623
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						3
Median type	None		None			
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume			91		1228	108
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			91		1228	108
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			68		63	34
cM capacity (veh/h)			1504		133	946
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	124	638	672			
Volume Left	0	483	49			
Volume Right	33	0	623			
cSH	1700	1504	1021			
Volume to Capacity	0.07	0.32	0.66			
Queue Length 95th (ft)	0	35	129			
Control Delay (s)	0.0	7.2	18.1			
Lane LOS		A	C			
Approach Delay (s)	0.0	7.2	18.1			
Approach LOS			C			
Intersection Summary						
Average Delay			11.7			
Intersection Capacity Utilization			48.8%	ICU Level of Service		A
Analysis Period (min)			15			

Intersection	
Intersection Delay, s/veh	9.6
Intersection LOS	A

Movement	EBU	EBL	EBT	WBU	WBT	WBR	SBU	SBL	SBR
Lane Configurations		↘	↕↕		↕	↘		↘↘	↘
Traffic Vol, veh/h	0	25	23	0	169	68	0	279	80
Future Vol, veh/h	0	25	23	0	169	68	0	279	80
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	27	25	0	184	74	0	303	87
Number of Lanes	0	1	2	0	1	1	0	2	1

Approach	EB	WB	SB
Opposing Approach	WB	EB	
Opposing Lanes	2	3	0
Conflicting Approach Left	SB		WB
Conflicting Lanes Left	3	0	2
Conflicting Approach Right		SB	EB
Conflicting Lanes Right	0	3	3
HCM Control Delay	8.9	10	9.5
HCM LOS	A	A	A

Lane	EBLn1	EBLn2	EBLn3	WBLn1	WBLn2	SBLn1	SBLn2	SBLn3
Vol Left, %	100%	0%	0%	0%	0%	100%	100%	0%
Vol Thru, %	0%	100%	100%	100%	0%	0%	0%	0%
Vol Right, %	0%	0%	0%	0%	100%	0%	0%	100%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	25	12	12	169	68	140	140	80
LT Vol	25	0	0	0	0	140	140	0
Through Vol	0	12	12	169	0	0	0	0
RT Vol	0	0	0	0	68	0	0	80
Lane Flow Rate	27	12	12	184	74	152	152	87
Geometry Grp	8	8	8	8	8	7	7	7
Degree of Util (X)	0.05	0.021	0.015	0.289	0.102	0.245	0.245	0.069
Departure Headway (Hd)	6.59	6.086	4.336	5.671	4.966	5.807	5.807	2.873
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cap	539	583	814	630	717	616	616	1230
Service Time	4.38	3.875	2.124	3.433	2.728	3.565	3.565	0.63
HCM Lane V/C Ratio	0.05	0.021	0.015	0.292	0.103	0.247	0.247	0.071
HCM Control Delay	9.7	9	7.2	10.7	8.3	10.5	10.5	5.8
HCM Lane LOS	A	A	A	B	A	B	B	A
HCM 95th-tile Q	0.2	0.1	0	1.2	0.3	1	1	0.2

HCM Unsignalized Intersection Capacity Analysis
 48: Greenville Rd & Northfront Road/Altamont Pass Road



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↻			↻	↻	↻
Sign Control	Stop			Stop	Stop	
Traffic Volume (vph)	13	644	278	500	91	53
Future Volume (vph)	13	644	278	500	91	53
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	14	700	302	543	99	58

Direction, Lane #	EB 1	WB 1	NB 1	NB 2
Volume Total (vph)	714	845	99	58
Volume Left (vph)	0	302	99	0
Volume Right (vph)	700	0	0	58
Hadj (s)	-0.55	0.11	0.23	-0.57
Departure Headway (s)	4.6	5.2	7.1	3.2
Degree Utilization, x	0.91	1.23	0.20	0.05
Capacity (veh/h)	780	697	493	1121
Control Delay (s)	35.1	132.7	11.8	6.4
Approach Delay (s)	35.1	132.7	9.8	
Approach LOS	E	F	A	

Intersection Summary			
Delay		80.8	
Level of Service		F	
Intersection Capacity Utilization		97.3%	ICU Level of Service
Analysis Period (min)		15	F



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	55	229	66	84	692	175
Future Volume (vph)	55	229	66	84	692	175
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.88	0.97	0.95	0.95	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	3433	2787	3433	3539	3539	1583
Flt Permitted	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (perm)	3433	2787	3433	3539	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	60	249	72	91	752	190
RTOR Reduction (vph)	0	199	0	0	0	106
Lane Group Flow (vph)	60	50	72	91	752	84
Turn Type	Prot	Perm	Prot	NA	NA	Perm
Protected Phases	8		1	6	2	
Permitted Phases		8				2
Actuated Green, G (s)	9.1	9.1	5.2	28.7	19.5	19.5
Effective Green, g (s)	9.7	9.7	5.2	30.4	21.2	21.2
Actuated g/C Ratio	0.20	0.20	0.11	0.63	0.44	0.44
Clearance Time (s)	4.6	4.6	4.0	5.7	5.7	5.7
Vehicle Extension (s)	5.0	5.0	6.0	2.5	2.5	2.5
Lane Grp Cap (vph)	692	562	371	2236	1559	697
v/s Ratio Prot	0.02		c0.02	0.03	c0.21	
v/s Ratio Perm		c0.02				0.05
v/c Ratio	0.09	0.09	0.19	0.04	0.48	0.12
Uniform Delay, d1	15.6	15.6	19.5	3.3	9.6	7.9
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.1	0.1	0.7	0.0	0.2	0.1
Delay (s)	15.7	15.8	20.3	3.3	9.7	8.0
Level of Service	B	B	C	A	A	A
Approach Delay (s)	15.7			10.8	9.4	
Approach LOS	B			B	A	

Intersection Summary

HCM 2000 Control Delay	10.9	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.34		
Actuated Cycle Length (s)	48.1	Sum of lost time (s)	12.0
Intersection Capacity Utilization	35.8%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Unsignalized Intersection Capacity Analysis
50: Greenville Rd & Patterson Pass Rd

BART to Livermore Extension Project
2013 Existing AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	12	4	41	195	381	130	31	112	2	7	310	53
Future Volume (Veh/h)	12	4	41	195	381	130	31	112	2	7	310	53
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	13	4	45	212	414	141	34	122	2	8	337	58
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	920	574	366	591	602	123	395			124		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	920	574	366	591	602	123	395			124		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	0	99	93	44	0	85	97			99		
cM capacity (veh/h)	0	414	679	378	399	928	1164			1463		
Direction, Lane #	EB 1	EB 2	WB 1	NB 1	NB 2	SB 1	SB 2					
Volume Total	13	49	767	34	124	8	395					
Volume Left	13	0	212	34	0	8	0					
Volume Right	0	45	141	0	2	0	58					
cSH	0	645	438	1164	1700	1463	1700					
Volume to Capacity	Err	0.08	1.75	0.03	0.07	0.01	0.23					
Queue Length 95th (ft)	Err	6	1180	2	0	0	0					
Control Delay (s)	Err	11.0	368.9	8.2	0.0	7.5	0.0					
Lane LOS	F	B	F	A		A						
Approach Delay (s)	Err		368.9	1.8		0.1						
Approach LOS	F		F									
Intersection Summary												
Average Delay			Err									
Intersection Capacity Utilization			77.8%		ICU Level of Service					D		
Analysis Period (min)			15									

HCM Signalized Intersection Capacity Analysis
1: Dougherty Rd & Amador Valley Rd








































Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	351	308	348	1871	1045	178
Future Volume (vph)	351	308	348	1871	1045	178
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5	5.7	5.7	
Lane Util. Factor	1.00	1.00	1.00	0.95	0.95	
Frt	1.00	0.85	1.00	1.00	0.98	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1770	1583	1770	3539	3462	
Flt Permitted	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	1770	1583	1770	3539	3462	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	382	335	378	2034	1136	193
RTOR Reduction (vph)	0	256	0	0	10	0
Lane Group Flow (vph)	382	79	378	2034	1319	0
Turn Type	Perm	Perm	Prot	NA	NA	
Protected Phases			5	2	6	
Permitted Phases	4	4				
Actuated Green, G (s)	27.1	27.1	27.9	77.1	44.7	
Effective Green, g (s)	27.1	27.1	27.9	77.1	44.7	
Actuated g/C Ratio	0.24	0.24	0.24	0.67	0.39	
Clearance Time (s)	4.5	4.5	4.5	5.7	5.7	
Vehicle Extension (s)	1.8	1.8	2.0	4.0	4.0	
Lane Grp Cap (vph)	419	374	431	2385	1352	
v/s Ratio Prot			0.21	c0.57	c0.38	
v/s Ratio Perm	c0.22	0.05				
v/c Ratio	0.91	0.21	0.88	0.85	0.98	
Uniform Delay, d1	42.5	35.1	41.6	14.3	34.3	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	23.4	0.1	17.4	3.3	18.8	
Delay (s)	65.9	35.2	59.0	17.6	53.1	
Level of Service	E	D	E	B	D	
Approach Delay (s)	51.5			24.1	53.1	
Approach LOS	D			C	D	

Intersection Summary

HCM 2000 Control Delay	37.1	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.94		
Actuated Cycle Length (s)	114.4	Sum of lost time (s)	14.7
Intersection Capacity Utilization	85.5%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
2: Dougherty Rd & Dublin Blvd

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations	 	  	 	  	  	 	  	  	 	 			
Traffic Volume (vph)	133	809	637	359	690	635	751	1434	345	506	1091	95	
Future Volume (vph)	133	809	637	359	690	635	751	1434	345	506	1091	95	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)	5.0	6.0	5.0	5.0	5.5	5.0	5.0	5.5	5.0	5.0	5.5		
Lane Util. Factor	0.97	0.91	0.88	0.94	0.91	1.00	0.94	0.91	0.88	0.97	0.86		
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99		
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		
Satd. Flow (prot)	3433	5085	2787	4990	5085	1583	4990	5085	2787	3433	6331		
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		
Satd. Flow (perm)	3433	5085	2787	4990	5085	1583	4990	5085	2787	3433	6331		
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	
Adj. Flow (vph)	145	879	692	390	750	690	816	1559	375	550	1186	103	
RTOR Reduction (vph)	0	0	40	0	0	25	0	0	24	0	7	0	
Lane Group Flow (vph)	145	879	652	390	750	665	816	1559	351	550	1282	0	
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA		
Protected Phases	5	2	3	1	6	7	3	8	1	7	4		
Permitted Phases			2			6			8				
Actuated Green, G (s)	15.1	36.5	68.6	17.9	39.8	71.4	32.1	55.3	73.2	31.6	54.8		
Effective Green, g (s)	15.1	36.5	68.6	17.9	39.8	71.4	32.1	55.3	73.2	31.6	54.8		
Actuated g/C Ratio	0.09	0.22	0.42	0.11	0.24	0.44	0.20	0.34	0.45	0.19	0.34		
Clearance Time (s)	5.0	6.0	5.0	5.0	5.5	5.0	5.0	5.5	5.0	5.0	5.5		
Vehicle Extension (s)	2.0	4.5	2.0	2.0	4.5	2.0	2.0	4.5	2.0	2.0	4.5		
Lane Grp Cap (vph)	318	1140	1174	548	1243	694	983	1727	1253	666	2131		
v/s Ratio Prot	0.04	0.17	0.11	c0.08	0.15	c0.19	0.16	c0.31	0.03	0.16	0.20		
v/s Ratio Perm			0.12			0.23			0.10				
v/c Ratio	0.46	0.77	0.56	0.71	0.60	0.96	0.83	0.90	0.28	0.83	0.60		
Uniform Delay, d1	70.0	59.2	35.6	70.0	54.5	44.2	62.7	51.2	28.2	63.0	44.9		
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		
Incremental Delay, d2	0.4	3.7	0.3	3.6	1.1	23.8	5.8	7.3	0.0	7.9	0.6		
Delay (s)	70.3	62.9	35.9	73.6	55.6	68.0	68.5	58.5	28.3	70.8	45.6		
Level of Service	E	E	D	E	E	E	E	E	C	E	D		
Approach Delay (s)		52.7			64.1			57.3			53.1		
Approach LOS		D			E			E			D		
Intersection Summary													
HCM 2000 Control Delay			56.9									HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio			0.93										
Actuated Cycle Length (s)			162.8									Sum of lost time (s)	21.5
Intersection Capacity Utilization			92.4%									ICU Level of Service	F
Analysis Period (min)			15										

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
3: Dougherty Rd & I-580 WB Ramps



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↔↔		↔↔		↑↑↑			↑↑↑	↔
Traffic Volume (vph)	0	0	0	302	0	596	0	1957	0	0	1206	0
Future Volume (vph)	0	0	0	302	0	596	0	1957	0	0	1206	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0		4.0		4.0			4.0	
Lane Util. Factor				0.97		0.88		0.91			0.86	
Frt				1.00		0.85		1.00			1.00	
Flt Protected				0.95		1.00		1.00			1.00	
Satd. Flow (prot)				3433		2787		5085			4806	
Flt Permitted				0.95		1.00		1.00			1.00	
Satd. Flow (perm)				3433		2787		5085			4806	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	328	0	648	0	2127	0	0	1311	0
RTOR Reduction (vph)	0	0	0	0	0	32	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	328	0	616	0	2127	0	0	1311	0
Turn Type				Prot		Prot		NA			NA	Perm
Protected Phases				4		4		2			6	
Permitted Phases												6
Actuated Green, G (s)				14.4		14.4		34.8			34.8	
Effective Green, g (s)				15.8		15.8		36.2			36.2	
Actuated g/C Ratio				0.26		0.26		0.60			0.60	
Clearance Time (s)				5.4		5.4		5.4			5.4	
Vehicle Extension (s)				3.0		3.0		3.0			3.0	
Lane Grp Cap (vph)				904		733		3067			2899	
v/s Ratio Prot				0.10		c0.22		c0.42			0.27	
v/s Ratio Perm												
v/c Ratio				0.36		0.84		0.69			0.45	
Uniform Delay, d1				18.0		20.9		8.1			6.5	
Progression Factor				1.00		1.00		1.19			1.00	
Incremental Delay, d2				0.2		8.4		0.5			0.5	
Delay (s)				18.2		29.3		10.1			7.0	
Level of Service				B		C		B			A	
Approach Delay (s)		0.0			25.6			10.1			7.0	
Approach LOS		A			C			B			A	

Intersection Summary		
HCM 2000 Control Delay	12.6	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.74	B
Actuated Cycle Length (s)	60.0	Sum of lost time (s)
Intersection Capacity Utilization	65.3%	8.0
Analysis Period (min)	15	ICU Level of Service
		C

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 4: Hopyard Rd/Dougherty Rd & I-580 EB Ramps



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔↔		↔↔					↑↑↑	↔		↑↑↑	↔
Traffic Volume (vph)	949	0	691	0	0	0	0	2160	0	0	1081	0
Future Volume (vph)	949	0	691	0	0	0	0	2160	0	0	1081	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0					4.0			4.0	
Lane Util. Factor	0.97		0.88					0.91			0.86	
Frt	1.00		0.85					1.00			1.00	
Flt Protected	0.95		1.00					1.00			1.00	
Satd. Flow (prot)	3433		2787					5085			4806	
Flt Permitted	0.95		1.00					1.00			1.00	
Satd. Flow (perm)	3433		2787					5085			4806	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	1032	0	751	0	0	0	0	2348	0	0	1175	0
RTOR Reduction (vph)	0	0	29	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	1032	0	722	0	0	0	0	2348	0	0	1175	0
Turn Type	Prot		Prot					NA	Free		NA	Perm
Protected Phases	4		4					2			6	
Permitted Phases									Free			6
Actuated Green, G (s)	23.3		23.3					25.9			25.9	
Effective Green, g (s)	24.7		24.7					27.3			27.3	
Actuated g/C Ratio	0.41		0.41					0.46			0.46	
Clearance Time (s)	5.4		5.4					5.4			5.4	
Vehicle Extension (s)	3.0		3.0					3.0			3.0	
Lane Grp Cap (vph)	1413		1147					2313			2186	
v/s Ratio Prot	c0.30		0.26					c0.46			0.24	
v/s Ratio Perm												
v/c Ratio	0.73		0.63					1.02			0.54	
Uniform Delay, d1	14.8		14.0					16.4			11.8	
Progression Factor	1.00		1.00					1.44			0.82	
Incremental Delay, d2	2.0		1.1					22.1			0.9	
Delay (s)	16.8		15.1					45.6			10.5	
Level of Service	B		B					D			B	
Approach Delay (s)		16.1			0.0			45.6			10.5	
Approach LOS		B			A			D			B	

Intersection Summary

HCM 2000 Control Delay	27.9	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.88		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	75.5%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
5: Hopyard Rd & Owens Rd

BART to Livermore Extension Project
2013 Existing PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	169	136	595	632	163	129	168	954	71	445	906	468
Future Volume (vph)	169	136	595	632	163	129	168	954	71	445	906	468
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	2.7	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	0.91	0.91		1.00	0.95	0.95	1.00	0.91	1.00	0.97	0.91	
Frt	1.00	0.89		1.00	0.97	0.85	1.00	1.00	0.85	1.00	0.95	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1610	3001		1770	1718	1504	1770	5085	1583	3433	4825	
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1610	3001		1770	1718	1504	1770	5085	1583	3433	4825	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	184	148	647	687	177	140	183	1037	77	484	985	509
RTOR Reduction (vph)	0	165	0	0	7	66	0	0	53	0	78	0
Lane Group Flow (vph)	101	713	0	687	213	31	183	1037	24	484	1416	0
Turn Type	Split	NA		Split	NA	pm+ov	Prot	NA	Perm	Prot	NA	
Protected Phases	8	8		4	4	1	5	2		1	6	
Permitted Phases						4			2			
Actuated Green, G (s)	28.7	28.7		13.4	13.4	35.7	12.0	35.3	35.3	22.3	45.6	
Effective Green, g (s)	30.0	30.0		14.7	14.7	38.3	12.0	37.0	37.0	22.3	47.3	
Actuated g/C Ratio	0.25	0.25		0.12	0.12	0.32	0.10	0.31	0.31	0.19	0.39	
Clearance Time (s)	5.3	5.3		5.3	5.3	4.0	4.0	5.7	5.7	4.0	5.7	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	402	750		216	210	480	177	1567	488	637	1901	
v/s Ratio Prot	0.06	c0.24		c0.39	0.12	0.01	c0.10	0.20		c0.14	c0.29	
v/s Ratio Perm						0.01			0.01			
v/c Ratio	0.25	1.20dr		3.18	1.01	0.06	1.03	0.66	0.05	0.76	0.74	
Uniform Delay, d1	36.0	44.3		52.6	52.6	28.4	54.0	36.1	29.1	46.3	31.2	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	0.98	1.05	
Incremental Delay, d2	0.3	21.6		993.3	65.8	0.1	76.8	2.2	0.2	4.4	2.3	
Delay (s)	36.3	65.8		1045.9	118.5	28.5	130.8	38.3	29.3	49.6	34.9	
Level of Service	D	E		F	F	C	F	D	C	D	C	
Approach Delay (s)		62.8			744.4			50.8			38.5	
Approach LOS		E			F			D			D	

Intersection Summary



































HCM 2000 Control Delay	180.9	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.19		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	104.2%	ICU Level of Service	G
Analysis Period (min)	15		

dr Defacto Right Lane. Recode with 1 though lane as a right lane.

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
6: Hopyard Rd & Stoneridge Dr

BART to Livermore Extension Project
2013 Existing PM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 	  		 	  		  	 		  		
Traffic Volume (vph)	194	1129	641	178	1238	162	614	732	65	260	755	169
Future Volume (vph)	194	1129	641	178	1238	162	614	732	65	260	755	169
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.91	1.00	0.97	0.91	1.00	0.94	0.95	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5085	1583	3433	5085	1583	4990	3539	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5085	1583	3433	5085	1583	4990	3539	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	211	1227	697	193	1346	176	667	796	71	283	821	184
RTOR Reduction (vph)	0	0	216	0	0	129	0	0	51	0	0	121
Lane Group Flow (vph)	211	1227	481	193	1346	47	667	796	20	283	821	63
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8			2			6
Actuated Green, G (s)	4.0	16.0	16.0	4.0	16.0	16.0	8.0	16.5	16.5	7.0	15.5	15.5
Effective Green, g (s)	4.0	16.0	16.0	4.0	16.0	16.0	8.0	16.5	16.5	7.0	15.5	15.5
Actuated g/C Ratio	0.07	0.27	0.27	0.07	0.27	0.27	0.13	0.28	0.28	0.12	0.26	0.26
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	230	1367	425	230	1367	425	670	981	438	403	1324	412
v/s Ratio Prot	c0.06	0.24		0.06	0.26		c0.13	c0.22		0.08	0.16	
v/s Ratio Perm			c0.30			0.03			0.01			0.04
v/c Ratio	0.92	0.90	1.13	0.84	0.98	0.11	1.00	0.81	0.04	0.70	0.62	0.15
Uniform Delay, d1	27.6	21.0	21.8	27.4	21.6	16.4	25.7	20.0	15.7	25.2	19.4	16.9
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	37.2	8.1	84.4	22.6	20.6	0.1	33.4	5.2	0.0	5.5	0.9	0.2
Delay (s)	64.8	29.0	106.2	50.1	42.2	16.5	59.2	25.2	15.8	30.7	20.3	17.1
Level of Service	E	C	F	D	D	B	E	C	B	C	C	B
Approach Delay (s)		57.8			40.4			39.5			22.1	
Approach LOS		E			D			D			C	

Intersection Summary

HCM 2000 Control Delay	42.2	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.99		
Actuated Cycle Length (s)	59.5	Sum of lost time (s)	16.0
Intersection Capacity Utilization	70.4%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
7: Hopyard Rd & Las Positas Blvd

BART to Livermore Extension Project
2013 Existing PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↕	↖	↖↗	↕	↖	↖↗	↕	↖	↖↗	↕	↖
Traffic Volume (vph)	93	220	446	497	321	137	391	783	261	67	1375	75
Future Volume (vph)	93	220	446	497	321	137	391	783	261	67	1375	75
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.95	1.00	0.97	0.95	1.00	0.97	0.91	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	3433	3539	1583	3433	5085	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	3433	3539	1583	3433	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	101	239	485	540	349	149	425	851	284	73	1495	82
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	54
Lane Group Flow (vph)	101	239	485	540	349	149	425	851	284	73	1495	28
Turn Type	Prot	NA	Free	Prot	NA	Free	Prot	NA	Free	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			Free			Free			Free			6
Actuated Green, G (s)	4.0	10.1	60.8	8.0	14.1	60.8	6.0	24.3	60.8	2.4	20.7	20.7
Effective Green, g (s)	4.0	10.1	60.8	8.0	14.1	60.8	6.0	24.3	60.8	2.4	20.7	20.7
Actuated g/C Ratio	0.07	0.17	1.00	0.13	0.23	1.00	0.10	0.40	1.00	0.04	0.34	0.34
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	225	587	1583	451	820	1583	338	2032	1583	135	1731	538
v/s Ratio Prot	0.03	0.07		c0.16	c0.10		c0.12	0.17		0.02	c0.29	
v/s Ratio Perm			c0.31			0.09			0.18			0.02
v/c Ratio	0.45	0.41	0.31	1.20	0.43	0.09	1.26	0.42	0.18	0.54	0.86	0.05
Uniform Delay, d1	27.3	22.7	0.0	26.4	19.9	0.0	27.4	13.2	0.0	28.7	18.7	13.5
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.4	0.5	0.5	108.6	0.4	0.1	137.7	0.1	0.2	4.4	4.7	0.0
Delay (s)	28.8	23.1	0.5	135.0	20.3	0.1	165.1	13.3	0.2	33.0	23.5	13.5
Level of Service	C	C	A	F	C	A	F	B	A	C	C	B
Approach Delay (s)		10.5			77.1			52.3			23.4	
Approach LOS		B			E			D			C	

Intersection Summary

HCM 2000 Control Delay	41.2	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.83		
Actuated Cycle Length (s)	60.8	Sum of lost time (s)	16.0
Intersection Capacity Utilization	71.3%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
8: Willow Rd & Owens Rd

BART to Livermore Extension Project
2013 Existing PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	75	507	108	128	503	46	144	61	0	160	88	75
Future Volume (vph)	75	507	108	128	503	46	144	61	0	160	88	75
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	5.3	4.0		5.3	4.0	4.0
Lane Util. Factor	0.97	0.91		0.97	0.91	1.00	1.00	0.95		1.00	1.00	1.00
Frt	1.00	0.97		1.00	1.00	0.85	1.00	1.00		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	4952		3433	5085	1583	1770	3539		1770	1863	1583
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.69	1.00		0.71	1.00	1.00
Satd. Flow (perm)	3433	4952		3433	5085	1583	1294	3539		1326	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	82	551	117	139	547	50	157	66	0	174	96	82
RTOR Reduction (vph)	0	40	0	0	0	31	0	0	0	0	0	59
Lane Group Flow (vph)	82	628	0	139	547	19	157	66	0	174	96	23
Turn Type	Prot	NA		Prot	NA	Perm	Perm	NA	Perm	Perm	NA	Perm
Protected Phases	1	6		5	2			4				8
Permitted Phases						2	4		4	8		8
Actuated Green, G (s)	3.9	14.8		5.9	16.8	16.8	12.2	12.2		12.2	12.2	12.2
Effective Green, g (s)	3.9	16.5		5.9	18.5	18.5	12.2	13.5		12.2	13.5	13.5
Actuated g/C Ratio	0.08	0.34		0.12	0.39	0.39	0.25	0.28		0.25	0.28	0.28
Clearance Time (s)	4.0	5.7		4.0	5.7	5.7	5.3	5.3		5.3	5.3	5.3
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	279	1705		422	1963	611	329	997		337	525	446
v/s Ratio Prot	0.02	c0.13		c0.04	0.11			0.02			0.05	
v/s Ratio Perm						0.01	0.12			c0.13		0.01
v/c Ratio	0.29	0.37		0.33	0.28	0.03	0.48	0.07		0.52	0.18	0.05
Uniform Delay, d1	20.7	11.8		19.2	10.1	9.1	15.1	12.6		15.3	13.0	12.5
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	0.6	0.1		0.5	0.1	0.0	1.1	0.0		1.3	0.2	0.0
Delay (s)	21.3	11.9		19.7	10.2	9.2	16.2	12.6		16.7	13.2	12.6
Level of Service	C	B		B	B	A	B	B		B	B	B
Approach Delay (s)		12.9			11.9			15.2			14.8	
Approach LOS		B			B			B			B	






































Intersection Summary

HCM 2000 Control Delay	13.1	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.39		
Actuated Cycle Length (s)	47.9	Sum of lost time (s)	12.0
Intersection Capacity Utilization	41.4%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
9: Hacienda Dr & Dublin Blvd

BART to Livermore Extension Project
2013 Existing PM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 	  	 	 	  		  	 	 	 	  	
Traffic Volume (vph)	91	925	166	178	507	20	185	518	418	81	565	88
Future Volume (vph)	91	925	166	178	507	20	185	518	418	81	565	88
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	6.0	5.0	4.5	6.0		5.0	6.0	6.0	4.5	5.5	5.5
Lane Util. Factor	0.97	0.91	0.88	0.97	0.91		0.94	0.95	0.88	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5085	2787	3433	5056		4990	3539	2787	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5085	2787	3433	5056		4990	3539	2787	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	99	1005	180	193	551	22	201	563	454	88	614	96
RTOR Reduction (vph)	0	0	86	0	3	0	0	0	327	0	0	71
Lane Group Flow (vph)	99	1005	94	193	570	0	201	563	127	88	614	25
Turn Type	Prot	NA	pm+ov	Prot	NA		Prot	NA	Perm	Prot	NA	Perm
Protected Phases	5	2	3	1	6		3	8		7	NA	4
Permitted Phases			2						8			4
Actuated Green, G (s)	7.8	29.8	38.9	11.1	33.1		9.1	26.9	26.9	7.5	25.3	25.3
Effective Green, g (s)	7.8	29.8	38.9	11.1	33.1		9.1	26.9	26.9	7.5	25.3	25.3
Actuated g/C Ratio	0.08	0.31	0.40	0.12	0.34		0.09	0.28	0.28	0.08	0.26	0.26
Clearance Time (s)	4.5	6.0	5.0	4.5	6.0		5.0	6.0	6.0	4.5	5.5	5.5
Vehicle Extension (s)	2.0	3.5	2.0	2.0	3.5		2.0	3.5	3.5	2.0	3.5	3.5
Lane Grp Cap (vph)	278	1573	1125	395	1737		471	988	778	267	1335	415
v/s Ratio Prot	0.03	c0.20	0.01	c0.06	c0.11		c0.04	c0.16		0.03	0.12	
v/s Ratio Perm			0.03						0.05			0.02
v/c Ratio	0.36	0.64	0.08	0.49	0.33		0.43	0.57	0.16	0.33	0.46	0.06
Uniform Delay, d1	41.9	28.6	17.7	39.9	23.4		41.1	29.7	26.2	42.0	29.8	26.6
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.3	0.9	0.0	0.3	0.1		0.2	0.8	0.1	0.3	0.3	0.1
Delay (s)	42.2	29.5	17.7	40.3	23.5		41.4	30.6	26.3	42.3	30.1	26.7
Level of Service	D	C	B	D	C		D	C	C	D	C	C
Approach Delay (s)		28.8			27.7			30.8			31.0	
Approach LOS		C			C			C			C	

Intersection Summary

HCM 2000 Control Delay	29.6	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.57		
Actuated Cycle Length (s)	96.3	Sum of lost time (s)	21.0
Intersection Capacity Utilization	59.7%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 10: Hacienda Dr & Martinelli Blvd/Hacienda Crossings



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗	↖↗	↖↗	↗		↖↗↘	↖↗↘	↖	↖↗	↖↗↘	
Traffic Volume (vph)	38	22	338	274	53	22	341	1091	479	76	856	36
Future Volume (vph)	38	22	338	274	53	22	341	1091	479	76	856	36
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	3.0	3.0	4.5	3.0		3.5	3.0	3.0	4.0	3.5	
Lane Util. Factor	1.00	0.91	0.91	0.97	1.00		0.94	0.91	1.00	0.97	0.86	
Frt	1.00	0.91	0.85	1.00	0.96		1.00	1.00	0.85	1.00	0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1770	1541	2882	3433	1781		4990	5085	1583	3433	6369	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1770	1541	2882	3433	1781		4990	5085	1583	3433	6369	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	41	24	367	298	58	24	371	1186	521	83	930	39
RTOR Reduction (vph)	0	30	266	0	10	0	0	0	224	0	3	0
Lane Group Flow (vph)	41	31	64	298	72	0	371	1186	297	83	966	0
Turn Type	Prot	NA	Perm	Prot	NA		Prot	NA	pm+ov	Prot	NA	
Protected Phases	5	2		1	6		3	8	1	7	4	
Permitted Phases			2						8			
Actuated Green, G (s)	4.9	14.4	14.4	12.4	22.4		12.2	31.6	44.0	6.3	25.7	
Effective Green, g (s)	5.4	16.4	16.4	12.9	24.4		13.2	33.6	48.0	6.8	27.2	
Actuated g/C Ratio	0.06	0.19	0.19	0.15	0.29		0.16	0.40	0.57	0.08	0.32	
Clearance Time (s)	4.5	5.0	5.0	5.0	5.0		4.5	5.0	5.0	4.5	5.0	
Vehicle Extension (s)	3.0	4.0	4.0	2.0	4.0		3.0	4.0	2.0	3.0	4.0	
Lane Grp Cap (vph)	113	300	561	525	516		782	2029	958	277	2057	
v/s Ratio Prot	0.02	0.02		c0.09	c0.04		c0.07	c0.23	0.05	0.02	0.15	
v/s Ratio Perm			0.02						0.13			
v/c Ratio	0.36	0.10	0.11	0.57	0.14		0.47	0.58	0.31	0.30	0.47	
Uniform Delay, d1	37.8	27.9	27.9	33.1	22.1		32.3	19.8	9.5	36.5	22.7	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	2.0	0.2	0.1	0.8	0.2		0.5	0.5	0.1	0.6	0.2	
Delay (s)	39.7	28.1	28.0	33.9	22.3		32.8	20.3	9.5	37.1	23.0	
Level of Service	D	C	C	C	C		C	C	A	D	C	
Approach Delay (s)		29.2			31.4			19.9			24.1	
Approach LOS		C			C			B			C	

Intersection Summary

HCM 2000 Control Delay	23.1	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.49		
Actuated Cycle Length (s)	84.2	Sum of lost time (s)	14.5
Intersection Capacity Utilization	54.7%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 11: Hacienda Dr & I-580 WB Ramps



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↔		↔		↑↑↑			↑↑↑	↔
Traffic Volume (vph)	0	0	0	351	0	247	0	1404	682	0	700	691
Future Volume (vph)	0	0	0	351	0	247	0	1404	682	0	700	691
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0		4.0		4.0			4.0	4.0
Lane Util. Factor				0.97		0.88		0.91			0.86	0.86
Frt				1.00		0.85		0.95			0.95	0.85
Flt Protected				0.95		1.00		1.00			1.00	1.00
Satd. Flow (prot)				3433		2787		4836			4567	1362
Flt Permitted				0.95		1.00		1.00			1.00	1.00
Satd. Flow (perm)				3433		2787		4836			4567	1362
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	382	0	268	0	1526	741	0	761	751
RTOR Reduction (vph)	0	0	0	0	0	38	0	114	0	0	116	146
Lane Group Flow (vph)	0	0	0	382	0	230	0	2153	0	0	1021	229
Turn Type				Prot		Prot		NA			NA	Perm
Protected Phases				4		4		2			6	
Permitted Phases												6
Actuated Green, G (s)				11.6		11.6		31.1			31.1	31.1
Effective Green, g (s)				13.0		13.0		33.0			33.0	33.0
Actuated g/C Ratio				0.24		0.24		0.61			0.61	0.61
Clearance Time (s)				5.4		5.4		5.9			5.9	5.9
Vehicle Extension (s)				3.0		3.0		3.0			3.0	3.0
Lane Grp Cap (vph)				826		670		2955			2790	832
v/s Ratio Prot				c0.11		0.08		c0.45			0.22	
v/s Ratio Perm												0.17
v/c Ratio				0.46		0.34		0.73			0.37	0.28
Uniform Delay, d1				17.5		17.0		7.4			5.3	4.9
Progression Factor				1.00		1.00		1.00			1.00	1.00
Incremental Delay, d2				0.4		0.3		0.9			0.1	0.2
Delay (s)				17.9		17.3		8.3			5.3	5.1
Level of Service				B		B		A			A	A
Approach Delay (s)		0.0			17.7			8.3			5.3	
Approach LOS		A			B			A			A	

Intersection Summary		
HCM 2000 Control Delay	8.6	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.65	A
Actuated Cycle Length (s)	54.0	Sum of lost time (s)
Intersection Capacity Utilization	59.1%	8.0
Analysis Period (min)	15	ICU Level of Service
		B

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
12: Hacienda Dr & I-580 EB Ramps

BART to Livermore Extension Project
2013 Existing PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔↔		↔↔					↔↔↔	↔		↔↔↔	
Traffic Volume (vph)	899	0	408	0	0	0	0	1324	582	0	632	313
Future Volume (vph)	899	0	408	0	0	0	0	1324	582	0	632	313
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0					4.0	4.0		4.0	
Lane Util. Factor	0.97		0.88					0.86	0.86		0.91	
Frt	1.00		0.85					0.98	0.85		0.95	
Flt Protected	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (prot)	3433		2787					4719	1362		4833	
Flt Permitted	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (perm)	3433		2787					4719	1362		4833	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	977	0	443	0	0	0	0	1439	633	0	687	340
RTOR Reduction (vph)	0	0	307	0	0	0	0	29	190	0	147	0
Lane Group Flow (vph)	977	0	136	0	0	0	0	1606	247	0	880	0
Turn Type	Prot		Prot					NA	Perm		NA	
Protected Phases	4		4					2			6	
Permitted Phases									2			
Actuated Green, G (s)	14.8		14.8					29.7	29.7		29.7	
Effective Green, g (s)	16.2		16.2					31.6	31.6		31.6	
Actuated g/C Ratio	0.29		0.29					0.57	0.57		0.57	
Clearance Time (s)	5.4		5.4					5.9	5.9		5.9	
Vehicle Extension (s)	2.0		2.0					2.0	2.0		2.0	
Lane Grp Cap (vph)	996		809					2672	771		2736	
v/s Ratio Prot	c0.28		0.05					c0.34			0.18	
v/s Ratio Perm									0.18			
v/c Ratio	0.98		0.17					0.60	0.32		0.32	
Uniform Delay, d1	19.6		14.8					8.0	6.4		6.4	
Progression Factor	1.00		1.00					1.00	1.00		1.00	
Incremental Delay, d2	23.8		0.0					0.3	0.1		0.0	
Delay (s)	43.4		14.8					8.2	6.5		6.4	
Level of Service	D		B					A	A		A	
Approach Delay (s)		34.5			0.0			7.9			6.4	
Approach LOS		C			A			A			A	

























Intersection Summary

HCM 2000 Control Delay	15.9	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.73		
Actuated Cycle Length (s)	55.8	Sum of lost time (s)	8.0
Intersection Capacity Utilization	62.2%	ICU Level of Service	B
Analysis Period (min)	15		
























c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
13: Hacienda Dr & Owens Rd

BART to Livermore Extension Project
2013 Existing PM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	688	736	60	169	273	469	18	747	177	497	340	188
Future Volume (vph)	688	736	60	169	273	469	18	747	177	497	340	188
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	2.3	4.0	4.0	2.3	4.0	4.0	2.7	4.0	4.0	2.7
Lane Util. Factor	0.97	0.91	1.00	0.97	0.91	1.00	0.97	0.91	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5085	1583	3433	5085	1583	3433	5085	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5085	1583	3433	5085	1583	3433	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	748	800	65	184	297	510	20	812	192	540	370	204
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	748	800	65	184	297	510	20	812	192	540	370	204
Turn Type	Prot	NA	Free	Prot	NA	Free	Prot	NA	Free	Prot	NA	Free
Protected Phases	1	6		5	2		7	4		3	8	
Permitted Phases			Free			Free			Free			Free
Actuated Green, G (s)	38.4	55.0	146.0	13.2	29.8	146.0	4.1	31.6	146.0	27.2	54.7	146.0
Effective Green, g (s)	38.4	56.7	146.0	13.2	31.5	146.0	4.1	32.9	146.0	27.2	56.0	146.0
Actuated g/C Ratio	0.26	0.39	1.00	0.09	0.22	1.00	0.03	0.23	1.00	0.19	0.38	1.00
Clearance Time (s)	4.0	5.7		4.0	5.7		4.0	5.3		4.0	5.3	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	902	1974	1583	310	1097	1583	96	1145	1583	639	1950	1583
v/s Ratio Prot	c0.22	c0.16		0.05	0.06		0.01	c0.16		c0.16	0.07	
v/s Ratio Perm			0.04			0.32			0.12			0.13
v/c Ratio	0.83	0.41	0.04	0.59	0.27	0.32	0.21	0.71	0.12	0.85	0.19	0.13
Uniform Delay, d1	50.7	32.4	0.0	63.8	47.7	0.0	69.4	52.1	0.0	57.4	29.9	0.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	6.4	0.6	0.0	3.0	0.6	0.5	1.1	2.0	0.2	10.0	0.0	0.2
Delay (s)	57.1	33.0	0.0	66.9	48.3	0.5	70.4	54.2	0.2	67.4	30.0	0.2
Level of Service	E	C	A	E	D	A	E	D	A	E	C	A
Approach Delay (s)		42.9			27.2			44.4			42.6	
Approach LOS		D			C			D			D	
Intersection Summary												
HCM 2000 Control Delay			39.9				HCM 2000 Level of Service				D	
HCM 2000 Volume to Capacity ratio			0.71									
Actuated Cycle Length (s)			146.0				Sum of lost time (s)			16.0		
Intersection Capacity Utilization			67.4%				ICU Level of Service			C		
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis
 14: Tassajara Rd & Dublin Blvd

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	290	686	489	231	216	25	390	817	416	75	701	158
Future Volume (vph)	290	686	489	231	216	25	390	817	416	75	701	158
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	6.0	6.0	5.0	6.0		5.0	6.0	6.0	5.0	6.0	6.0
Lane Util. Factor	0.97	0.95	0.88	0.94	0.95		0.94	0.95	1.00	0.97	0.86	0.88
Frt	1.00	1.00	0.85	1.00	0.98		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	2787	4990	3485		4990	3539	1583	3433	6408	2787
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	2787	4990	3485		4990	3539	1583	3433	6408	2787
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	315	746	532	251	235	27	424	888	452	82	762	172
RTOR Reduction (vph)	0	0	265	0	4	0	0	0	179	0	0	118
Lane Group Flow (vph)	315	746	267	251	258	0	424	888	273	82	762	54
Turn Type	Prot	NA	Perm	Prot	NA		Prot	NA	Perm	Prot	NA	Perm
Protected Phases	5	2		1	6		3	8		7		4
Permitted Phases			2						8			4
Actuated Green, G (s)	19.5	44.0	44.0	16.2	40.7		18.6	49.9	49.9	15.2	46.5	46.5
Effective Green, g (s)	19.5	44.0	44.0	16.2	40.7		18.6	49.9	49.9	15.2	46.5	46.5
Actuated g/C Ratio	0.13	0.30	0.30	0.11	0.28		0.13	0.34	0.34	0.10	0.32	0.32
Clearance Time (s)	5.0	6.0	6.0	5.0	6.0		5.0	6.0	6.0	5.0	6.0	6.0
Vehicle Extension (s)	2.0	3.0	3.0	2.0	3.0		2.0	4.0	4.0	2.0	4.0	4.0
Lane Grp Cap (vph)	454	1057	832	548	962		630	1198	536	354	2022	879
v/s Ratio Prot	c0.09	c0.21		0.05	0.07		c0.08	c0.25		0.02	0.12	
v/s Ratio Perm			0.10						0.17			0.02
v/c Ratio	0.69	0.71	0.32	0.46	0.27		0.67	0.74	0.51	0.23	0.38	0.06
Uniform Delay, d1	61.0	45.9	40.1	61.4	41.7		61.4	43.0	38.9	60.7	39.1	35.2
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	3.7	2.2	0.2	0.2	0.2		2.2	2.7	1.1	0.1	0.2	0.0
Delay (s)	64.7	48.1	40.3	61.7	41.8		63.7	45.7	40.0	60.8	39.3	35.2
Level of Service	E	D	D	E	D		E	D	D	E	D	D
Approach Delay (s)		48.8			51.5			48.6			40.4	
Approach LOS		D			D			D			D	
Intersection Summary												
HCM 2000 Control Delay			47.2				HCM 2000 Level of Service			D		
HCM 2000 Volume to Capacity ratio			0.74									
Actuated Cycle Length (s)			147.3				Sum of lost time (s)		22.0			
Intersection Capacity Utilization			85.7%				ICU Level of Service		E			
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis
 15: Tassajara Rd & I-580 WB Ramps



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↔↔		↔↔		↑↑	↔		↑↑↔	↔
Traffic Volume (vph)	0	0	0	440	0	218	0	1255	565	0	1159	614
Future Volume (vph)	0	0	0	440	0	218	0	1255	565	0	1159	614
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0		4.0		4.0	4.0		4.0	4.0
Lane Util. Factor				0.97		0.88		0.95	1.00		0.86	0.86
Frt				1.00		0.85		1.00	0.85		0.98	0.85
Flt Protected				0.95		1.00		1.00	1.00		1.00	1.00
Satd. Flow (prot)				3433		2787		3539	1583		4693	1362
Flt Permitted				0.95		1.00		1.00	1.00		1.00	1.00
Satd. Flow (perm)				3433		2787		3539	1583		4693	1362
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	478	0	237	0	1364	614	0	1260	667
RTOR Reduction (vph)	0	0	0	0	0	83	0	0	202	0	31	143
Lane Group Flow (vph)	0	0	0	478	0	155	0	1364	412	0	1462	291
Turn Type				Perm		Perm		NA	Perm		NA	Perm
Protected Phases								2			6	
Permitted Phases				8		8			2			6
Actuated Green, G (s)				15.0		15.0		47.0	47.0		47.0	47.0
Effective Green, g (s)				15.0		15.0		47.0	47.0		47.0	47.0
Actuated g/C Ratio				0.21		0.21		0.67	0.67		0.67	0.67
Clearance Time (s)				4.0		4.0		4.0	4.0		4.0	4.0
Vehicle Extension (s)				3.0		3.0		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)				735		597		2376	1062		3151	914
v/s Ratio Prot								c0.39			0.31	
v/s Ratio Perm				c0.14		0.06			0.26			0.21
v/c Ratio				0.65		0.26		0.57	0.39		0.46	0.32
Uniform Delay, d1				25.1		22.9		6.1	5.1		5.5	4.8
Progression Factor				1.00		1.00		1.00	1.00		1.00	1.00
Incremental Delay, d2				2.1		0.2		1.0	1.1		0.5	0.9
Delay (s)				27.2		23.1		7.2	6.2		6.0	5.7
Level of Service				C		C		A	A		A	A
Approach Delay (s)		0.0			25.8			6.9			5.9	
Approach LOS		A			C			A			A	

Intersection Summary			
HCM 2000 Control Delay	9.4	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.59		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	53.9%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 16: Santa Rita Rd & I-580 EB Ramps/Pimilco Dr



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	490	197	3	308	0	150	0	1081	109	275	890	0
Future Volume (vph)	490	197	3	308	0	150	0	1081	109	275	890	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0		4.0		4.0		4.0	4.0	
Lane Util. Factor	0.97	1.00	1.00	0.97		0.88		0.86		1.00	0.95	
Frt	1.00	1.00	0.85	1.00		0.85		0.99		1.00	1.00	
Flt Protected	0.95	1.00	1.00	0.95		1.00		1.00		0.95	1.00	
Satd. Flow (prot)	3433	1863	1583	3433		2787		6320		1770	3539	
Flt Permitted	0.95	1.00	1.00	0.95		1.00		1.00		0.95	1.00	
Satd. Flow (perm)	3433	1863	1583	3433		2787		6320		1770	3539	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	533	214	3	335	0	163	0	1175	118	299	967	0
RTOR Reduction (vph)	0	0	2	0	0	54	0	23	0	0	0	0
Lane Group Flow (vph)	533	214	1	335	0	109	0	1270	0	299	967	0
Turn Type	Perm	NA	Perm	Prot		pm+ov		NA		Prot	NA	Perm
Protected Phases		4		3		1		2		1	6	
Permitted Phases	4		4			3						6
Actuated Green, G (s)	15.0	15.0	15.0	8.0		21.8		17.2		13.8	35.0	
Effective Green, g (s)	15.0	15.0	15.0	8.0		21.8		17.2		13.8	35.0	
Actuated g/C Ratio	0.21	0.21	0.21	0.11		0.31		0.25		0.20	0.50	
Clearance Time (s)	4.0	4.0	4.0	4.0		4.0		4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0		3.0		3.0		3.0	3.0	
Lane Grp Cap (vph)	735	399	339	392		867		1552		348	1769	
v/s Ratio Prot		0.11		c0.10		0.02		c0.20		c0.17	0.27	
v/s Ratio Perm	c0.16		0.00			0.01						
v/c Ratio	0.73	0.54	0.00	0.85		0.13		0.82		0.86	0.55	
Uniform Delay, d1	25.6	24.4	21.6	30.4		17.3		24.9		27.2	12.0	
Progression Factor	1.00	1.00	1.00	1.00		1.00		1.00		1.00	1.00	
Incremental Delay, d2	3.6	1.4	0.0	16.4		0.1		4.9		18.6	1.2	
Delay (s)	29.1	25.8	21.6	46.8		17.3		29.9		45.7	13.3	
Level of Service	C	C	C	D		B		C		D	B	
Approach Delay (s)		28.2			37.2			29.9			20.9	
Approach LOS		C			D			C			C	

Intersection Summary		
HCM 2000 Control Delay	27.5	HCM 2000 Level of Service C
HCM 2000 Volume to Capacity ratio	0.81	
Actuated Cycle Length (s)	70.0	Sum of lost time (s) 16.0
Intersection Capacity Utilization	65.2%	ICU Level of Service C
Analysis Period (min)	15	

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 17: Santa Rita Rd & Valley Ave

BART to Livermore Extension Project
 2013 Existing PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	312	526	89	134	327	636	99	692	123	855	925	244
Future Volume (vph)	312	526	89	134	327	636	99	692	123	855	925	244
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.97	0.95		0.97	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.98		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	3433	3459		3433	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	3433	3459		3433	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	339	572	97	146	355	691	108	752	134	929	1005	265
RTOR Reduction (vph)	0	0	76	0	0	0	0	20	0	0	0	149
Lane Group Flow (vph)	339	572	21	146	355	691	108	866	0	929	1005	116
Turn Type	Prot	NA	Perm	Prot	NA	Free	Prot	NA		Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			Free						6
Actuated Green, G (s)	5.0	15.0	15.0	5.0	15.0	69.9	3.2	17.9		16.0	30.7	30.7
Effective Green, g (s)	5.0	15.0	15.0	5.0	15.0	69.9	3.2	17.9		16.0	30.7	30.7
Actuated g/C Ratio	0.07	0.21	0.21	0.07	0.21	1.00	0.05	0.26		0.23	0.44	0.44
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	245	759	339	126	759	1583	157	885		785	1554	695
v/s Ratio Prot	c0.10	c0.16		0.08	0.10		0.03	c0.25		c0.27	0.28	
v/s Ratio Perm			0.01			0.44						0.07
v/c Ratio	1.38	0.75	0.06	1.16	0.47	0.44	0.69	0.98		1.18	0.65	0.17
Uniform Delay, d1	32.5	25.7	21.8	32.5	24.0	0.0	32.9	25.8		27.0	15.4	11.9
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	196.0	4.3	0.1	129.1	0.5	0.9	11.8	24.7		95.4	0.9	0.1
Delay (s)	228.4	30.0	21.9	161.6	24.4	0.9	44.7	50.6		122.3	16.3	12.0
Level of Service	F	C	C	F	C	A	D	D		F	B	B
Approach Delay (s)		95.9			27.6			49.9			60.6	
Approach LOS		F			C			D			E	

Intersection Summary		
HCM 2000 Control Delay	57.9	HCM 2000 Level of Service E
HCM 2000 Volume to Capacity ratio	1.01	
Actuated Cycle Length (s)	69.9	Sum of lost time (s) 16.0
Intersection Capacity Utilization	82.7%	ICU Level of Service E
Analysis Period (min)	15	

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
18: Bernal Ave/Valley Ave & Stanley Blvd



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	174	870	47	147	236	295	46	367	274	818	508	131
Future Volume (vph)	174	870	47	147	236	295	46	367	274	818	508	131
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.95	1.00	0.97	0.91	0.91	1.00	0.95	1.00	0.97	0.95	0.95
Frt	1.00	1.00	0.85	1.00	0.95	0.85	1.00	1.00	0.85	1.00	0.97	0.97
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	3433	3210	1441	1770	3539	1583	3433	3431	3431
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	3433	3210	1441	1770	3539	1583	3433	3431	3431
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	189	946	51	160	257	321	50	399	298	889	552	142
RTOR Reduction (vph)	0	0	33	0	72	37	0	0	129	0	25	0
Lane Group Flow (vph)	189	946	18	160	326	143	50	399	169	889	669	0
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	NA
Protected Phases	7	4	5	3	8	1	5	2		1	6	
Permitted Phases			4			8			2			
Actuated Green, G (s)	8.6	25.6	30.3	5.0	22.0	46.6	4.7	16.3	16.3	24.6	36.2	
Effective Green, g (s)	8.6	25.6	30.3	5.0	22.0	46.6	4.7	16.3	16.3	24.6	36.2	
Actuated g/C Ratio	0.10	0.29	0.35	0.06	0.25	0.53	0.05	0.19	0.19	0.28	0.41	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	337	1035	620	196	807	833	95	659	294	965	1419	
v/s Ratio Prot	0.06	c0.27	0.00	c0.05	0.10	0.05	0.03	c0.11		c0.26	0.19	
v/s Ratio Perm			0.01			0.05			0.11			
v/c Ratio	0.56	0.91	0.03	0.82	0.40	0.17	0.53	0.61	0.58	0.92	0.47	
Uniform Delay, d1	37.6	29.9	18.9	40.8	27.3	10.5	40.3	32.7	32.5	30.5	18.7	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	2.1	12.1	0.0	22.4	0.3	0.1	5.2	1.6	2.7	13.7	0.2	
Delay (s)	39.8	42.0	18.9	63.2	27.6	10.6	45.5	34.2	35.2	44.2	18.9	
Level of Service	D	D	B	E	C	B	D	C	D	D	B	
Approach Delay (s)		40.6			31.2			35.4			33.1	
Approach LOS		D			C			D			C	

Intersection Summary

HCM 2000 Control Delay	35.3	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.84		
Actuated Cycle Length (s)	87.5	Sum of lost time (s)	16.0
Intersection Capacity Utilization	75.1%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
19: Fallon Rd & Dublin Blvd/Croak Rd

BART to Livermore Extension Project
2013 Existing PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	167	0	399	0	0	0	127	696	0	0	535	73
Future Volume (vph)	167	0	399	0	0	0	127	696	0	0	535	73
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.3		5.3				5.3	4.9			4.9	4.9
Lane Util. Factor	1.00		0.88				1.00	0.95			0.95	1.00
Frt	1.00		0.85				1.00	1.00			1.00	0.85
Flt Protected	0.95		1.00				0.95	1.00			1.00	1.00
Satd. Flow (prot)	1770		2787				1770	3539			3539	1583
Flt Permitted	0.95		1.00				0.95	1.00			1.00	1.00
Satd. Flow (perm)	1770		2787				1770	3539			3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	182	0	434	0	0	0	138	757	0	0	582	79
RTOR Reduction (vph)	0	0	260	0	0	0	0	0	0	0	0	53
Lane Group Flow (vph)	182	0	174	0	0	0	138	757	0	0	582	26
Turn Type	Prot		pm+ov	Prot			Prot	NA		Prot	NA	Perm
Protected Phases	5	2	3	1	6		3	8		7	4	
Permitted Phases			2									4
Actuated Green, G (s)	13.4		23.0				9.6	33.8			18.9	18.9
Effective Green, g (s)	13.4		23.0				9.6	33.8			18.9	18.9
Actuated g/C Ratio	0.23		0.40				0.17	0.59			0.33	0.33
Clearance Time (s)	5.3		5.3				5.3	4.9			4.9	4.9
Vehicle Extension (s)	2.0		2.0				2.0	4.0			4.0	4.0
Lane Grp Cap (vph)	413		1374				296	2083			1165	521
v/s Ratio Prot	c0.10		0.02				0.08	c0.21			c0.16	
v/s Ratio Perm			0.04									0.02
v/c Ratio	0.44		0.13				0.47	0.36			0.50	0.05
Uniform Delay, d1	18.8		10.9				21.6	6.2			15.5	13.1
Progression Factor	1.00		1.00				1.00	1.00			1.00	1.00
Incremental Delay, d2	0.3		0.0				0.4	0.1			0.5	0.1
Delay (s)	19.1		10.9				22.0	6.3			15.9	13.2
Level of Service	B		B				C	A			B	B
Approach Delay (s)		13.3			0.0			8.7			15.6	
Approach LOS		B			A			A			B	

Intersection Summary

HCM 2000 Control Delay	12.1	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.52		
Actuated Cycle Length (s)	57.4	Sum of lost time (s)	19.5
Intersection Capacity Utilization	45.5%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
20: El Charro Rd/Fallon Rd & I-580 WB Ramps

BART to Livermore Extension Project
2013 Existing PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↙	↖	↗		↖	↗		↖↖	↗
Traffic Volume (vph)	0	0	0	142	0	425	0	639	245	0	834	344
Future Volume (vph)	0	0	0	142	0	425	0	639	245	0	834	344
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0	4.0	4.0		4.0	4.0		4.0	4.0
Lane Util. Factor				0.95	0.95	0.88		0.95	0.95		0.95	1.00
Frt				1.00	1.00	0.85		0.99	0.85		1.00	0.85
Flt Protected				0.95	0.95	1.00		1.00	1.00		1.00	1.00
Satd. Flow (prot)				1681	1681	2787		1760	1504		3539	1583
Flt Permitted				0.95	0.95	1.00		1.00	1.00		1.00	1.00
Satd. Flow (perm)				1681	1681	2787		1760	1504		3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	154	0	462	0	695	266	0	907	374
RTOR Reduction (vph)	0	0	0	0	0	279	0	2	112	0	0	176
Lane Group Flow (vph)	0	0	0	79	75	183	0	720	127	0	907	198
Turn Type				Perm	NA	Perm		NA	Perm		NA	Perm
Protected Phases					8			2			6	
Permitted Phases				8		8			2			6
Actuated Green, G (s)				10.7	10.7	10.7		20.5	20.5		20.5	20.5
Effective Green, g (s)				10.2	10.2	10.2		20.5	20.5		20.5	20.5
Actuated g/C Ratio				0.26	0.26	0.26		0.53	0.53		0.53	0.53
Clearance Time (s)				3.5	3.5	3.5		4.0	4.0		4.0	4.0
Vehicle Extension (s)				2.0	2.0	2.0		2.0	2.0		2.0	2.0
Lane Grp Cap (vph)				443	443	734		932	796		1874	838
v/s Ratio Prot								c0.41			0.26	
v/s Ratio Perm				0.05	0.04	c0.07			0.08			0.13
v/c Ratio				0.18	0.17	0.25		0.77	0.16		0.48	0.24
Uniform Delay, d1				11.0	11.0	11.2		7.2	4.7		5.8	4.9
Progression Factor				1.00	1.00	1.00		1.00	1.00		1.00	1.00
Incremental Delay, d2				0.1	0.1	0.1		3.7	0.0		0.1	0.1
Delay (s)				11.1	11.1	11.3		10.9	4.7		5.8	4.9
Level of Service				B	B	B		B	A		A	A
Approach Delay (s)		0.0			11.2			9.4			5.6	
Approach LOS		A			B			A			A	

Intersection Summary

HCM 2000 Control Delay	8.1	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.60		
Actuated Cycle Length (s)	38.7	Sum of lost time (s)	8.0
Intersection Capacity Utilization	60.1%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 21: El Charro Rd & I-580 EB Ramps



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔↔		↔↔					↕↕	↔		↕↕	↔
Traffic Volume (vph)	319	0	359	0	0	0	0	440	281	0	564	0
Future Volume (vph)	319	0	359	0	0	0	0	440	281	0	564	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0					4.0	4.0		4.0	
Lane Util. Factor	0.97		0.88					0.91	0.91		0.91	
Frt	1.00		0.85					0.99	0.85		1.00	
Flt Protected	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (prot)	3433		2787					3354	1441		3390	
Flt Permitted	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (perm)	3433		2787					3354	1441		3390	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	347	0	390	0	0	0	0	478	305	0	613	0
RTOR Reduction (vph)	0	0	284	0	0	0	0	9	152	0	0	0
Lane Group Flow (vph)	347	0	106	0	0	0	0	506	116	0	613	0
Turn Type	Prot		Perm					NA	Perm		NA	Perm
Protected Phases	4							2			6	
Permitted Phases			4						2			6
Actuated Green, G (s)	7.4		7.4					11.7	11.7		11.7	
Effective Green, g (s)	7.4		7.4					11.7	11.7		11.7	
Actuated g/C Ratio	0.27		0.27					0.43	0.43		0.43	
Clearance Time (s)	4.0		4.0					4.0	4.0		4.0	
Vehicle Extension (s)	2.0		2.0					3.0	3.0		3.0	
Lane Grp Cap (vph)	937		761					1448	622		1463	
v/s Ratio Prot	c0.10							0.15			c0.18	
v/s Ratio Perm			0.04						0.08			
v/c Ratio	0.37		0.14					0.35	0.19		0.42	
Uniform Delay, d1	8.0		7.4					5.2	4.8		5.3	
Progression Factor	1.00		1.00					1.00	1.00		1.00	
Incremental Delay, d2	0.1		0.0					0.1	0.1		0.2	
Delay (s)	8.1		7.5					5.3	4.9		5.5	
Level of Service	A		A					A	A		A	
Approach Delay (s)		7.7			0.0			5.2			5.5	
Approach LOS		A			A			A			A	

Intersection Summary

HCM 2000 Control Delay	6.2	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.40		
Actuated Cycle Length (s)	27.1	Sum of lost time (s)	8.0
Intersection Capacity Utilization	34.8%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 22: El Charro Rd & Stoneridge Dr/Jack London Blvd

BART to Livermore Extension Project
 2013 Existing PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔↔↔	↑↑	↗	↖	↑	↗↗	↖	↑↑		↗↗↗	↑	↗
Traffic Volume (vph)	256	453	2	1	113	418	1	17	8	738	12	147
Future Volume (vph)	256	453	2	1	113	418	1	17	8	738	12	147
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	0.94	0.95	1.00	1.00	1.00	0.88	1.00	0.95		0.94	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.95		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	4491	3185	1425	1593	1676	2508	1593	3026		4491	1676	1425
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	4491	3185	1425	1593	1676	2508	1593	3026		4491	1676	1425
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	278	492	2	1	123	454	1	18	9	802	13	160
RTOR Reduction (vph)	0	0	1	0	0	280	0	7	0	0	0	104
Lane Group Flow (vph)	278	492	1	1	123	174	1	20	0	802	13	56
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Prot	NA		Prot	NA	Perm
Protected Phases	7	4		3	8	1	5	2		1		6
Permitted Phases			4			8						6
Actuated Green, G (s)	6.0	15.6	15.6	0.7	10.3	19.5	0.7	9.3		9.2	17.8	17.8
Effective Green, g (s)	6.0	15.6	15.6	0.7	10.3	19.5	0.7	9.3		9.2	17.8	17.8
Actuated g/C Ratio	0.12	0.31	0.31	0.01	0.20	0.38	0.01	0.18		0.18	0.35	0.35
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	530	978	437	21	339	1160	21	553		813	587	499
v/s Ratio Prot	c0.06	c0.15		0.00	0.07	0.03	0.00	0.01		c0.18	0.01	
v/s Ratio Perm			0.00			0.04						c0.04
v/c Ratio	0.52	0.50	0.00	0.05	0.36	0.15	0.05	0.04		0.99	0.02	0.11
Uniform Delay, d1	21.1	14.4	12.2	24.7	17.4	10.2	24.7	17.1		20.7	10.8	11.2
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	0.9	0.4	0.0	0.9	0.7	0.1	0.9	0.0		28.0	0.0	0.1
Delay (s)	22.0	14.8	12.2	25.7	18.1	10.3	25.7	17.1		48.7	10.8	11.3
Level of Service	C	B	B	C	B	B	C	B		D	B	B
Approach Delay (s)		17.4			12.0			17.4			42.0	
Approach LOS		B			B			B			D	

Intersection Summary		
HCM 2000 Control Delay	26.3	HCM 2000 Level of Service C
HCM 2000 Volume to Capacity ratio	0.57	
Actuated Cycle Length (s)	50.8	Sum of lost time (s) 16.0
Intersection Capacity Utilization	42.8%	ICU Level of Service A
Analysis Period (min)	15	

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
24: Airway Blvd/Driveway & N Canyons Pkwy



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑	↑	↑↑	↑	↑		↑	↑↑		↑	
Traffic Volume (vph)	0	17	82	810	11	0	49	0	700	0	0	0
Future Volume (vph)	0	17	82	810	11	0	49	0	700	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0	4.0	4.0			4.0	4.0			
Lane Util. Factor		0.95	1.00	0.97	1.00			1.00	0.88			
Frt		1.00	0.85	1.00	1.00			1.00	0.85			
Flt Protected		1.00	1.00	0.95	1.00			0.95	1.00			
Satd. Flow (prot)		3539	1583	3433	1863			1770	2787			
Flt Permitted		1.00	1.00	0.95	1.00			0.95	1.00			
Satd. Flow (perm)		3539	1583	3433	1863			1770	2787			
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	18	89	880	12	0	53	0	761	0	0	0
RTOR Reduction (vph)	0	0	67	0	0	0	0	0	239	0	0	0
Lane Group Flow (vph)	0	18	22	880	12	0	0	53	522	0	0	0
Turn Type		NA	Perm	Prot	NA	Perm	Split	NA	pm+ov			
Protected Phases		2		1	6		8	8	1	4	4	
Permitted Phases			2			6			8			
Actuated Green, G (s)		34.0	34.0	88.2	128.2			8.6	96.8			
Effective Green, g (s)		36.0	36.0	90.2	130.2			8.8	100.8			
Actuated g/C Ratio		0.24	0.24	0.61	0.89			0.06	0.69			
Clearance Time (s)		6.0	6.0	6.0	6.0			4.2	6.0			
Vehicle Extension (s)		3.0	3.0	3.0	3.0			3.0	3.0			
Lane Grp Cap (vph)		866	387	2106	1650			105	1911			
v/s Ratio Prot		0.01		c0.26	0.01			c0.03	0.17			
v/s Ratio Perm			c0.01						0.02			
v/c Ratio		0.02	0.06	0.42	0.01			0.50	0.27			
Uniform Delay, d1		42.1	42.5	14.8	1.0			67.0	8.9			
Progression Factor		1.00	1.00	1.00	1.00			1.00	1.00			
Incremental Delay, d2		0.0	0.1	0.6	0.0			3.8	0.1			
Delay (s)		42.1	42.6	15.4	1.0			70.8	9.0			
Level of Service		D	D	B	A			E	A			
Approach Delay (s)		42.5			15.2			13.0			0.0	
Approach LOS		D			B			B			A	

Intersection Summary

HCM 2000 Control Delay	15.8	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.34		
Actuated Cycle Length (s)	147.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	39.8%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
25: Airway Blvd & I-580 WB Ramps



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↵	↵	↵↵		↕↕	↵		↕↕↕	
Traffic Volume (vph)	0	0	0	64	1	167	0	667	236	0	287	667
Future Volume (vph)	0	0	0	64	1	167	0	667	236	0	287	667
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0	4.0	4.0		4.0	4.0		4.0	
Lane Util. Factor				0.95	0.95	0.88		0.95	1.00		0.91	
Frt				1.00	1.00	0.85		1.00	0.85		0.90	
Flt Protected				0.95	0.95	1.00		1.00	1.00		1.00	
Satd. Flow (prot)				1681	1688	2787		3539	1583		4552	
Flt Permitted				0.95	0.95	1.00		1.00	1.00		1.00	
Satd. Flow (perm)				1681	1688	2787		3539	1583		4552	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	70	1	182	0	725	257	0	312	725
RTOR Reduction (vph)	0	0	0	0	0	164	0	0	60	0	170	0
Lane Group Flow (vph)	0	0	0	37	34	18	0	725	197	0	867	0
Turn Type				Split	NA	Perm		NA	Perm		NA	
Protected Phases				8	8			2			6	
Permitted Phases						8			2			
Actuated Green, G (s)				5.9	5.9	5.9		44.1	44.1		44.1	
Effective Green, g (s)				5.9	5.9	5.9		45.4	45.4		45.4	
Actuated g/C Ratio				0.10	0.10	0.10		0.77	0.77		0.77	
Clearance Time (s)				4.0	4.0	4.0		5.3	5.3		5.3	
Vehicle Extension (s)				2.0	2.0	2.0		4.0	4.0		4.0	
Lane Grp Cap (vph)				167	167	277		2709	1211		3485	
v/s Ratio Prot				c0.02	0.02			c0.20			0.19	
v/s Ratio Perm						0.01			0.12			
v/c Ratio				0.22	0.20	0.07		0.27	0.16		0.25	
Uniform Delay, d1				24.6	24.5	24.2		2.0	1.9		2.0	
Progression Factor				1.00	1.00	1.00		1.00	1.00		1.00	
Incremental Delay, d2				0.2	0.2	0.0		0.2	0.3		0.2	
Delay (s)				24.8	24.8	24.2		2.3	2.1		2.2	
Level of Service				C	C	C		A	A		A	
Approach Delay (s)		0.0			24.4			2.3			2.2	
Approach LOS		A			C			A			A	

Intersection Summary

HCM 2000 Control Delay	4.7	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.26		
Actuated Cycle Length (s)	59.3	Sum of lost time (s)	8.0
Intersection Capacity Utilization	30.9%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
26: Airway Blvd & I-580 EB Ramps/Kitty Hawk Rd



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↑	↖	↖	↑	↖	↖	↕↔		↖	↕↔	
Traffic Volume (vph)	535	219	349	14	86	182	37	199	126	122	115	106
Future Volume (vph)	535	219	349	14	86	182	37	199	126	122	115	106
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	3.6	3.6	3.6	4.0	4.0		4.0	4.0	
Lane Util. Factor	0.97	1.00	1.00	1.00	1.00	1.00	1.00	0.95		1.00	0.95	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.94		1.00	0.93	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	3433	1863	1583	1770	1863	1583	1770	3333		1770	3285	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	3433	1863	1583	1770	1863	1583	1770	3333		1770	3285	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	582	238	379	15	93	198	40	216	137	133	125	115
RTOR Reduction (vph)	0	0	294	0	0	154	0	73	0	0	58	0
Lane Group Flow (vph)	582	238	85	15	93	44	40	280	0	133	182	0
Turn Type	Split	NA	Perm	Split	NA	pm+ov	Prot	NA		Prot	NA	
Protected Phases	7	7		8	8	1	5	2		1	6	
Permitted Phases			7			8						
Actuated Green, G (s)	25.2	25.2	25.2	11.2	11.2	24.0	5.0	46.2		12.8	54.5	
Effective Green, g (s)	25.2	25.2	25.2	11.6	11.6	24.8	4.5	47.5		12.8	55.8	
Actuated g/C Ratio	0.22	0.22	0.22	0.10	0.10	0.22	0.04	0.42		0.11	0.50	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	3.5	5.3		4.0	5.3	
Vehicle Extension (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	3.5		2.0	4.0	
Lane Grp Cap (vph)	767	416	353	182	191	398	70	1404		201	1626	
v/s Ratio Prot	c0.17	0.13		0.01	c0.05	0.01	0.02	c0.08		c0.08	0.06	
v/s Ratio Perm			0.05			0.01						
v/c Ratio	0.76	0.57	0.24	0.08	0.49	0.11	0.57	0.20		0.66	0.11	
Uniform Delay, d1	40.9	39.0	35.9	45.7	47.7	35.1	53.2	20.6		47.9	15.2	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	3.9	1.2	0.1	0.1	0.7	0.0	6.8	0.3		6.2	0.1	
Delay (s)	44.8	40.1	36.0	45.8	48.5	35.2	60.0	20.9		54.1	15.3	
Level of Service	D	D	D	D	D	D	E	C		D	B	
Approach Delay (s)		41.1			39.7			24.9			29.2	
Approach LOS		D			D			C			C	

Intersection Summary

HCM 2000 Control Delay	36.1	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.44		
Actuated Cycle Length (s)	112.7	Sum of lost time (s)	15.6
Intersection Capacity Utilization	49.9%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
27: Collier Canyon Rd & N Canyons Pkwy/Portola Ave

BART to Livermore Extension Project
2013 Existing PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↕	↖	↖	↕	↖	↖	↕		↖	↕	↖
Traffic Volume (vph)	181	496	7	18	178	60	22	7	145	87	4	133
Future Volume (vph)	181	496	7	18	178	60	22	7	145	87	4	133
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.86		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	1770	1597		1770	1863	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	1770	1597		1770	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	197	539	8	20	193	65	24	8	158	95	4	145
RTOR Reduction (vph)	0	0	3	0	0	33	0	133	0	0	0	114
Lane Group Flow (vph)	197	539	5	20	193	32	24	33	0	95	4	31
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA		Prot	NA	Perm
Protected Phases	1	6		5	2		3	8		7	NA	4
Permitted Phases			6			2						4
Actuated Green, G (s)	11.3	58.8	58.8	3.2	50.7	50.7	3.3	15.8		8.9	21.8	21.8
Effective Green, g (s)	11.3	60.1	60.1	3.2	52.0	52.0	3.3	16.8		8.9	22.4	22.4
Actuated g/C Ratio	0.11	0.57	0.57	0.03	0.50	0.50	0.03	0.16		0.08	0.21	0.21
Clearance Time (s)	4.0	5.3	5.3	4.0	5.3	5.3	4.0	5.0		4.0	4.6	4.6
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	369	2025	906	53	1752	783	55	255		150	397	337
v/s Ratio Prot	c0.06	c0.15		0.01	0.05		0.01	c0.02		c0.05	0.00	
v/s Ratio Perm			0.00			0.02						0.02
v/c Ratio	0.53	0.27	0.01	0.38	0.11	0.04	0.44	0.13		0.63	0.01	0.09
Uniform Delay, d1	44.4	11.3	9.6	49.9	14.1	13.7	49.9	37.8		46.5	32.6	33.1
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	1.5	0.3	0.0	4.5	0.1	0.1	5.5	0.2		8.4	0.0	0.1
Delay (s)	45.8	11.6	9.6	54.4	14.3	13.8	55.4	38.1		54.9	32.6	33.3
Level of Service	D	B	A	D	B	B	E	D		D	C	C
Approach Delay (s)		20.7			17.0			40.3			41.7	
Approach LOS		C			B			D			D	

Intersection Summary

HCM 2000 Control Delay	26.1	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.32		
Actuated Cycle Length (s)	105.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	45.2%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
28: Isabel Ave/Campus Hill Dr & Portola Ave

BART to Livermore Extension Project
2013 Existing PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	6	307	442	176	125	88	182	267	103	97	194	6
Future Volume (vph)	6	307	442	176	125	88	182	267	103	97	194	6
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	0.88	0.94	0.95		0.97	0.95	1.00	1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	0.94		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	1863	2787	4990	3320		3433	3539	1583	1770	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	1863	2787	4990	3320		3433	3539	1583	1770	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	7	334	480	191	136	96	198	290	112	105	211	7
RTOR Reduction (vph)	0	0	320	0	54	0	0	0	86	0	0	6
Lane Group Flow (vph)	7	334	160	191	178	0	198	290	26	105	211	1
Turn Type	Prot	NA	Perm	Prot	NA		Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4						2			6
Actuated Green, G (s)	1.4	24.5	24.5	9.5	32.6		10.3	16.5	16.5	8.4	15.0	15.0
Effective Green, g (s)	1.4	25.8	25.8	9.5	33.9		10.3	17.8	17.8	8.4	15.9	15.9
Actuated g/C Ratio	0.02	0.33	0.33	0.12	0.44		0.13	0.23	0.23	0.11	0.21	0.21
Clearance Time (s)	4.0	5.3	5.3	4.0	5.3		4.0	5.3	5.3	4.0	4.9	4.9
Vehicle Extension (s)	2.0	3.0	3.0	2.0	3.0		2.0	3.0	3.0	2.0	3.0	3.0
Lane Grp Cap (vph)	31	620	927	611	1452		456	812	363	191	726	324
v/s Ratio Prot	0.00	c0.18		c0.04	0.05		0.06	c0.08		c0.06	0.06	
v/s Ratio Perm			0.06						0.02			0.00
v/c Ratio	0.23	0.54	0.17	0.31	0.12		0.43	0.36	0.07	0.55	0.29	0.00
Uniform Delay, d1	37.5	21.0	18.3	31.0	13.0		30.9	25.0	23.4	32.8	26.0	24.5
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.3	0.9	0.1	0.1	0.0		0.2	0.3	0.1	1.7	0.2	0.0
Delay (s)	38.9	21.9	18.4	31.1	13.0		31.2	25.3	23.5	34.5	26.3	24.5
Level of Service	D	C	B	C	B		C	C	C	C	C	C
Approach Delay (s)		20.0			21.2			26.9			28.9	
Approach LOS		B			C			C			C	

Intersection Summary

HCM 2000 Control Delay	23.5	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.45		
Actuated Cycle Length (s)	77.5	Sum of lost time (s)	16.0
Intersection Capacity Utilization	54.5%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
29: Isabel Ave & I-580 WB Ramps

BART to Livermore Extension Project
2013 Existing PM

























Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↔↔		↗		↕↕	↗↗		↕↕	↗
Traffic Volume (vph)	0	0	0	680	0	159	0	364	0	0	494	264
Future Volume (vph)	0	0	0	680	0	159	0	364	0	0	494	264
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0		4.0		4.0			4.0	4.0
Lane Util. Factor				0.97		1.00		0.95			0.95	1.00
Frt				1.00		0.85		1.00			1.00	0.85
Flt Protected				0.95		1.00		1.00			1.00	1.00
Satd. Flow (prot)				3433		1583		3539			3539	1583
Flt Permitted				0.95		1.00		1.00			1.00	1.00
Satd. Flow (perm)				3433		1583		3539			3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	739	0	173	0	396	0	0	537	287
RTOR Reduction (vph)	0	0	0	0	0	112	0	0	0	0	0	163
Lane Group Flow (vph)	0	0	0	739	0	61	0	396	0	0	537	124
Turn Type				Prot		Prot		NA	Free		NA	Prot
Protected Phases				8		8		2			6	6
Permitted Phases									Free			
Actuated Green, G (s)				12.9		12.9		15.0			15.0	15.0
Effective Green, g (s)				12.9		12.9		15.8			15.8	15.8
Actuated g/C Ratio				0.35		0.35		0.43			0.43	0.43
Clearance Time (s)				4.0		4.0		4.8			4.8	4.8
Vehicle Extension (s)				2.0		2.0		4.0			4.0	4.0
Lane Grp Cap (vph)				1206		556		1523			1523	681
v/s Ratio Prot				c0.22		0.04		0.11			c0.15	0.08
v/s Ratio Perm												
v/c Ratio				0.61		0.11		0.26			0.35	0.18
Uniform Delay, d1				9.8		8.0		6.7			7.0	6.5
Progression Factor				1.00		1.00		1.00			1.00	1.00
Incremental Delay, d2				0.7		0.0		0.1			0.2	0.2
Delay (s)				10.5		8.1		6.8			7.2	6.6
Level of Service				B		A		A			A	A
Approach Delay (s)		0.0			10.0			6.8			7.0	
Approach LOS		A			B			A			A	

Intersection Summary

HCM 2000 Control Delay	8.3	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.47		
Actuated Cycle Length (s)	36.7	Sum of lost time (s)	8.0
Intersection Capacity Utilization	39.7%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
30: Isabel Ave & I-580 EB Ramps

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations	 		 					 			 		
Traffic Volume (vph)	182	0	344	0	0	0	0	697	618	0	885	262	
Future Volume (vph)	182	0	344	0	0	0	0	697	618	0	885	262	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)	4.0		4.0					4.0	4.0		4.0	4.0	
Lane Util. Factor	0.97		0.88					0.95	1.00		0.95	1.00	
Frt	1.00		0.85					1.00	0.85		1.00	0.85	
Flt Protected	0.95		1.00					1.00	1.00		1.00	1.00	
Satd. Flow (prot)	3433		2787					3539	1583		3539	1583	
Flt Permitted	0.95		1.00					1.00	1.00		1.00	1.00	
Satd. Flow (perm)	3433		2787					3539	1583		3539	1583	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	
Adj. Flow (vph)	198	0	374	0	0	0	0	758	672	0	962	285	
RTOR Reduction (vph)	0	0	93	0	0	0	0	0	0	0	0	0	
Lane Group Flow (vph)	198	0	281	0	0	0	0	758	672	0	962	285	
Turn Type	Prot		Perm					NA	Free		NA	Free	
Protected Phases	4							2			6		
Permitted Phases			4						Free			Free	
Actuated Green, G (s)	9.4		9.4					19.2	37.6		19.2	37.6	
Effective Green, g (s)	9.4		9.4					20.2	37.6		20.2	37.6	
Actuated g/C Ratio	0.25		0.25					0.54	1.00		0.54	1.00	
Clearance Time (s)	4.0		4.0					5.0			5.0		
Vehicle Extension (s)	2.0		2.0					4.0			4.0		
Lane Grp Cap (vph)	858		696					1901	1583		1901	1583	
v/s Ratio Prot	0.06							0.21			0.27		
v/s Ratio Perm			0.10						c0.42			0.18	
v/c Ratio	0.23		0.40					0.40	0.42		0.51	0.18	
Uniform Delay, d1	11.2		11.8					5.1	0.0		5.5	0.0	
Progression Factor	1.00		1.00					1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.1		0.1					0.2	0.8		0.3	0.2	
Delay (s)	11.3		11.9					5.3	0.8		5.8	0.2	
Level of Service	B		B					A	A		A	A	
Approach Delay (s)		11.7			0.0			3.2			4.5		
Approach LOS		B			A			A			A		
Intersection Summary													
HCM 2000 Control Delay			5.2									HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio			0.54										
Actuated Cycle Length (s)			37.6									Sum of lost time (s)	8.0
Intersection Capacity Utilization			43.2%									ICU Level of Service	A
Analysis Period (min)			15										
c Critical Lane Group													

HCM Signalized Intersection Capacity Analysis
31: Isabel Ave & Airway Blvd



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↘	↑	↗	↘	↑	↗	↘	↑↑↑	↗	↘↗	↑↑↑	↗
Traffic Volume (vph)	8	110	345	27	33	201	201	1023	69	265	1352	15
Future Volume (vph)	8	110	345	27	33	201	201	1023	69	265	1352	15
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.4	4.0	4.0	4.4	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.91	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	1863	1583	1770	1863	1583	1770	5085	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	1863	1583	1770	1863	1583	1770	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	9	120	375	29	36	218	218	1112	75	288	1470	16
RTOR Reduction (vph)	0	0	189	0	0	147	0	0	39	0	0	16
Lane Group Flow (vph)	9	120	186	29	36	71	218	1112	36	288	1470	0
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	NA
Protected Phases	7	4	5	3	8	1	5	2		1	6	
Permitted Phases			4			8			2			
Actuated Green, G (s)	1.2	13.0	29.7	4.3	16.1	29.0	16.7	43.7	43.7	12.9	39.9	0.0
Effective Green, g (s)	1.8	13.6	30.9	4.9	16.7	30.2	17.7	44.7	44.7	13.9	40.9	0.0
Actuated g/C Ratio	0.02	0.15	0.33	0.05	0.18	0.32	0.19	0.48	0.48	0.15	0.44	0.00
Clearance Time (s)	4.6	4.6	5.0	4.6	4.6	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	5.0	5.0	3.0	5.0	
Lane Grp Cap (vph)	34	272	525	93	334	513	336	2441	760	512	2233	0
v/s Ratio Prot	0.01	c0.06	0.07	c0.02	0.02	c0.02	c0.12	c0.22		0.08	c0.29	
v/s Ratio Perm			0.05			0.02			0.02			
v/c Ratio	0.26	0.44	0.35	0.31	0.11	0.14	0.65	0.46	0.05	0.56	0.66	0.00
Uniform Delay, d1	45.0	36.3	23.5	42.5	32.0	22.2	34.8	16.1	12.9	36.8	20.6	46.5
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	4.1	1.1	0.4	1.9	0.1	0.1	4.3	0.3	0.1	1.4	1.0	0.0
Delay (s)	49.1	37.4	24.0	44.4	32.1	22.4	39.1	16.4	12.9	38.2	21.5	46.5
Level of Service	D	D	C	D	C	C	D	B	B	D	C	D
Approach Delay (s)		27.6			25.9			19.7			24.5	
Approach LOS		C			C			B			C	

































Intersection Summary

HCM 2000 Control Delay	23.3	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.58		
Actuated Cycle Length (s)	93.1	Sum of lost time (s)	16.4
Intersection Capacity Utilization	61.2%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
32: Isabel Ave & Jack London Blvd

BART to Livermore Extension Project
2013 Existing PM

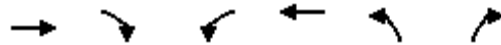
												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 	 		 			 	  		 	 	
Traffic Volume (vph)	154	647	253	119	129	300	45	874	134	377	1170	44
Future Volume (vph)	154	647	253	119	129	300	45	874	134	377	1170	44
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3
Lane Util. Factor	0.97	0.95	1.00	0.97	1.00	1.00	0.97	0.91	1.00	0.97	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	3433	1863	1583	3433	5085	1583	3433	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	3433	1863	1583	3433	5085	1583	3433	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	167	703	275	129	140	326	49	950	146	410	1272	48
RTOR Reduction (vph)	0	0	124	0	0	42	0	0	101	0	0	27
Lane Group Flow (vph)	167	703	151	129	140	284	49	950	45	410	1272	21
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8	1	5	2		1	NA	6
Permitted Phases			4			8			2			6
Actuated Green, G (s)	9.9	26.8	26.8	7.6	24.5	42.5	3.5	33.1	33.1	18.0	47.6	47.6
Effective Green, g (s)	9.9	26.8	26.8	7.6	24.5	42.5	3.5	33.1	33.1	18.0	47.6	47.6
Actuated g/C Ratio	0.09	0.25	0.25	0.07	0.23	0.40	0.03	0.31	0.31	0.17	0.45	0.45
Clearance Time (s)	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	318	888	397	244	427	709	112	1577	491	579	1578	706
v/s Ratio Prot	c0.05	c0.20		0.04	0.08	0.07	0.01	0.19		c0.12	c0.36	
v/s Ratio Perm			0.10			0.11			0.03			0.01
v/c Ratio	0.53	0.79	0.38	0.53	0.33	0.40	0.44	0.60	0.09	0.71	0.81	0.03
Uniform Delay, d1	46.2	37.3	33.1	47.8	34.2	23.0	50.6	31.2	26.1	41.9	25.6	16.6
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.6	4.9	0.6	2.1	0.5	0.4	2.7	0.7	0.1	4.0	3.1	0.0
Delay (s)	47.7	42.2	33.7	49.9	34.7	23.4	53.4	31.9	26.2	45.8	28.7	16.6
Level of Service	D	D	C	D	C	C	D	C	C	D	C	B
Approach Delay (s)		41.0			31.8			32.1			32.4	
Approach LOS		D			C			C			C	

Intersection Summary

HCM 2000 Control Delay	34.4	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.81		
Actuated Cycle Length (s)	106.7	Sum of lost time (s)	21.2
Intersection Capacity Utilization	74.6%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
33: Isabel Ave Connector & Stanley Blvd



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑	↑	↑↓	↑↑	↑↓	↑↓
Traffic Volume (vph)	1704	360	154	492	134	356
Future Volume (vph)	1704	360	154	492	134	356
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	2.5
Lane Util. Factor	0.95	1.00	0.97	0.95	0.97	0.88
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	3539	1583	3433	3539	3433	2787
Flt Permitted	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (perm)	3539	1583	3433	3539	3433	2787
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	1852	391	167	535	146	387
RTOR Reduction (vph)	0	136	0	0	0	1
Lane Group Flow (vph)	1852	255	167	535	146	386
Turn Type	NA	Perm	Prot	NA	Prot	pm+ov
Protected Phases	2		1	6	8	1
Permitted Phases		2				8
Actuated Green, G (s)	53.4	53.4	8.5	65.9	8.7	17.2
Effective Green, g (s)	55.1	55.1	8.5	67.6	10.2	20.2
Actuated g/C Ratio	0.64	0.64	0.10	0.79	0.12	0.24
Clearance Time (s)	5.7	5.7	4.0	5.7	5.5	4.0
Vehicle Extension (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Grp Cap (vph)	2272	1016	340	2788	408	656
v/s Ratio Prot	c0.52		0.05	0.15	0.04	c0.07
v/s Ratio Perm		0.16				0.07
v/c Ratio	0.82	0.25	0.49	0.19	0.36	0.59
Uniform Delay, d1	11.5	6.5	36.6	2.3	34.8	29.1
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	2.2	0.0	0.4	0.0	0.2	0.9
Delay (s)	13.8	6.6	37.0	2.3	35.0	30.0
Level of Service	B	A	D	A	C	C
Approach Delay (s)	12.5			10.5	31.4	
Approach LOS	B			B	C	

Intersection Summary

HCM 2000 Control Delay	15.0	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.77		
Actuated Cycle Length (s)	85.8	Sum of lost time (s)	12.0
Intersection Capacity Utilization	68.2%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 34: Murrieta Blvd/Driveway & Portola Ave

BART to Livermore Extension Project
 2013 Existing PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↗	↗↘		↗	↗↘		↗	↗	↗		↗↘	
Traffic Volume (vph)	2	884	107	242	441	2	125	2	305	7	1	3
Future Volume (vph)	2	884	107	242	441	2	125	2	305	7	1	3
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0		4.0	
Lane Util. Factor	1.00	0.95		1.00	0.95		0.95	0.95	1.00		1.00	
Frt	1.00	0.98		1.00	1.00		1.00	1.00	0.85		0.97	
Flt Protected	0.95	1.00		0.95	1.00		0.95	0.95	1.00		0.97	
Satd. Flow (prot)	1770	3482		1770	3537		1681	1688	1583		1742	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	0.95	1.00		0.97	
Satd. Flow (perm)	1770	3482		1770	3537		1681	1688	1583		1742	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	2	961	116	263	479	2	136	2	332	8	1	3
RTOR Reduction (vph)	0	4	0	0	0	0	0	0	305	0	3	0
Lane Group Flow (vph)	2	1073	0	263	481	0	71	67	27	0	9	0
Turn Type	Prot	NA		Prot	NA		Split	NA	Perm		Split	NA
Protected Phases	5	2		1	6		8	8		4	4	
Permitted Phases									8			
Actuated Green, G (s)	1.1	85.8		25.4	110.1		11.2	11.2	11.2		2.6	
Effective Green, g (s)	1.1	86.7		25.4	111.0		11.8	11.8	11.8		2.6	
Actuated g/C Ratio	0.01	0.61		0.18	0.78		0.08	0.08	0.08		0.02	
Clearance Time (s)	4.0	4.9		4.0	4.9		4.6	4.6	4.6		4.0	
Vehicle Extension (s)	2.0	2.0		2.0	2.0		2.0	2.0	2.0		2.0	
Lane Grp Cap (vph)	13	2118		315	2755		139	139	131		31	
v/s Ratio Prot	0.00	c0.31		c0.15	0.14		c0.04	0.04			c0.01	
v/s Ratio Perm									0.02			
v/c Ratio	0.15	0.51		0.83	0.17		0.51	0.48	0.21		0.29	
Uniform Delay, d1	70.2	15.8		56.5	4.0		62.6	62.4	61.0		69.0	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00		1.00	
Incremental Delay, d2	2.0	0.9		16.4	0.1		1.3	1.0	0.3		1.9	
Delay (s)	72.2	16.7		73.0	4.2		63.9	63.4	61.3		70.9	
Level of Service	E	B		E	A		E	E	E		E	
Approach Delay (s)		16.8			28.5			62.0			70.9	
Approach LOS		B			C			E			E	

Intersection Summary

HCM 2000 Control Delay	30.1	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.57		
Actuated Cycle Length (s)	142.5	Sum of lost time (s)	16.0
Intersection Capacity Utilization	60.1%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
35: Murrieta Blvd & Jack London Blvd

BART to Livermore Extension Project
2013 Existing PM



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	246	591	389	224	287	120
Future Volume (vph)	246	591	389	224	287	120
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00	1.00	0.95	0.91	
Frt	1.00	0.85	1.00	1.00	0.96	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1770	1583	1770	3539	4861	
Flt Permitted	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	1770	1583	1770	3539	4861	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	267	642	423	243	312	130
RTOR Reduction (vph)	0	469	0	0	106	0
Lane Group Flow (vph)	267	173	423	243	336	0
Turn Type	Prot	Perm	Prot	NA	NA	
Protected Phases	4		5	2	6	
Permitted Phases		4				
Actuated Green, G (s)	14.8	14.8	18.2	32.2	10.0	
Effective Green, g (s)	14.8	14.8	18.2	32.2	10.0	
Actuated g/C Ratio	0.27	0.27	0.33	0.59	0.18	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	476	425	585	2071	883	
v/s Ratio Prot	c0.15		c0.24	0.07	c0.07	
v/s Ratio Perm		0.11				
v/c Ratio	0.56	0.41	0.72	0.12	0.38	
Uniform Delay, d1	17.3	16.5	16.2	5.1	19.8	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	1.5	0.6	4.4	0.0	0.3	
Delay (s)	18.8	17.1	20.6	5.1	20.1	
Level of Service	B	B	C	A	C	
Approach Delay (s)	17.6			14.9	20.1	
Approach LOS	B			B	C	

Intersection Summary

HCM 2000 Control Delay	17.3	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.59		
Actuated Cycle Length (s)	55.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	53.4%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	268	1048	469	29	397	216	280	297	14	208	332	169
Future Volume (vph)	268	1048	469	29	397	216	280	297	14	208	332	169
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0			4.0	4.9
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	0.91	0.91			0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00			1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	0.99			0.98	1.00
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583	1610	3326			3472	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	0.99			0.98	1.00
Satd. Flow (perm)	1770	3539	1583	1770	3539	1583	1610	3326			3472	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	291	1139	510	32	432	235	304	323	15	226	361	184
RTOR Reduction (vph)	0	0	159	0	0	79	0	2	0	0	0	140
Lane Group Flow (vph)	291	1139	351	32	432	156	167	473	0	0	587	44
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Split	NA		Split	NA	Perm
Protected Phases	1	6		5	2	4	3	3		4	4	
Permitted Phases			6			2						4
Actuated Green, G (s)	25.2	44.2	44.2	4.8	23.8	52.6	23.8	23.8			28.8	28.8
Effective Green, g (s)	25.2	45.1	45.1	4.8	24.7	54.4	24.7	24.7			29.7	28.8
Actuated g/C Ratio	0.21	0.37	0.37	0.04	0.21	0.45	0.21	0.21			0.25	0.24
Clearance Time (s)	4.0	4.9	4.9	4.0	4.9	4.9	4.9	4.9			4.9	4.9
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0			3.0	3.0
Lane Grp Cap (vph)	370	1326	593	70	726	715	330	682			857	378
v/s Ratio Prot	c0.16	c0.32		0.02	0.12	0.05	0.10	c0.14			c0.17	
v/s Ratio Perm			0.22			0.04						0.03
v/c Ratio	0.79	0.86	0.59	0.46	0.60	0.22	0.51	0.69			0.68	0.12
Uniform Delay, d1	45.0	34.7	30.2	56.5	43.3	20.0	42.4	44.3			41.1	35.8
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00			1.00	1.00
Incremental Delay, d2	10.5	5.8	1.6	4.7	1.3	0.2	1.2	3.1			2.3	0.1
Delay (s)	55.5	40.4	31.8	61.2	44.6	20.2	43.6	47.4			43.3	35.9
Level of Service	E	D	C	E	D	C	D	D			D	D
Approach Delay (s)		40.4			37.1			46.4			41.6	
Approach LOS		D			D			D			D	

Intersection Summary

HCM 2000 Control Delay	41.0	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.78		
Actuated Cycle Length (s)	120.3	Sum of lost time (s)	16.0
Intersection Capacity Utilization	72.1%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
37: Livermore Ave & I-580 WB Ramps



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↖	↔		↖↗	↑			↕↔	
Traffic Volume (vph)	0	0	0	268	1	19	602	458	0	0	107	0
Future Volume (vph)	0	0	0	268	1	19	602	458	0	0	107	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)					4.0		4.0	4.0			4.0	
Lane Util. Factor					0.95		0.97	1.00			0.95	
Frt					0.99		1.00	1.00			1.00	
Flt Protected					0.96		0.95	1.00			1.00	
Satd. Flow (prot)					1674		3433	1863			3539	
Flt Permitted					0.96		0.95	1.00			1.00	
Satd. Flow (perm)					1674		3433	1863			3539	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	291	1	21	654	498	0	0	116	0
RTOR Reduction (vph)	0	0	0	0	4	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	0	309	0	654	498	0	0	116	0
Turn Type				Split	NA		Prot	NA			NA	
Protected Phases				8	8		5	2			6	
Permitted Phases												
Actuated Green, G (s)					15.7		15.1	31.6			13.0	
Effective Green, g (s)					15.7		14.6	33.3			14.7	
Actuated g/C Ratio					0.28		0.26	0.58			0.26	
Clearance Time (s)					4.0		3.5	5.7			5.7	
Vehicle Extension (s)					2.0		2.0	2.5			2.5	
Lane Grp Cap (vph)					461		879	1088			912	
v/s Ratio Prot					c0.18		c0.19	c0.27			0.03	
v/s Ratio Perm												
v/c Ratio					0.67		0.74	0.46			0.13	
Uniform Delay, d1					18.3		19.5	6.7			16.2	
Progression Factor					1.00		0.67	0.91			1.00	
Incremental Delay, d2					2.9		0.3	0.1			0.3	
Delay (s)					21.2		13.2	6.3			16.5	
Level of Service					C		B	A			B	
Approach Delay (s)		0.0			21.2			10.2			16.5	
Approach LOS		A			C			B			B	

Intersection Summary

HCM 2000 Control Delay	12.9	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.65		
Actuated Cycle Length (s)	57.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	91.8%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
38: Livermore Ave & I-580 EB Ramps



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕	↗					↕		↘	↕	
Traffic Volume (vph)	327	34	1159	0	0	0	0	721	255	10	370	0
Future Volume (vph)	327	34	1159	0	0	0	0	721	255	10	370	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0					4.0		4.0	4.0	
Lane Util. Factor		0.95	0.95					0.95		1.00	0.95	
Frt		0.91	0.85					0.96		1.00	1.00	
Flt Protected		0.98	1.00					1.00		0.95	1.00	
Satd. Flow (prot)		1580	1504					3401		1770	3539	
Flt Permitted		0.98	1.00					1.00		0.95	1.00	
Satd. Flow (perm)		1580	1504					3401		1770	3539	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	355	37	1260	0	0	0	0	784	277	11	402	0
RTOR Reduction (vph)	0	98	301	0	0	0	0	47	0	0	0	0
Lane Group Flow (vph)	0	911	342	0	0	0	0	1014	0	11	402	0
Turn Type	Prot	NA	Perm					NA		Prot	NA	
Protected Phases	7	4						2		1	6	
Permitted Phases			4									
Actuated Green, G (s)		17.5	17.5					26.3		1.2	30.5	
Effective Green, g (s)		17.5	17.5					27.3		0.2	31.5	
Actuated g/C Ratio		0.31	0.31					0.48		0.00	0.55	
Clearance Time (s)		4.0	4.0					5.0		3.0	5.0	
Vehicle Extension (s)		2.0	2.0					2.5		2.0	2.5	
Lane Grp Cap (vph)		485	461					1628		6	1955	
v/s Ratio Prot								c0.30		c0.01	0.11	
v/s Ratio Perm		0.58	0.23									
v/c Ratio		1.88	0.74					0.62		1.83	0.21	
Uniform Delay, d1		19.8	17.7					11.0		28.4	6.4	
Progression Factor		1.00	1.00					1.00		1.26	0.31	
Incremental Delay, d2		402.7	5.6					1.8		689.2	0.2	
Delay (s)		422.4	23.3					12.8		725.1	2.2	
Level of Service		F	C					B		F	A	
Approach Delay (s)		267.1			0.0			12.8			21.5	
Approach LOS		F			A			B			C	

Intersection Summary

HCM 2000 Control Delay	148.3	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.12		
Actuated Cycle Length (s)	57.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	91.8%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
39: Livermore Ave & Portola Ave

BART to Livermore Extension Project
2013 Existing PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	411	510	113	25	304	61	110	549	43	207	761	403
Future Volume (vph)	411	510	113	25	304	61	110	549	43	207	761	403
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	3.1
Lane Util. Factor	0.97	0.95		1.00	0.95		1.00	0.95		1.00	0.95	1.00
Frt	1.00	0.97		1.00	0.97		1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3443		1770	3451		1770	3500		1770	3539	1583
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3443		1770	3451		1770	3500		1770	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	447	554	123	27	330	66	120	597	47	225	827	438
RTOR Reduction (vph)	0	17	0	0	17	0	0	5	0	0	0	132
Lane Group Flow (vph)	447	660	0	27	379	0	120	639	0	225	827	306
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	pm+ov
Protected Phases	3	8		7	4		1	6		5	2	3
Permitted Phases												2
Actuated Green, G (s)	17.7	34.7		4.9	21.9		13.0	33.2		23.0	43.2	60.9
Effective Green, g (s)	17.7	36.0		4.9	23.2		13.0	34.1		23.0	44.1	62.7
Actuated g/C Ratio	0.16	0.32		0.04	0.20		0.11	0.30		0.20	0.39	0.55
Clearance Time (s)	4.0	5.3		4.0	5.3		4.0	4.9		4.0	4.9	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	533	1087		76	702		201	1046		357	1369	870
v/s Ratio Prot	c0.13	c0.19		0.02	0.11		0.07	0.18		c0.13	c0.23	0.06
v/s Ratio Perm												0.14
v/c Ratio	0.84	0.61		0.36	0.54		0.60	0.61		0.63	0.60	0.35
Uniform Delay, d1	46.8	33.0		53.0	40.6		48.0	34.3		41.6	28.0	14.3
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	11.1	1.0		2.8	0.9		4.7	2.7		3.6	2.0	0.2
Delay (s)	57.8	34.0		55.9	41.5		52.7	36.9		45.2	29.9	14.6
Level of Service	E	C		E	D		D	D		D	C	B
Approach Delay (s)		43.5			42.4			39.4			27.7	
Approach LOS		D			D			D			C	

Intersection Summary

HCM 2000 Control Delay	36.4	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.68		
Actuated Cycle Length (s)	114.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	63.4%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
40: First St/Springtown Blvd & I-580 WB Ramps



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations			↗↘			↗	↗↘	↑			↗↘	↗
Traffic Volume (vph)	0	0	267	0	0	0	373	1439	0	0	416	184
Future Volume (vph)	0	0	267	0	0	0	373	1439	0	0	416	184
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)			4.0				4.0	4.0			4.0	4.0
Lane Util. Factor			0.88				0.97	1.00			0.95	1.00
Frt			0.85				1.00	1.00			1.00	0.85
Flt Protected			1.00				0.95	1.00			1.00	1.00
Satd. Flow (prot)			2787				3433	1863			3539	1583
Flt Permitted			1.00				0.95	1.00			1.00	1.00
Satd. Flow (perm)			2787				3433	1863			3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	290	0	0	0	405	1564	0	0	452	200
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	89
Lane Group Flow (vph)	0	0	290	0	0	0	405	1564	0	0	452	111
Turn Type			Over			Free	Prot	NA			NA	Perm
Protected Phases			5				5	2			6	
Permitted Phases						Free						6
Actuated Green, G (s)			8.6				8.6	36.1			19.5	19.5
Effective Green, g (s)			8.1				8.1	36.1			20.0	20.0
Actuated g/C Ratio			0.22				0.22	1.00			0.55	0.55
Clearance Time (s)			3.5				3.5	4.0			4.5	4.5
Vehicle Extension (s)			2.0				2.0	0.2			4.0	4.0
Lane Grp Cap (vph)			625				770	1863			1960	877
v/s Ratio Prot			0.10				0.12	c0.84			0.13	
v/s Ratio Perm												0.07
v/c Ratio			0.46				0.53	0.84			0.23	0.13
Uniform Delay, d1			12.1				12.3	0.0			4.1	3.9
Progression Factor			1.00				1.00	1.00			1.00	1.00
Incremental Delay, d2			0.2				0.3	3.4			0.1	0.1
Delay (s)			12.3				12.6	3.4			4.2	3.9
Level of Service			B				B	A			A	A
Approach Delay (s)		12.3			0.0			5.3			4.1	
Approach LOS		B			A			A			A	

Intersection Summary

HCM 2000 Control Delay	5.7	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	1.08		
Actuated Cycle Length (s)	36.1	Sum of lost time (s)	8.0
Intersection Capacity Utilization	79.1%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
41: First St & I-580 EB Ramps



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕	↗↘					↕↕	↗	↘	↕↕	
Traffic Volume (vph)	559	68	569	0	0	0	0	1199	463	16	693	0
Future Volume (vph)	559	68	569	0	0	0	0	1199	463	16	693	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0					4.0	4.0	4.0	4.0	
Lane Util. Factor		1.00	0.88					0.95	1.00	1.00	0.95	
Frt		1.00	0.85					1.00	0.85	1.00	1.00	
Flt Protected		0.96	1.00					1.00	1.00	0.95	1.00	
Satd. Flow (prot)		1783	2787					3539	1583	1770	3539	
Flt Permitted		0.96	1.00					1.00	1.00	0.95	1.00	
Satd. Flow (perm)		1783	2787					3539	1583	1770	3539	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	608	74	618	0	0	0	0	1303	503	17	753	0
RTOR Reduction (vph)	0	0	229	0	0	0	0	0	281	0	0	0
Lane Group Flow (vph)	0	682	389	0	0	0	0	1303	222	17	753	0
Turn Type	Perm	NA	Perm					NA	Perm	Prot	NA	
Protected Phases		4						2		1	6	
Permitted Phases	4		4						2			
Actuated Green, G (s)		27.1	27.1					30.1	30.1	1.2	34.3	
Effective Green, g (s)		26.6	26.6					30.6	30.6	0.2	34.8	
Actuated g/C Ratio		0.38	0.38					0.44	0.44	0.00	0.50	
Clearance Time (s)		3.5	3.5					4.5	4.5	3.0	4.5	
Vehicle Extension (s)		2.5	2.5					4.0	4.0	2.0	4.0	
Lane Grp Cap (vph)		683	1068					1560	697	5	1774	
v/s Ratio Prot								c0.37		0.01	c0.21	
v/s Ratio Perm		0.38	0.14						0.14			
v/c Ratio		1.00	0.36					0.84	0.32	3.40	0.42	
Uniform Delay, d1		21.4	15.3					17.2	12.6	34.6	11.0	
Progression Factor		1.00	1.00					1.00	1.00	1.00	1.00	
Incremental Delay, d2		33.8	0.2					4.2	0.4	1457.8	0.2	
Delay (s)		55.2	15.5					21.4	13.0	1492.4	11.2	
Level of Service		E	B					C	B	F	B	
Approach Delay (s)		36.3			0.0			19.0			43.9	
Approach LOS		D			A			B			D	

Intersection Summary

HCM 2000 Control Delay	29.8	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.92		
Actuated Cycle Length (s)	69.4	Sum of lost time (s)	12.0
Intersection Capacity Utilization	76.5%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
42: 1st St & Mines Rd

BART to Livermore Extension Project
2013 Existing PM






















Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	59	267	40	412	128	327	39	1537	620	364	733	39
Future Volume (vph)	59	267	40	412	128	327	39	1537	620	364	733	39
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	0.97	1.00	1.00	1.00	0.91	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	1863	1583	3433	1863	1583	1770	5085	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	1863	1583	3433	1863	1583	1770	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	64	290	43	448	139	355	42	1671	674	396	797	42
RTOR Reduction (vph)	0	0	35	0	0	149	0	0	130	0	0	22
Lane Group Flow (vph)	64	290	8	448	139	206	42	1671	544	396	797	20
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8			2			6
Actuated Green, G (s)	4.8	16.5	16.5	12.0	23.7	23.7	3.6	36.6	36.6	11.0	44.0	44.0
Effective Green, g (s)	4.8	16.5	16.5	12.0	23.7	23.7	3.6	36.6	36.6	11.0	44.0	44.0
Actuated g/C Ratio	0.05	0.18	0.18	0.13	0.26	0.26	0.04	0.40	0.40	0.12	0.48	0.48
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	92	333	283	447	479	407	69	2020	629	410	2429	756
v/s Ratio Prot	0.04	c0.16		c0.13	0.07		0.02	0.33		c0.12	0.16	
v/s Ratio Perm			0.00			0.13			c0.34			0.01
v/c Ratio	0.70	0.87	0.03	1.00	0.29	0.51	0.61	0.83	0.86	0.97	0.33	0.03
Uniform Delay, d1	42.9	36.8	31.2	40.0	27.4	29.2	43.6	24.9	25.5	40.4	14.9	12.7
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	20.4	21.2	0.0	43.1	0.3	1.0	14.3	2.9	11.9	35.3	0.1	0.0
Delay (s)	63.3	57.9	31.2	83.2	27.8	30.2	57.8	27.8	37.3	75.6	15.0	12.7
Level of Service	E	E	C	F	C	C	E	C	D	E	B	B
Approach Delay (s)		55.9			55.0			31.1			34.3	
Approach LOS		E			E			C			C	

Intersection Summary




















HCM 2000 Control Delay	38.4	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.90		
Actuated Cycle Length (s)	92.1	Sum of lost time (s)	16.0
Intersection Capacity Utilization	79.2%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Unsignalized Intersection Capacity Analysis
43: Vasco Rd & I-580 WB Ramps

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations								 				
Traffic Volume (veh/h)	0	0	0	0	0	88	0	1804	0	0	402	0
Future Volume (Veh/h)	0	0	0	0	0	88	0	1804	0	0	402	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	0	0	0	96	0	1961	0	0	437	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage (veh)												
Upstream signal (ft)											487	
pX, platoon unblocked												
vC, conflicting volume	1514	2398	437	2398	2398	980	437			1961		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1514	2398	437	2398	2398	980	437			1961		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	100	100	61	100			100		
cM capacity (veh/h)	51	33	567	17	33	249	1119			293		
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	SB 1	SB 2					
Volume Total	0	96	980	980	0	437	0					
Volume Left	0	0	0	0	0	0	0					
Volume Right	0	96	0	0	0	0	0					
cSH	1700	249	1700	1700	1700	1700	1700					
Volume to Capacity	0.00	0.39	0.58	0.58	0.00	0.26	0.00					
Queue Length 95th (ft)	0	43	0	0	0	0	0					
Control Delay (s)	0.0	28.3	0.0	0.0	0.0	0.0	0.0					
Lane LOS	A	D										
Approach Delay (s)	0.0	28.3	0.0			0.0						
Approach LOS	A	D										
Intersection Summary												
Average Delay			1.1									
Intersection Capacity Utilization			62.0%	ICU Level of Service	B							
Analysis Period (min)			15									

HCM Unsignalized Intersection Capacity Analysis
44: Vasco Rd & I-580 EB Ramps

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	0	0	0	0	1927	0	64	472	0
Future Volume (Veh/h)	0	0	0	0	0	0	0	1927	0	64	472	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	0	0	0	0	0	2095	0	70	513	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1700	2748	513	2748	2748	1048	513			2095		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1700	2748	513	2748	2748	1048	513			2095		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	100	100	100	100			73		
cM capacity (veh/h)	47	14	506	7	14	224	1049			260		
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2						
Volume Total	0	0	1397	698	70	513						
Volume Left	0	0	0	0	70	0						
Volume Right	0	0	0	0	0	0						
cSH	1700	1700	1700	1700	260	1700						
Volume to Capacity	0.00	0.00	0.82	0.41	0.27	0.30						
Queue Length 95th (ft)	0	0	0	0	26	0						
Control Delay (s)	0.0	0.0	0.0	0.0	23.9	0.0						
Lane LOS	A	A			C							
Approach Delay (s)	0.0	0.0	0.0		2.9							
Approach LOS	A	A										
Intersection Summary												
Average Delay			0.6									
Intersection Capacity Utilization			56.6%	ICU Level of Service	B							
Analysis Period (min)			15									

HCM Signalized Intersection Capacity Analysis
45: Vasco Rd & East Ave



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	409	26	86	142	302	177	63	370	4	12	314	270
Future Volume (vph)	409	26	86	142	302	177	63	370	4	12	314	270
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	0.95		0.97	1.00	1.00
Frt	1.00	0.88		1.00	0.94		1.00	1.00		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	3131		1770	3343		1770	3534		3433	1863	1583
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1770	3131		1770	3343		1770	3534		3433	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	445	28	93	154	328	192	68	402	4	13	341	293
RTOR Reduction (vph)	0	68	0	0	149	0	0	1	0	0	0	211
Lane Group Flow (vph)	445	53	0	154	371	0	68	405	0	13	341	82
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												6
Actuated Green, G (s)	8.4	14.4		6.1	12.1		2.1	16.4		0.7	15.0	15.0
Effective Green, g (s)	8.4	14.4		6.1	12.1		2.1	16.4		0.7	15.0	15.0
Actuated g/C Ratio	0.16	0.27		0.11	0.23		0.04	0.31		0.01	0.28	0.28
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	277	841		201	754		69	1081		44	521	443
v/s Ratio Prot	c0.25	0.02		0.09	c0.11		c0.04	0.11		0.00	c0.18	
v/s Ratio Perm												0.05
v/c Ratio	1.61	0.06		0.77	0.49		0.99	0.37		0.30	0.65	0.19
Uniform Delay, d1	22.6	14.6		23.1	18.1		25.7	14.6		26.2	17.0	14.7
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	289.2	0.0		15.9	0.5		102.6	0.2		3.7	3.0	0.2
Delay (s)	311.8	14.6		39.0	18.6		128.3	14.8		29.9	20.0	14.9
Level of Service	F	B		D	B		F	B		C	B	B
Approach Delay (s)		248.2			23.2			31.1			17.9	
Approach LOS		F			C			C			B	

Intersection Summary

HCM 2000 Control Delay	77.3	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	0.80		
Actuated Cycle Length (s)	53.6	Sum of lost time (s)	16.0
Intersection Capacity Utilization	70.0%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Unsignalized Intersection Capacity Analysis
 46: I-580 WB Ramps & Northfront Rd/Northfront Road



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	605	5	228	109	22	96
Future Volume (Veh/h)	605	5	228	109	22	96
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	658	5	248	118	24	104
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						3
Median type	None		None			
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume			658		1274	660
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			658		1274	660
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			73		82	78
cM capacity (veh/h)			930		135	463
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	663	366	128			
Volume Left	0	248	24			
Volume Right	5	0	104			
cSH	1700	930	569			
Volume to Capacity	0.39	0.27	0.22			
Queue Length 95th (ft)	0	27	21			
Control Delay (s)	0.0	7.9	19.2			
Lane LOS		A	C			
Approach Delay (s)	0.0	7.9	19.2			
Approach LOS			C			
Intersection Summary						
Average Delay			4.6			
Intersection Capacity Utilization			63.8%	ICU Level of Service		B
Analysis Period (min)			15			

Intersection	
Intersection Delay, s/veh	13.6
Intersection LOS	B

Movement	EBU	EBL	EBT	WBU	WBT	WBR	SBU	SBL	SBR
Lane Configurations		↘	↕↕		↕	↘		↘↘	↘
Traffic Vol, veh/h	0	286	255	0	82	269	0	188	8
Future Vol, veh/h	0	286	255	0	82	269	0	188	8
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	311	277	0	89	292	0	204	9
Number of Lanes	0	1	2	0	1	1	0	2	1

Approach	EB	WB	SB
Opposing Approach	WB	EB	
Opposing Lanes	2	3	0
Conflicting Approach Left	SB		WB
Conflicting Lanes Left	3	0	2
Conflicting Approach Right		SB	EB
Conflicting Lanes Right	0	3	3
HCM Control Delay	14.4	13.3	11.9
HCM LOS	B	B	B

Lane	EBLn1	EBLn2	EBLn3	WBLn1	WBLn2	SBLn1	SBLn2	SBLn3
Vol Left, %	100%	0%	0%	0%	0%	100%	100%	0%
Vol Thru, %	0%	100%	100%	100%	0%	0%	0%	0%
Vol Right, %	0%	0%	0%	0%	100%	0%	0%	100%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	286	128	128	82	269	94	94	8
LT Vol	286	0	0	0	0	94	94	0
Through Vol	0	128	128	82	0	0	0	0
RT Vol	0	0	0	0	269	0	0	8
Lane Flow Rate	311	139	139	89	292	102	102	9
Geometry Grp	8	8	8	8	8	7	7	7
Degree of Util (X)	0.584	0.241	0.174	0.164	0.481	0.209	0.209	0.011
Departure Headway (Hd)	6.766	6.261	4.508	6.636	5.928	7.361	7.361	4.396
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cap	532	572	791	539	605	486	486	809
Service Time	4.519	4.013	2.26	4.395	3.687	5.118	5.118	2.151
HCM Lane V/C Ratio	0.585	0.243	0.176	0.165	0.483	0.21	0.21	0.011
HCM Control Delay	18.6	11	8.2	10.7	14.1	12.1	12.1	7.2
HCM Lane LOS	C	B	A	B	B	B	B	A
HCM 95th-tile Q	3.7	0.9	0.6	0.6	2.6	0.8	0.8	0

HCM Unsignalized Intersection Capacity Analysis
 48: Greenville Rd & Northfront Road/Altamont Pass Road



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	→			←	←	→
Sign Control	Stop			Stop	Stop	
Traffic Volume (vph)	587	110	11	41	299	1028
Future Volume (vph)	587	110	11	41	299	1028
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	638	120	12	45	325	1117

Direction, Lane #	EB 1	WB 1	NB 1	NB 2
Volume Total (vph)	758	57	325	1117
Volume Left (vph)	0	12	325	0
Volume Right (vph)	120	0	0	1117
Hadj (s)	-0.06	0.08	0.23	-0.57
Departure Headway (s)	5.0	6.0	6.1	3.2
Degree Utilization, x	1.06	0.10	0.55	0.99
Capacity (veh/h)	713	568	582	1117
Control Delay (s)	71.8	9.7	16.4	42.4
Approach Delay (s)	71.8	9.7	36.6	
Approach LOS	F	A	E	

Intersection Summary			
Delay		47.7	
Level of Service		E	
Intersection Capacity Utilization	107.9%		ICU Level of Service G
Analysis Period (min)		15	



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	438	75	264	932	66	54
Future Volume (vph)	438	75	264	932	66	54
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.88	0.97	0.95	0.95	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	3433	2787	3433	3539	3539	1583
Flt Permitted	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (perm)	3433	2787	3433	3539	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	476	82	287	1013	72	59
RTOR Reduction (vph)	0	56	0	0	0	48
Lane Group Flow (vph)	476	26	287	1013	72	11
Turn Type	Prot	Perm	Prot	NA	NA	Perm
Protected Phases	8		1	6	2	
Permitted Phases		8				2
Actuated Green, G (s)	15.2	15.2	12.8	24.0	7.2	7.2
Effective Green, g (s)	15.8	15.8	12.8	25.7	8.9	8.9
Actuated g/C Ratio	0.32	0.32	0.26	0.52	0.18	0.18
Clearance Time (s)	4.6	4.6	4.0	5.7	5.7	5.7
Vehicle Extension (s)	5.0	5.0	6.0	2.5	2.5	2.5
Lane Grp Cap (vph)	1095	889	887	1837	636	284
v/s Ratio Prot	c0.14		0.08	c0.29	0.02	
v/s Ratio Perm		0.01				0.01
v/c Ratio	0.43	0.03	0.32	0.55	0.11	0.04
Uniform Delay, d1	13.3	11.6	14.8	8.0	17.0	16.8
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.6	0.0	0.6	0.3	0.1	0.0
Delay (s)	13.9	11.6	15.4	8.3	17.1	16.8
Level of Service	B	B	B	A	B	B
Approach Delay (s)	13.6			9.9	16.9	
Approach LOS	B			A	B	

Intersection Summary

HCM 2000 Control Delay	11.4	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.56		
Actuated Cycle Length (s)	49.5	Sum of lost time (s)	12.0
Intersection Capacity Utilization	44.9%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Unsignalized Intersection Capacity Analysis
50: Greenville Rd & Patterson Pass Rd

BART to Livermore Extension Project
2013 Existing PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	47	218	130	0	10	13	55	354	313	506	119	24
Future Volume (Veh/h)	47	218	130	0	10	13	55	354	313	506	119	24
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	51	237	141	0	11	14	60	385	340	550	129	26
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1766	2087	142	2164	1930	555	155			725		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1766	2087	142	2164	1930	555	155			725		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	0	0	84	0	54	97	96			37		
cM capacity (veh/h)	21	19	906	0	24	531	1425			878		
Direction, Lane #	EB 1	EB 2	WB 1	NB 1	NB 2	SB 1	SB 2					
Volume Total	51	378	25	60	725	550	155					
Volume Left	51	0	0	60	0	550	0					
Volume Right	0	141	14	0	340	0	26					
cSH	21	30	51	1425	1700	878	1700					
Volume to Capacity	2.45	12.71	0.49	0.04	0.43	0.63	0.09					
Queue Length 95th (ft)	166	Err	46	3	0	113	0					
Control Delay (s)	1050.4	Err	130.6	7.6	0.0	15.7	0.0					
Lane LOS	F	F	F	A		C						
Approach Delay (s)	8935.2		130.6	0.6		12.3						
Approach LOS	F		F									
Intersection Summary												
Average Delay			1978.2									
Intersection Capacity Utilization			95.2%		ICU Level of Service				F			
Analysis Period (min)			15									

HCM Signalized Intersection Capacity Analysis
1: Dougherty Rd & Amador Valley Rd



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	84	497	386	710	1757	137
Future Volume (vph)	84	497	386	710	1757	137
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5	5.7	5.7	
Lane Util. Factor	1.00	1.00	0.97	0.91	0.91	
Frt	1.00	0.85	1.00	1.00	0.99	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1770	1583	3433	5085	5030	
Flt Permitted	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	1770	1583	3433	5085	5030	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	91	540	420	772	1910	149
RTOR Reduction (vph)	0	195	0	0	9	0
Lane Group Flow (vph)	91	345	420	772	2050	0
Turn Type	Perm	Perm	Prot	NA	NA	
Protected Phases			5	2	6	
Permitted Phases	4	4				
Actuated Green, G (s)	21.8	21.8	12.2	56.2	39.5	
Effective Green, g (s)	21.8	21.8	12.2	56.2	39.5	
Actuated g/C Ratio	0.25	0.25	0.14	0.64	0.45	
Clearance Time (s)	4.5	4.5	4.5	5.7	5.7	
Vehicle Extension (s)	1.8	1.8	2.0	4.0	4.0	
Lane Grp Cap (vph)	437	391	474	3240	2252	
v/s Ratio Prot			c0.12	0.15	c0.41	
v/s Ratio Perm	0.05	c0.22				
v/c Ratio	0.21	0.88	0.89	0.24	0.91	
Uniform Delay, d1	26.4	32.0	37.3	6.8	22.7	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.1	19.7	17.3	0.1	6.2	
Delay (s)	26.4	51.7	54.6	6.9	28.9	
Level of Service	C	D	D	A	C	
Approach Delay (s)	48.1			23.7	28.9	
Approach LOS	D			C	C	

Intersection Summary

HCM 2000 Control Delay	30.4	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.90		
Actuated Cycle Length (s)	88.2	Sum of lost time (s)	14.7
Intersection Capacity Utilization	76.3%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
2: Dougherty Rd & Dublin Blvd



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	41	354	427	275	603	368	603	988	112	650	1748	73
Future Volume (vph)	41	354	427	275	603	368	603	988	112	650	1748	73
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	6.0	5.0	5.0	5.5	5.0	5.0	5.5	5.0	5.0	5.5	
Lane Util. Factor	0.97	0.91	0.88	0.94	0.91	1.00	0.94	0.91	0.88	0.97	0.86	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	3433	5085	2787	4990	5085	1583	4990	5085	2787	3433	6369	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	3433	5085	2787	4990	5085	1583	4990	5085	2787	3433	6369	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	45	385	464	299	655	400	655	1074	122	707	1900	79
RTOR Reduction (vph)	0	0	41	0	0	101	0	0	73	0	4	0
Lane Group Flow (vph)	45	385	423	299	655	299	655	1074	49	707	1975	0
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	
Protected Phases	5	2	3	1	6	7	3	8	1	7	4	
Permitted Phases			2			6			8			
Actuated Green, G (s)	11.8	22.3	39.3	15.0	26.0	52.3	17.0	32.8	47.8	26.3	42.1	
Effective Green, g (s)	11.8	22.3	39.3	15.0	26.0	52.3	17.0	32.8	47.8	26.3	42.1	
Actuated g/C Ratio	0.10	0.19	0.33	0.13	0.22	0.44	0.14	0.28	0.41	0.22	0.36	
Clearance Time (s)	5.0	6.0	5.0	5.0	5.5	5.0	5.0	5.5	5.0	5.0	5.5	
Vehicle Extension (s)	2.0	4.5	2.0	2.0	4.5	2.0	2.0	4.5	2.0	2.0	4.5	
Lane Grp Cap (vph)	343	961	929	634	1121	702	719	1414	1129	765	2274	
v/s Ratio Prot	0.01	0.08	0.07	c0.06	c0.13	0.10	0.13	0.21	0.01	c0.21	c0.31	
v/s Ratio Perm			0.09			0.09			0.01			
v/c Ratio	0.13	0.40	0.46	0.47	0.58	0.43	0.91	0.76	0.04	0.92	0.87	
Uniform Delay, d1	48.4	41.9	30.9	47.8	41.1	22.5	49.7	38.9	21.2	44.8	35.3	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.1	0.5	0.1	0.2	1.1	0.2	15.5	2.7	0.0	16.5	4.1	
Delay (s)	48.4	42.4	31.0	48.0	42.2	22.7	65.2	41.6	21.2	61.4	39.4	
Level of Service	D	D	C	D	D	C	E	D	C	E	D	
Approach Delay (s)		36.8			37.7			48.6			45.2	
Approach LOS		D			D			D			D	

Intersection Summary

HCM 2000 Control Delay	43.5	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.80		
Actuated Cycle Length (s)	117.9	Sum of lost time (s)	21.5
Intersection Capacity Utilization	81.5%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
3: Dougherty Rd & I-580 WB Ramps



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↔↔		↔↔		↑↑↑			↑↑↑	↔
Traffic Volume (vph)	0	0	0	395	0	637	0	1281	0	0	1671	0
Future Volume (vph)	0	0	0	395	0	637	0	1281	0	0	1671	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0		4.0		4.0			4.0	
Lane Util. Factor				0.97		0.88		0.91			0.86	
Frt				1.00		0.85		1.00			1.00	
Flt Protected				0.95		1.00		1.00			1.00	
Satd. Flow (prot)				3433		2787		5085			4806	
Flt Permitted				0.95		1.00		1.00			1.00	
Satd. Flow (perm)				3433		2787		5085			4806	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	429	0	692	0	1392	0	0	1816	0
RTOR Reduction (vph)	0	0	0	0	0	36	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	429	0	656	0	1392	0	0	1816	0
Turn Type				Prot		Prot		NA			NA	Perm
Protected Phases				4		4		2			6	
Permitted Phases												6
Actuated Green, G (s)				14.0		14.0		25.2			25.2	
Effective Green, g (s)				15.4		15.4		26.6			26.6	
Actuated g/C Ratio				0.31		0.31		0.53			0.53	
Clearance Time (s)				5.4		5.4		5.4			5.4	
Vehicle Extension (s)				3.0		3.0		3.0			3.0	
Lane Grp Cap (vph)				1057		858		2705			2556	
v/s Ratio Prot				0.12		c0.24		0.27			c0.38	
v/s Ratio Perm												
v/c Ratio				0.41		0.76		0.51			0.71	
Uniform Delay, d1				13.7		15.7		7.5			8.8	
Progression Factor				1.00		1.00		0.75			1.00	
Incremental Delay, d2				0.3		4.1		0.6			1.7	
Delay (s)				13.9		19.8		6.3			10.5	
Level of Service				B		B		A			B	
Approach Delay (s)		0.0			17.5			6.3			10.5	
Approach LOS		A			B			A			B	

Intersection Summary		
HCM 2000 Control Delay	11.0	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.73	B
Actuated Cycle Length (s)	50.0	Sum of lost time (s)
Intersection Capacity Utilization	53.7%	8.0
Analysis Period (min)	15	ICU Level of Service
		A

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
4: Hopyard Rd/Dougherty Rd & I-580 EB Ramps



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗		↖↗					↑↑↑	↖		↑↑↑	↖
Traffic Volume (vph)	756	0	1433	0	0	0	0	757	0	0	1527	0
Future Volume (vph)	756	0	1433	0	0	0	0	757	0	0	1527	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0					4.0			4.0	
Lane Util. Factor	0.97		0.88					0.91			0.86	
Frt	1.00		0.85					1.00			1.00	
Flt Protected	0.95		1.00					1.00			1.00	
Satd. Flow (prot)	3433		2787					5085			4806	
Flt Permitted	0.95		1.00					1.00			1.00	
Satd. Flow (perm)	3433		2787					5085			4806	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	822	0	1558	0	0	0	0	823	0	0	1660	0
RTOR Reduction (vph)	0	0	26	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	822	0	1532	0	0	0	0	823	0	0	1660	0
Turn Type	Prot		Prot					NA	Free		NA	Perm
Protected Phases	4		4					2			6	
Permitted Phases									Free			6
Actuated Green, G (s)	23.4		23.4					15.8			15.8	
Effective Green, g (s)	24.8		24.8					17.2			17.2	
Actuated g/C Ratio	0.50		0.50					0.34			0.34	
Clearance Time (s)	5.4		5.4					5.4			5.4	
Vehicle Extension (s)	3.0		3.0					3.0			3.0	
Lane Grp Cap (vph)	1702		1382					1749			1653	
v/s Ratio Prot	0.24		c0.55					0.16			c0.35	
v/s Ratio Perm												
v/c Ratio	0.48		1.11					0.47			1.00	
Uniform Delay, d1	8.4		12.6					12.8			16.4	
Progression Factor	1.00		1.00					1.00			0.70	
Incremental Delay, d2	0.2		59.7					0.9			20.3	
Delay (s)	8.6		72.3					13.7			31.8	
Level of Service	A		E					B			C	
Approach Delay (s)		50.3			0.0			13.7			31.8	
Approach LOS		D			A			B			C	

Intersection Summary

HCM 2000 Control Delay	37.8	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	1.07		
Actuated Cycle Length (s)	50.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	86.3%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
5: Hopyard Rd & Owens Rd

BART to Livermore Extension Project
2025 No Project AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↔↗		↖	↗	↗	↖	↑↑↑	↗	↖↗	↑↑↗	
Traffic Volume (vph)	203	94	52	115	130	200	137	681	137	821	1630	558
Future Volume (vph)	203	94	52	115	130	200	137	681	137	821	1630	558
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	2.7	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	0.91	0.91		1.00	0.95	0.95	1.00	0.91	1.00	0.97	0.91	
Frt	1.00	0.97		1.00	0.95	0.85	1.00	1.00	0.85	1.00	0.96	
Flt Protected	0.95	0.98		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1610	3216		1770	1684	1504	1770	5085	1583	3433	4891	
Flt Permitted	0.95	0.98		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1610	3216		1770	1684	1504	1770	5085	1583	3433	4891	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	221	102	57	125	141	217	149	740	149	892	1772	607
RTOR Reduction (vph)	0	26	0	0	19	49	0	0	111	0	69	0
Lane Group Flow (vph)	122	232	0	125	189	101	149	740	38	892	2310	0
Turn Type	Split	NA		Split	NA	pm+ov	Prot	NA	Perm	Prot	NA	
Protected Phases	8	8		4	4	1	5	2		1	6	
Permitted Phases						4			2			
Actuated Green, G (s)	6.7	6.7		9.7	9.7	41.7	8.0	21.3	21.3	32.0	45.3	
Effective Green, g (s)	8.0	8.0		11.0	11.0	44.3	8.0	23.0	23.0	32.0	47.0	
Actuated g/C Ratio	0.09	0.09		0.12	0.12	0.49	0.09	0.26	0.26	0.36	0.52	
Clearance Time (s)	5.3	5.3		5.3	5.3	4.0	4.0	5.7	5.7	4.0	5.7	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	143	285		216	205	785	157	1299	404	1220	2554	
v/s Ratio Prot	c0.08	0.07		0.07	c0.11	0.05	0.08	0.15		c0.26	c0.47	
v/s Ratio Perm						0.02			0.02			
v/c Ratio	0.85	0.81		0.58	0.92	0.13	0.95	0.57	0.09	0.73	0.90	
Uniform Delay, d1	40.4	40.3		37.3	39.1	12.4	40.8	29.2	25.6	25.3	19.5	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	36.0	16.0		3.7	41.2	0.1	56.0	0.6	0.1	2.3	5.0	
Delay (s)	76.4	56.3		41.0	80.3	12.5	96.8	29.8	25.7	27.5	24.5	
Level of Service	E	E		D	F	B	F	C	C	C	C	
Approach Delay (s)		62.7			49.1			38.8			25.3	
Approach LOS		E			D			D			C	

Intersection Summary

HCM 2000 Control Delay	33.0	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.91		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	82.6%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
6: Hopyard Rd & Stoneridge Dr

BART to Livermore Extension Project
2025 No Project AM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	146	731	437	81	982	114	646	723	87	280	974	233
Future Volume (vph)	146	731	437	81	982	114	646	723	87	280	974	233
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.91	1.00	0.97	0.91	1.00	0.94	0.95	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5085	1583	3433	5085	1583	4990	3539	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5085	1583	3433	5085	1583	4990	3539	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	159	795	475	88	1067	124	702	786	95	304	1059	253
RTOR Reduction (vph)	0	0	223	0	0	90	0	0	68	0	0	121
Lane Group Flow (vph)	159	795	252	88	1067	34	702	786	27	304	1059	132
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8			2			6
Actuated Green, G (s)	4.0	17.5	17.5	3.2	16.7	16.7	8.0	17.0	17.0	7.0	16.0	16.0
Effective Green, g (s)	4.0	17.5	17.5	3.2	16.7	16.7	8.0	17.0	17.0	7.0	16.0	16.0
Actuated g/C Ratio	0.07	0.29	0.29	0.05	0.28	0.28	0.13	0.28	0.28	0.12	0.26	0.26
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	226	1466	456	180	1399	435	657	991	443	395	1340	417
v/s Ratio Prot	c0.05	0.16		0.03	c0.21		c0.14	c0.22		0.09	0.21	
v/s Ratio Perm			0.16			0.02			0.02			0.08
v/c Ratio	0.70	0.54	0.55	0.49	0.76	0.08	1.07	0.79	0.06	0.77	0.79	0.32
Uniform Delay, d1	27.8	18.2	18.3	28.0	20.2	16.3	26.4	20.2	16.0	26.1	20.8	18.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	9.5	0.4	1.4	2.1	2.5	0.1	54.8	4.4	0.1	8.8	3.3	0.4
Delay (s)	37.3	18.6	19.7	30.0	22.7	16.4	81.2	24.7	16.1	34.8	24.0	18.4
Level of Service	D	B	B	C	C	B	F	C	B	C	C	B
Approach Delay (s)		21.1			22.6			49.2			25.2	
Approach LOS		C			C			D			C	

Intersection Summary

HCM 2000 Control Delay	30.1	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.84		
Actuated Cycle Length (s)	60.7	Sum of lost time (s)	16.0
Intersection Capacity Utilization	67.6%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
7: Hopyard Rd & Las Positas Blvd

BART to Livermore Extension Project
2025 No Project AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	151	461	373	351	447	57	413	1154	366	111	1010	90
Future Volume (vph)	151	461	373	351	447	57	413	1154	366	111	1010	90
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.95	1.00	0.97	0.95	1.00	0.97	0.91	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	3433	3539	1583	3433	5085	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	3433	3539	1583	3433	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	164	501	405	382	486	62	449	1254	398	121	1098	98
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	72
Lane Group Flow (vph)	164	501	405	382	486	62	449	1254	398	121	1098	26
Turn Type	Prot	NA	Free	Prot	NA	Free	Prot	NA	Free	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1		6
Permitted Phases			Free			Free			Free			6
Actuated Green, G (s)	5.5	14.6	64.5	8.0	17.1	64.5	9.0	22.7	64.5	3.2	16.9	16.9
Effective Green, g (s)	5.5	14.6	64.5	8.0	17.1	64.5	9.0	22.7	64.5	3.2	16.9	16.9
Actuated g/C Ratio	0.09	0.23	1.00	0.12	0.27	1.00	0.14	0.35	1.00	0.05	0.26	0.26
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	292	801	1583	425	938	1583	479	1789	1583	170	1332	414
v/s Ratio Prot	0.05	c0.14		c0.11	0.14		c0.13	0.25		0.04	c0.22	
v/s Ratio Perm			c0.26			0.04			0.25			0.02
v/c Ratio	0.56	0.63	0.26	0.90	0.52	0.04	0.94	0.70	0.25	0.71	0.82	0.06
Uniform Delay, d1	28.3	22.5	0.0	27.9	20.2	0.0	27.5	18.0	0.0	30.2	22.4	17.9
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	2.5	1.5	0.4	21.2	0.5	0.0	26.0	1.3	0.4	13.2	4.3	0.1
Delay (s)	30.8	24.0	0.4	49.0	20.7	0.0	53.5	19.2	0.4	43.3	26.7	17.9
Level of Service	C	C	A	D	C	A	D	B	A	D	C	B
Approach Delay (s)		16.1			30.9			23.0			27.6	
Approach LOS		B			C			C			C	

Intersection Summary

HCM 2000 Control Delay	24.1	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.79		
Actuated Cycle Length (s)	64.5	Sum of lost time (s)	16.0
Intersection Capacity Utilization	67.4%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
8: Willow Rd & Owens Rd

BART to Livermore Extension Project
2025 No Project AM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	105	378	194	117	324	90	93	93	0	132	102	92
Future Volume (vph)	105	378	194	117	324	90	93	93	0	132	102	92
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	5.3	4.0		5.3	4.0	4.0
Lane Util. Factor	0.97	0.91		0.97	0.91	1.00	1.00	0.95		1.00	1.00	1.00
Frt	1.00	0.95		1.00	1.00	0.85	1.00	1.00		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	4827		3433	5085	1583	1770	3539		1770	1863	1583
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.69	1.00		0.69	1.00	1.00
Satd. Flow (perm)	3433	4827		3433	5085	1583	1277	3539		1282	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	114	411	211	127	352	98	101	101	0	143	111	100
RTOR Reduction (vph)	0	129	0	0	0	60	0	0	0	0	0	76
Lane Group Flow (vph)	114	493	0	127	352	38	101	101	0	143	111	24
Turn Type	Prot	NA		Prot	NA	Perm	Perm	NA	Perm	Perm	NA	Perm
Protected Phases	1	6		5	2			4			8	
Permitted Phases						2	4		4	8		8
Actuated Green, G (s)	3.8	14.7		3.8	14.7	14.7	8.6	8.6		8.6	8.6	8.6
Effective Green, g (s)	3.8	16.4		3.8	16.4	16.4	8.6	9.9		8.6	9.9	9.9
Actuated g/C Ratio	0.09	0.39		0.09	0.39	0.39	0.20	0.24		0.20	0.24	0.24
Clearance Time (s)	4.0	5.7		4.0	5.7	5.7	5.3	5.3		5.3	5.3	5.3
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	309	1880		309	1980	616	260	832		261	438	372
v/s Ratio Prot	0.03	c0.10		c0.04	0.07			0.03			0.06	
v/s Ratio Perm						0.02	0.08			c0.11		0.01
v/c Ratio	0.37	0.26		0.41	0.18	0.06	0.39	0.12		0.55	0.25	0.06
Uniform Delay, d1	18.0	8.7		18.1	8.4	8.0	14.5	12.7		15.0	13.1	12.5
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	0.7	0.1		0.9	0.0	0.0	1.0	0.1		2.3	0.3	0.1
Delay (s)	18.8	8.8		19.0	8.5	8.1	15.4	12.7		17.4	13.4	12.6
Level of Service	B	A		B	A	A	B	B		B	B	B
Approach Delay (s)		10.4			10.7			14.1			14.8	
Approach LOS		B			B			B			B	

Intersection Summary		
HCM 2000 Control Delay	11.7	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.35	B
Actuated Cycle Length (s)	42.1	Sum of lost time (s)
Intersection Capacity Utilization	39.0%	12.0
Analysis Period (min)	15	ICU Level of Service
		A

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 9: Hacienda Dr & Dublin Blvd

BART to Livermore Extension Project
 2025 No Project AM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	72	335	93	272	745	80	157	633	115	12	390	132
Future Volume (vph)	72	335	93	272	745	80	157	633	115	12	390	132
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	6.0	5.0	4.5	6.0		5.0	6.0	6.0	4.5	5.5	5.5
Lane Util. Factor	0.97	0.91	0.88	0.97	0.91		0.94	0.95	0.88	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5085	2787	3433	5011		4990	3539	2787	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5085	2787	3433	5011		4990	3539	2787	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	78	364	101	296	810	87	171	688	125	13	424	143
RTOR Reduction (vph)	0	0	71	0	12	0	0	0	86	0	0	117
Lane Group Flow (vph)	78	364	30	296	885	0	171	688	39	13	424	26
Turn Type	Prot	NA	pm+ov	Prot	NA		Prot	NA	Perm	Prot	NA	Perm
Protected Phases	5	2	3	1	6		3	8		7	NA	4
Permitted Phases			2						8			4
Actuated Green, G (s)	4.8	12.1	22.4	17.4	24.7		10.3	23.5	23.5	0.6	13.8	13.8
Effective Green, g (s)	4.8	12.1	22.4	17.4	24.7		10.3	23.5	23.5	0.6	13.8	13.8
Actuated g/C Ratio	0.06	0.16	0.30	0.23	0.33		0.14	0.32	0.32	0.01	0.18	0.18
Clearance Time (s)	4.5	6.0	5.0	4.5	6.0		5.0	6.0	6.0	4.5	5.5	5.5
Vehicle Extension (s)	2.0	3.5	2.0	2.0	3.5		2.0	3.5	3.5	2.0	3.5	3.5
Lane Grp Cap (vph)	220	824	1023	800	1659		688	1114	877	27	940	292
v/s Ratio Prot	0.02	c0.07	0.00	0.09	c0.18		0.03	c0.19		0.00	c0.08	
v/s Ratio Perm			0.01						0.01			0.02
v/c Ratio	0.35	0.44	0.03	0.37	0.53		0.25	0.62	0.04	0.48	0.45	0.09
Uniform Delay, d1	33.4	28.2	18.4	24.0	20.3		28.7	21.7	17.8	36.8	27.0	25.2
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.4	0.4	0.0	0.1	0.4		0.1	1.1	0.0	4.9	0.4	0.2
Delay (s)	33.8	28.7	18.4	24.1	20.6		28.8	22.8	17.8	41.7	27.4	25.4
Level of Service	C	C	B	C	C		C	C	B	D	C	C
Approach Delay (s)		27.5			21.5			23.2			27.2	
Approach LOS		C			C			C			C	

Intersection Summary		
HCM 2000 Control Delay	24.0	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.59	C
Actuated Cycle Length (s)	74.6	Sum of lost time (s)
Intersection Capacity Utilization	57.8%	21.0
Analysis Period (min)	15	ICU Level of Service
		B

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 10: Hacienda Dr & Martinelli Blvd/Hacienda Crossings



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗	↘	↙	↘		↖	↗	↘	↙	↘	↙
Traffic Volume (vph)	11	8	174	110	12	8	244	869	112	17	727	49
Future Volume (vph)	11	8	174	110	12	8	244	869	112	17	727	49
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	3.0	3.0	5.5	3.0		3.5	3.0	3.0	5.0	3.5	
Lane Util. Factor	1.00	0.91	0.91	0.97	1.00		0.94	0.91	1.00	0.97	0.86	
Frt	1.00	0.90	0.85	1.00	0.94		1.00	1.00	0.85	1.00	0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1770	1523	2882	3433	1748		4990	5085	1583	3433	6347	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1770	1523	2882	3433	1748		4990	5085	1583	3433	6347	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	12	9	189	120	13	9	265	945	122	18	790	53
RTOR Reduction (vph)	0	14	129	0	6	0	0	0	54	0	8	0
Lane Group Flow (vph)	12	14	41	120	16	0	265	945	68	18	835	0
Turn Type	Prot	NA	Perm	Prot	NA		Prot	NA	pm+ov	Prot	NA	
Protected Phases	5	2		1	6		3	8	1	7	4	
Permitted Phases			2						8			
Actuated Green, G (s)	1.7	15.8	15.8	6.9	21.5		8.2	29.7	36.6	1.1	22.6	
Effective Green, g (s)	1.2	17.8	17.8	6.4	23.5		9.2	31.7	40.6	0.6	24.1	
Actuated g/C Ratio	0.02	0.24	0.24	0.09	0.32		0.13	0.43	0.56	0.01	0.33	
Clearance Time (s)	4.5	5.0	5.0	5.0	5.0		4.5	5.0	5.0	4.5	5.0	
Vehicle Extension (s)	3.0	4.0	4.0	2.0	4.0		3.0	4.0	2.0	3.0	4.0	
Lane Grp Cap (vph)	29	371	702	300	562		628	2208	945	28	2095	
v/s Ratio Prot	c0.01	0.01		c0.03	0.01		c0.05	c0.19	0.01	0.01	0.13	
v/s Ratio Perm			c0.01						0.03			
v/c Ratio	0.41	0.04	0.06	0.40	0.03		0.42	0.43	0.07	0.64	0.40	
Uniform Delay, d1	35.6	21.1	21.2	31.5	16.9		29.4	14.3	7.5	36.1	18.9	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	9.3	0.1	0.0	0.3	0.0		0.5	0.2	0.0	40.9	0.2	
Delay (s)	44.9	21.1	21.2	31.8	17.0		29.9	14.5	7.5	77.0	19.0	
Level of Service	D	C	C	C	B		C	B	A	E	B	
Approach Delay (s)		22.6			29.5			16.9			20.2	
Approach LOS		C			C			B			C	

Intersection Summary

HCM 2000 Control Delay	19.2	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.34		
Actuated Cycle Length (s)	73.0	Sum of lost time (s)	16.5
Intersection Capacity Utilization	42.6%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 11: Hacienda Dr & I-580 WB Ramps



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↔↔		↔↔		↑↑↑			↑↑↑	↔
Traffic Volume (vph)	0	0	0	280	0	452	0	1065	183	0	616	416
Future Volume (vph)	0	0	0	280	0	452	0	1065	183	0	616	416
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0		4.0		4.0			4.0	4.0
Lane Util. Factor				0.97		0.88		0.91			0.86	0.86
Frt				1.00		0.85		0.98			0.96	0.85
Flt Protected				0.95		1.00		1.00			1.00	1.00
Satd. Flow (prot)				3433		2787		4973			4624	1362
Flt Permitted				0.95		1.00		1.00			1.00	1.00
Satd. Flow (perm)				3433		2787		4973			4624	1362
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	304	0	491	0	1158	199	0	670	452
RTOR Reduction (vph)	0	0	0	0	0	97	0	45	0	0	92	92
Lane Group Flow (vph)	0	0	0	304	0	394	0	1312	0	0	804	134
Turn Type				Prot		Prot		NA			NA	Perm
Protected Phases				4		4		2			6	
Permitted Phases												6
Actuated Green, G (s)				10.9		10.9		27.8			27.8	27.8
Effective Green, g (s)				12.3		12.3		29.7			29.7	29.7
Actuated g/C Ratio				0.25		0.25		0.59			0.59	0.59
Clearance Time (s)				5.4		5.4		5.9			5.9	5.9
Vehicle Extension (s)				3.0		3.0		3.0			3.0	3.0
Lane Grp Cap (vph)				844		685		2953			2746	809
v/s Ratio Prot				0.09		c0.14		c0.26			0.17	
v/s Ratio Perm												0.10
v/c Ratio				0.36		0.57		0.44			0.29	0.17
Uniform Delay, d1				15.6		16.6		5.6			5.0	4.6
Progression Factor				1.00		1.00		0.55			1.00	1.00
Incremental Delay, d2				0.3		1.2		0.4			0.3	0.4
Delay (s)				15.9		17.7		3.5			5.3	5.0
Level of Service				B		B		A			A	A
Approach Delay (s)		0.0			17.0			3.5			5.2	
Approach LOS		A			B			A			A	

Intersection Summary		
HCM 2000 Control Delay	7.4	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.48	A
Actuated Cycle Length (s)	50.0	Sum of lost time (s)
Intersection Capacity Utilization	47.1%	8.0
Analysis Period (min)	15	ICU Level of Service
		A

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 12: Hacienda Dr & I-580 EB Ramps




































Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗		↖↗					↑↑↑	↖		↑↑↑	
Traffic Volume (vph)	751	0	1095	0	0	0	0	460	228	0	1001	149
Future Volume (vph)	751	0	1095	0	0	0	0	460	228	0	1001	149
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0					4.0	4.0		4.0	
Lane Util. Factor	0.97		0.88					0.86	0.86		0.91	
Frt	1.00		0.85					0.98	0.85		0.98	
Flt Protected	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (prot)	3433		2787					4710	1362		4986	
Flt Permitted	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (perm)	3433		2787					4710	1362		4986	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	816	0	1190	0	0	0	0	500	248	0	1088	162
RTOR Reduction (vph)	0	0	86	0	0	0	0	44	97	0	51	0
Lane Group Flow (vph)	816	0	1104	0	0	0	0	533	74	0	1199	0
Turn Type	Prot		Prot					NA	Perm		NA	
Protected Phases	4		4					2			6	
Permitted Phases									2			
Actuated Green, G (s)	19.0		19.0					19.7	19.7		19.7	
Effective Green, g (s)	20.4		20.4					21.6	21.6		21.6	
Actuated g/C Ratio	0.41		0.41					0.43	0.43		0.43	
Clearance Time (s)	5.4		5.4					5.9	5.9		5.9	
Vehicle Extension (s)	2.0		2.0					2.0	2.0		2.0	
Lane Grp Cap (vph)	1400		1137					2034	588		2153	
v/s Ratio Prot	0.24		c0.40					0.11			c0.24	
v/s Ratio Perm									0.05			
v/c Ratio	0.58		0.97					0.26	0.13		0.56	
Uniform Delay, d1	11.5		14.5					9.1	8.5		10.6	
Progression Factor	1.00		1.00					1.00	1.00		0.81	
Incremental Delay, d2	0.4		19.9					0.3	0.4		1.0	
Delay (s)	11.9		34.4					9.4	9.0		9.6	
Level of Service	B		C					A	A		A	
Approach Delay (s)		25.3			0.0			9.3			9.6	
Approach LOS		C			A			A			A	

Intersection Summary	
HCM 2000 Control Delay	17.4
HCM 2000 Volume to Capacity ratio	0.76
Actuated Cycle Length (s)	50.0
Intersection Capacity Utilization	67.6%
Analysis Period (min)	15
HCM 2000 Level of Service	B
Sum of lost time (s)	8.0
ICU Level of Service	C

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 13: Hacienda Dr & Owens Rd

BART to Livermore Extension Project
 2025 No Project AM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 	  		 	  		 	  		  		
Traffic Volume (vph)	147	210	26	92	244	254	24	283	104	538	969	562
Future Volume (vph)	147	210	26	92	244	254	24	283	104	538	969	562
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	2.3	4.0	4.0	2.3	4.0	4.0	2.7	4.0	4.0	2.7
Lane Util. Factor	0.97	0.91	1.00	0.97	0.91	1.00	0.97	0.91	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5085	1583	3433	5085	1583	3433	5085	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5085	1583	3433	5085	1583	3433	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	160	228	28	100	265	276	26	308	113	585	1053	611
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	160	228	28	100	265	276	26	308	113	585	1053	611
Turn Type	Prot	NA	Free	Prot	NA	Free	Prot	NA	Free	Prot	NA	Free
Protected Phases	1	6		5	2		7	4		3	8	
Permitted Phases			Free			Free			Free			Free
Actuated Green, G (s)	4.0	8.6	59.0	4.0	8.6	59.0	1.5	9.1	59.0	18.3	25.9	59.0
Effective Green, g (s)	4.0	10.3	59.0	4.0	10.3	59.0	1.5	10.4	59.0	18.3	27.2	59.0
Actuated g/C Ratio	0.07	0.17	1.00	0.07	0.17	1.00	0.03	0.18	1.00	0.31	0.46	1.00
Clearance Time (s)	4.0	5.7		4.0	5.7		4.0	5.3		4.0	5.3	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	232	887	1583	232	887	1583	87	896	1583	1064	2344	1583
v/s Ratio Prot	0.05	0.04		0.03	0.05		0.01	0.06		c0.17	0.21	
v/s Ratio Perm			0.02			0.17			0.07			c0.39
v/c Ratio	0.69	0.26	0.02	0.43	0.30	0.17	0.30	0.34	0.07	0.55	0.45	0.39
Uniform Delay, d1	26.9	21.0	0.0	26.4	21.2	0.0	28.2	21.3	0.0	16.9	10.8	0.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	8.3	0.2	0.0	1.3	0.2	0.2	1.9	0.2	0.1	0.6	0.1	0.7
Delay (s)	35.2	21.2	0.0	27.7	21.4	0.2	30.2	21.5	0.1	17.5	10.9	0.7
Level of Service	D	C	A	C	C	A	C	C	A	B	B	A
Approach Delay (s)		25.1			13.3			16.6			9.9	
Approach LOS		C			B			B			A	
Intersection Summary												
HCM 2000 Control Delay			12.9			HCM 2000 Level of Service			B			
HCM 2000 Volume to Capacity ratio			0.56									
Actuated Cycle Length (s)			59.0			Sum of lost time (s)			16.0			
Intersection Capacity Utilization			45.4%			ICU Level of Service			A			
Analysis Period (min)			15									

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 14: Tassajara Rd & Dublin Blvd



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	92	149	159	513	653	43	226	509	145	25	1239	232
Future Volume (vph)	92	149	159	513	653	43	226	509	145	25	1239	232
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	6.0	6.0	5.0	6.0		5.0	6.0	6.0	5.0	6.0	6.0
Lane Util. Factor	0.97	0.95	0.88	0.94	0.95		0.94	0.91	1.00	0.97	0.86	0.88
Frt	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	2787	4990	3506		4990	5085	1583	3433	6408	2787
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	2787	4990	3506		4990	5085	1583	3433	6408	2787
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	100	162	173	558	710	47	246	553	158	27	1347	252
RTOR Reduction (vph)	0	0	131	0	4	0	0	0	97	0	0	169
Lane Group Flow (vph)	100	162	42	558	753	0	246	553	61	27	1347	83
Turn Type	Prot	NA	Perm	Prot	NA		Prot	NA	Perm	Prot	NA	Perm
Protected Phases	5	2		1	6		3	8		7	NA	4
Permitted Phases			2						8			4
Actuated Green, G (s)	16.2	32.3	32.3	19.3	35.4		16.2	51.9	51.9	8.4	44.1	44.1
Effective Green, g (s)	16.2	32.3	32.3	19.3	35.4		16.2	51.9	51.9	8.4	44.1	44.1
Actuated g/C Ratio	0.12	0.24	0.24	0.14	0.26		0.12	0.39	0.39	0.06	0.33	0.33
Clearance Time (s)	5.0	6.0	6.0	5.0	6.0		5.0	6.0	6.0	5.0	6.0	6.0
Vehicle Extension (s)	2.0	3.0	3.0	2.0	3.0		2.0	4.0	4.0	2.0	4.0	4.0
Lane Grp Cap (vph)	415	853	672	719	926		603	1970	613	215	2110	917
v/s Ratio Prot	0.03	0.05		c0.11	c0.21		c0.05	0.11		0.01	c0.21	
v/s Ratio Perm			0.01						0.04			0.03
v/c Ratio	0.24	0.19	0.06	0.78	0.81		0.41	0.28	0.10	0.13	0.64	0.09
Uniform Delay, d1	53.3	40.4	39.1	55.2	46.2		54.4	28.2	26.1	59.3	38.1	31.0
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.1	0.1	0.0	4.8	5.5		0.2	0.1	0.1	0.1	0.7	0.1
Delay (s)	53.4	40.5	39.2	60.0	51.7		54.6	28.3	26.2	59.4	38.9	31.1
Level of Service	D	D	D	E	D		D	C	C	E	D	C
Approach Delay (s)		42.9			55.2			34.7			38.0	
Approach LOS		D			E			C			D	

Intersection Summary

HCM 2000 Control Delay	43.0	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.70		
Actuated Cycle Length (s)	133.9	Sum of lost time (s)	22.0
Intersection Capacity Utilization	82.4%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 15: Tassajara Rd & I-580 WB Ramps

BART to Livermore Extension Project
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



























Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↔		↔		↑↑	↔		↑↑↑	↔
Traffic Volume (vph)	0	0	0	561	0	294	0	1033	467	0	943	935
Future Volume (vph)	0	0	0	561	0	294	0	1033	467	0	943	935
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0		4.0		4.0	4.0		4.0	4.0
Lane Util. Factor				0.97		0.88		0.95	1.00		0.86	0.86
Frt				1.00		0.85		1.00	0.85		0.95	0.85
Flt Protected				0.95		1.00		1.00	1.00		1.00	1.00
Satd. Flow (prot)				3433		2787		3539	1583		4567	1362
Flt Permitted				0.95		1.00		1.00	1.00		1.00	1.00
Satd. Flow (perm)				3433		2787		3539	1583		4567	1362
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	610	0	320	0	1123	508	0	1025	1016
RTOR Reduction (vph)	0	0	0	0	0	28	0	0	283	0	207	283
Lane Group Flow (vph)	0	0	0	610	0	292	0	1123	225	0	1326	225
Turn Type				Perm		Perm		NA	Perm		NA	Perm
Protected Phases								2			6	
Permitted Phases				8		8			2			6
Actuated Green, G (s)				12.2		12.2		16.1	16.1		16.1	16.1
Effective Green, g (s)				12.2		12.2		16.1	16.1		16.1	16.1
Actuated g/C Ratio				0.34		0.34		0.44	0.44		0.44	0.44
Clearance Time (s)				4.0		4.0		4.0	4.0		4.0	4.0
Vehicle Extension (s)				3.0		3.0		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)				1153		936		1569	702		2025	604
v/s Ratio Prot								c0.32			0.29	
v/s Ratio Perm				c0.18		0.10			0.14			0.17
v/c Ratio				0.53		0.31		0.72	0.32		0.65	0.37
Uniform Delay, d1				9.7		8.9		8.2	6.6		7.9	6.7
Progression Factor				1.00		1.00		1.00	1.00		1.00	1.00
Incremental Delay, d2				0.4		0.2		1.6	0.3		0.8	0.4
Delay (s)				10.2		9.1		9.8	6.8		8.7	7.1
Level of Service				B		A		A	A		A	A
Approach Delay (s)		0.0			9.8			8.9			8.3	
Approach LOS		A			A			A			A	

Intersection Summary

HCM 2000 Control Delay	8.8	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.63		
Actuated Cycle Length (s)	36.3	Sum of lost time (s)	8.0
Intersection Capacity Utilization	51.2%	ICU Level of Service	A
Analysis Period (min)	15		































c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 16: Santa Rita Rd & I-580 EB Ramps/Pimilco Dr

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 		 	 		 		  		 	 	
Traffic Volume (vph)	536	120	677	182	0	192	0	733	107	193	1251	0
Future Volume (vph)	536	120	677	182	0	192	0	733	107	193	1251	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0		4.0		4.0		4.0	4.0	
Lane Util. Factor	0.97	1.00	1.00	0.97		0.88		0.86		1.00	0.95	
Frt	1.00	1.00	0.85	1.00		0.85		0.98		1.00	1.00	
Flt Protected	0.95	1.00	1.00	0.95		1.00		1.00		0.95	1.00	
Satd. Flow (prot)	3433	1863	1583	3433		2787		6286		1770	3539	
Flt Permitted	0.95	1.00	1.00	0.95		1.00		1.00		0.95	1.00	
Satd. Flow (perm)	3433	1863	1583	3433		2787		6286		1770	3539	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	583	130	736	198	0	209	0	797	116	210	1360	0
RTOR Reduction (vph)	0	0	0	0	0	72	0	44	0	0	0	0
Lane Group Flow (vph)	583	130	736	198	0	137	0	869	0	210	1360	0
Turn Type	Perm	NA	Free	Prot		pm+ov		NA		Prot	NA	Perm
Protected Phases		4		3		1		2		1	6	
Permitted Phases	4		Free			3						6
Actuated Green, G (s)	14.3	14.3	57.2	4.0		12.1		14.8		8.1	26.9	
Effective Green, g (s)	14.3	14.3	57.2	4.0		12.1		14.8		8.1	26.9	
Actuated g/C Ratio	0.25	0.25	1.00	0.07		0.21		0.26		0.14	0.47	
Clearance Time (s)	4.0	4.0		4.0		4.0		4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0		3.0		3.0		3.0	3.0	
Lane Grp Cap (vph)	858	465	1583	240		589		1626		250	1664	
v/s Ratio Prot		0.07		0.06		0.03		0.14		0.12	c0.38	
v/s Ratio Perm	c0.17		c0.46			0.02						
v/c Ratio	0.68	0.28	0.46	0.82		0.23		0.53		0.84	0.82	
Uniform Delay, d1	19.4	17.3	0.0	26.3		18.7		18.2		23.9	13.0	
Progression Factor	1.00	1.00	1.00	1.00		1.00		1.00		1.00	1.00	
Incremental Delay, d2	2.2	0.3	1.0	20.1		0.2		0.3		21.2	3.2	
Delay (s)	21.5	17.6	1.0	46.3		18.9		18.6		45.2	16.3	
Level of Service	C	B	A	D		B		B		D	B	
Approach Delay (s)		10.7			32.2			18.6			20.1	
Approach LOS		B			C			B			C	
Intersection Summary												
HCM 2000 Control Delay			17.8									B
HCM 2000 Volume to Capacity ratio			0.86									
Actuated Cycle Length (s)			57.2							16.0		
Intersection Capacity Utilization			56.5%									B
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis
 17: Santa Rita Rd & Valley Ave

BART to Livermore Extension Project
 2025 No Project AM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 	 			 		 	 		 	 	
Traffic Volume (vph)	187	223	79	179	331	827	92	472	72	572	915	155
Future Volume (vph)	187	223	79	179	331	827	92	472	72	572	915	155
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.97	0.95		0.97	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.98		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	3433	3469		3433	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	3433	3469		3433	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	203	242	86	195	360	899	100	513	78	622	995	168
RTOR Reduction (vph)	0	0	74	0	0	0	0	14	0	0	0	96
Lane Group Flow (vph)	203	242	12	195	360	899	100	577	0	622	995	72
Turn Type	Prot	NA	Perm	Prot	NA	Free	Prot	NA		Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			Free						6
Actuated Green, G (s)	9.2	11.0	11.0	12.8	14.6	77.2	4.5	19.2		18.2	32.9	32.9
Effective Green, g (s)	9.2	11.0	11.0	12.8	14.6	77.2	4.5	19.2		18.2	32.9	32.9
Actuated g/C Ratio	0.12	0.14	0.14	0.17	0.19	1.00	0.06	0.25		0.24	0.43	0.43
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	409	504	225	293	669	1583	200	862		809	1508	674
v/s Ratio Prot	0.06	0.07		0.11	0.10		0.03	0.17		c0.18	c0.28	
v/s Ratio Perm			0.01			c0.57						0.05
v/c Ratio	0.50	0.48	0.05	0.67	0.54	0.57	0.50	0.67		0.77	0.66	0.11
Uniform Delay, d1	31.8	30.5	28.6	30.2	28.3	0.0	35.3	26.1		27.5	17.7	13.3
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	1.0	0.7	0.1	5.6	0.8	1.5	2.0	2.0		4.4	1.1	0.1
Delay (s)	32.8	31.2	28.7	35.8	29.1	1.5	37.2	28.1		32.0	18.7	13.4
Level of Service	C	C	C	D	C	A	D	C		C	B	B
Approach Delay (s)		31.4			12.9			29.4			22.8	
Approach LOS		C			B			C			C	
Intersection Summary												
HCM 2000 Control Delay			21.7			HCM 2000 Level of Service			C			
HCM 2000 Volume to Capacity ratio			0.76									
Actuated Cycle Length (s)			77.2			Sum of lost time (s)			16.0			
Intersection Capacity Utilization			61.1%			ICU Level of Service			B			
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis
18: Bernal Ave/Valley Ave & Stanley Blvd

BART to Livermore Extension Project
2025 No Project AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	204	202	52	250	895	954	173	476	106	139	344	116
Future Volume (vph)	204	202	52	250	895	954	173	476	106	139	344	116
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.95	1.00	0.97	0.91	0.91	1.00	0.95	1.00	0.97	0.95	0.95
Frt	1.00	1.00	0.85	1.00	0.96	0.85	1.00	1.00	0.85	1.00	0.96	0.96
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	3433	3238	1441	1770	3539	1583	3433	3405	3405
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	3433	3238	1441	1770	3539	1583	3433	3405	3405
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	222	220	57	272	973	1037	188	517	115	151	374	126
RTOR Reduction (vph)	0	0	28	0	46	28	0	0	91	0	38	0
Lane Group Flow (vph)	222	220	29	272	1342	594	188	517	24	151	462	0
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	NA
Protected Phases	7	4	5	3	8	1	5	2		1	6	
Permitted Phases			4			8			2			
Actuated Green, G (s)	6.0	32.1	43.7	11.0	37.1	46.9	11.6	18.2	18.2	9.8	16.4	
Effective Green, g (s)	6.0	32.1	43.7	11.0	37.1	46.9	11.6	18.2	18.2	9.8	16.4	
Actuated g/C Ratio	0.07	0.37	0.50	0.13	0.43	0.54	0.13	0.21	0.21	0.11	0.19	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	236	1304	866	433	1379	842	235	739	330	386	641	
v/s Ratio Prot	c0.06	0.06	0.00	0.08	c0.41	0.08	c0.11	c0.15		0.04	0.14	
v/s Ratio Perm			0.01			0.33			0.02			
v/c Ratio	0.94	0.17	0.03	0.63	0.97	0.71	0.80	0.70	0.07	0.39	0.72	
Uniform Delay, d1	40.4	18.5	11.0	36.1	24.5	15.0	36.6	31.9	27.7	35.9	33.2	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	42.3	0.1	0.0	2.8	18.0	2.7	17.5	2.9	0.1	0.7	4.0	
Delay (s)	82.7	18.6	11.0	39.0	42.5	17.7	54.1	34.8	27.8	36.5	37.2	
Level of Service	F	B	B	D	D	B	D	C	C	D	D	
Approach Delay (s)		46.2			35.3			38.2			37.0	
Approach LOS		D			D			D			D	

Intersection Summary

HCM 2000 Control Delay	37.4	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.89		
Actuated Cycle Length (s)	87.1	Sum of lost time (s)	16.0
Intersection Capacity Utilization	76.9%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 19: Fallon Rd & Dublin Blvd



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	45	52	83	280	1101	341	745	238	27	55	664	324
Future Volume (vph)	45	52	83	280	1101	341	745	238	27	55	664	324
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.3	5.3	5.3	4.0	4.0	4.0	5.3	4.9	4.9	5.3	4.9	4.9
Lane Util. Factor	0.97	0.91	0.88	0.94	0.91	1.00	0.97	0.91	0.88	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3090	4577	2508	4491	4577	1425	3090	4577	2508	3090	4577	1425
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3090	4577	2508	4491	4577	1425	3090	4577	2508	3090	4577	1425
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	49	57	90	304	1197	371	810	259	29	60	722	352
RTOR Reduction (vph)	0	0	58	0	0	272	0	0	15	0	0	149
Lane Group Flow (vph)	49	57	32	304	1197	99	810	259	14	60	722	203
Turn Type	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	5	2	3	1	6		3	8		7		4
Permitted Phases			2			6			8			4
Actuated Green, G (s)	3.1	9.3	38.8	23.2	29.4	29.4	29.5	54.2	54.2	4.5	29.2	29.2
Effective Green, g (s)	3.1	9.3	38.8	23.2	29.4	29.4	29.5	54.2	54.2	4.5	29.2	29.2
Actuated g/C Ratio	0.03	0.08	0.35	0.21	0.27	0.27	0.27	0.49	0.49	0.04	0.26	0.26
Clearance Time (s)	5.3	5.3	5.3	4.0	4.0	4.0	5.3	4.9	4.9	5.3	4.9	4.9
Vehicle Extension (s)	2.0	4.0	2.0	2.0	2.0	2.0	2.0	4.0	4.0	2.0	4.0	4.0
Lane Grp Cap (vph)	86	384	879	941	1215	378	823	2240	1227	125	1207	375
v/s Ratio Prot	0.02	0.01	0.01	c0.07	c0.26		c0.26	0.06		0.02	c0.16	
v/s Ratio Perm			0.00			0.07			0.01			0.14
v/c Ratio	0.57	0.15	0.04	0.32	0.99	0.26	0.98	0.12	0.01	0.48	0.60	0.54
Uniform Delay, d1	53.1	47.0	23.6	37.1	40.4	32.1	40.4	15.3	14.5	52.0	35.6	35.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	5.1	0.2	0.0	0.1	22.0	0.1	27.2	0.0	0.0	1.1	0.9	2.0
Delay (s)	58.2	47.3	23.7	37.2	62.5	32.2	67.6	15.3	14.5	53.0	36.6	37.0
Level of Service	E	D	C	D	E	C	E	B	B	D	D	D
Approach Delay (s)		39.2			52.4			53.8			37.6	
Approach LOS		D			D			D			D	

Intersection Summary		
HCM 2000 Control Delay	48.2	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.85	D
Actuated Cycle Length (s)	110.7	Sum of lost time (s)
Intersection Capacity Utilization	81.0%	19.5
Analysis Period (min)	15	ICU Level of Service
		D

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 20: El Charro Rd/Fallon Rd & I-580 WB Ramps



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↙	↖	↗		↑	↘		↑↑	↗
Traffic Volume (vph)	0	0	0	168	0	609	0	554	478	0	524	399
Future Volume (vph)	0	0	0	168	0	609	0	554	478	0	524	399
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0	4.0	4.0		4.0	4.0		4.0	4.0
Lane Util. Factor				0.95	0.95	0.88		0.95	0.95		0.95	1.00
Frt				1.00	1.00	0.85		0.99	0.85		1.00	0.85
Flt Protected				0.95	0.95	1.00		1.00	1.00		1.00	1.00
Satd. Flow (prot)				1681	1681	2787		1749	1504		3539	1583
Flt Permitted				0.95	0.95	1.00		1.00	1.00		1.00	1.00
Satd. Flow (perm)				1681	1681	2787		1749	1504		3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	183	0	662	0	602	520	0	570	434
RTOR Reduction (vph)	0	0	0	0	0	372	0	5	175	0	0	162
Lane Group Flow (vph)	0	0	0	93	90	290	0	649	293	0	570	272
Turn Type				Perm	NA	Perm		NA	Perm		NA	Perm
Protected Phases					8			2			6	
Permitted Phases				8		8			2			6
Actuated Green, G (s)				11.2	11.2	11.2		31.3	31.3		31.3	31.3
Effective Green, g (s)				10.7	10.7	10.7		31.3	31.3		31.3	31.3
Actuated g/C Ratio				0.21	0.21	0.21		0.63	0.63		0.63	0.63
Clearance Time (s)				3.5	3.5	3.5		4.0	4.0		4.0	4.0
Vehicle Extension (s)				2.0	2.0	2.0		2.0	2.0		2.0	2.0
Lane Grp Cap (vph)				359	359	596		1094	941		2215	990
v/s Ratio Prot								c0.37			0.16	
v/s Ratio Perm				0.06	0.05	c0.10			0.19			0.17
v/c Ratio				0.26	0.25	0.49		0.59	0.31		0.26	0.27
Uniform Delay, d1				16.4	16.3	17.2		5.6	4.3		4.2	4.2
Progression Factor				1.00	1.00	1.00		0.55	0.36		1.00	1.00
Incremental Delay, d2				0.1	0.1	0.2		2.3	0.8		0.3	0.7
Delay (s)				16.5	16.5	17.5		5.3	2.4		4.4	4.9
Level of Service				B	B	B		A	A		A	A
Approach Delay (s)		0.0			17.3			4.1			4.6	
Approach LOS		A			B			A			A	

Intersection Summary

HCM 2000 Control Delay	8.0	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.57		
Actuated Cycle Length (s)	50.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	66.8%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 21: El Charro Rd & I-580 EB Ramps



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations	↔↔		↔↔					↕↔	↔		↕↔	↔	
Traffic Volume (vph)	245	0	402	0	0	0	0	767	142	0	372	0	
Future Volume (vph)	245	0	402	0	0	0	0	767	142	0	372	0	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)	4.0		4.0					4.0	4.0		4.0		
Lane Util. Factor	0.97		0.88					0.91	0.91		0.91		
Frt	1.00		0.85					1.00	0.85		1.00		
Flt Protected	0.95		1.00					1.00	1.00		1.00		
Satd. Flow (prot)	3433		2787					3379	1441		3390		
Flt Permitted	0.95		1.00					1.00	1.00		1.00		
Satd. Flow (perm)	3433		2787					3379	1441		3390		
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	
Adj. Flow (vph)	266	0	437	0	0	0	0	834	154	0	404	0	
RTOR Reduction (vph)	0	0	365	0	0	0	0	2	44	0	0	0	
Lane Group Flow (vph)	266	0	72	0	0	0	0	850	92	0	404	0	
Turn Type	Prot		Perm					NA	Perm		NA	Perm	
Protected Phases	4							2			6		
Permitted Phases			4						2			6	
Actuated Green, G (s)	8.2		8.2					33.8	33.8		33.8		
Effective Green, g (s)	8.2		8.2					33.8	33.8		33.8		
Actuated g/C Ratio	0.16		0.16					0.68	0.68		0.68		
Clearance Time (s)	4.0		4.0					4.0	4.0		4.0		
Vehicle Extension (s)	2.0		2.0					3.0	3.0		3.0		
Lane Grp Cap (vph)	563		457					2284	974		2291		
v/s Ratio Prot	c0.08							c0.25			0.12		
v/s Ratio Perm			0.03						0.06				
v/c Ratio	0.47		0.16					0.37	0.09		0.18		
Uniform Delay, d1	18.9		17.9					3.5	2.8		3.0		
Progression Factor	1.00		1.00					0.80	0.56		0.90		
Incremental Delay, d2	0.2		0.1					0.4	0.2		0.2		
Delay (s)	19.2		18.0					3.2	1.7		2.9		
Level of Service	B		B					A	A		A		
Approach Delay (s)		18.4			0.0			3.0			2.9		
Approach LOS		B			A			A			A		
Intersection Summary													
HCM 2000 Control Delay			8.2									HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio			0.39										
Actuated Cycle Length (s)			50.0									Sum of lost time (s)	8.0
Intersection Capacity Utilization			36.4%									ICU Level of Service	A
Analysis Period (min)			15										

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 22: El Charro Rd & Stoneridge Dr/Jack London Blvd

BART to Livermore Extension Project
 2025 No Project AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔↔↔	↑↑	↗	↖	↑↑	↗↗	↖	↑↑		↖↖↖	↑	↗↗
Traffic Volume (vph)	146	100	8	16	594	633	7	96	2	210	90	172
Future Volume (vph)	146	100	8	16	594	633	7	96	2	210	90	172
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	0.94	0.95	1.00	1.00	0.95	0.88	1.00	0.95		0.94	1.00	0.88
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	4491	3185	1425	1593	3185	2508	1593	3176		4491	1676	2508
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	4491	3185	1425	1593	3185	2508	1593	3176		4491	1676	2508
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	159	109	9	17	646	688	8	104	2	228	98	187
RTOR Reduction (vph)	0	0	6	0	0	384	0	1	0	0	0	104
Lane Group Flow (vph)	159	109	3	17	646	304	8	105	0	228	98	83
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Prot	NA		Prot	NA	Perm
Protected Phases	7	4		3	8	1	5	2		1	6	
Permitted Phases			4			8						6
Actuated Green, G (s)	8.9	35.0	35.0	3.1	29.2	44.2	1.5	30.9		15.0	44.4	44.4
Effective Green, g (s)	8.9	35.0	35.0	3.1	29.2	44.2	1.5	30.9		15.0	44.4	44.4
Actuated g/C Ratio	0.09	0.35	0.35	0.03	0.29	0.44	0.02	0.31		0.15	0.44	0.44
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	399	1114	498	49	930	1108	23	981		673	744	1113
v/s Ratio Prot	c0.04	0.03		0.01	c0.20	0.04	c0.01	0.03		c0.05	c0.06	
v/s Ratio Perm			0.00			0.08						0.03
v/c Ratio	0.40	0.10	0.01	0.35	0.69	0.27	0.35	0.11		0.34	0.13	0.07
Uniform Delay, d1	43.0	21.9	21.2	47.5	31.4	17.7	48.8	24.7		38.1	16.4	16.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		0.95	0.93	0.98
Incremental Delay, d2	0.7	0.0	0.0	4.2	2.3	0.1	8.9	0.2		0.3	0.4	0.1
Delay (s)	43.7	21.9	21.2	51.7	33.7	17.9	57.7	24.9		36.5	15.6	15.7
Level of Service	D	C	C	D	C	B	E	C		D	B	B
Approach Delay (s)		34.4			25.9			27.2			25.0	
Approach LOS		C			C			C			C	

Intersection Summary		
HCM 2000 Control Delay	26.8	HCM 2000 Level of Service C
HCM 2000 Volume to Capacity ratio	0.39	
Actuated Cycle Length (s)	100.0	Sum of lost time (s) 16.0
Intersection Capacity Utilization	42.7%	ICU Level of Service A
Analysis Period (min)	15	

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
24: Airway Blvd/Driveway & N Canyons Pkwy



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑	↑	↑↑	↑	↑		↑	↑↑		↑	
Traffic Volume (vph)	0	56	80	687	480	0	1152	0	889	0	0	0
Future Volume (vph)	0	56	80	687	480	0	1152	0	889	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0	4.0	4.0			4.4	4.0			
Lane Util. Factor		0.95	1.00	0.97	1.00			1.00	0.88			
Frt		1.00	0.85	1.00	1.00			1.00	0.85			
Flt Protected		1.00	1.00	0.95	1.00			0.95	1.00			
Satd. Flow (prot)		3539	1583	3433	1863			1770	2787			
Flt Permitted		1.00	1.00	0.95	1.00			0.95	1.00			
Satd. Flow (perm)		3539	1583	3433	1863			1770	2787			
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	61	87	747	522	0	1252	0	966	0	0	0
RTOR Reduction (vph)	0	0	79	0	0	0	0	0	57	0	0	0
Lane Group Flow (vph)	0	61	8	747	522	0	0	1252	909	0	0	0
Turn Type		NA	Perm	Prot	NA	Perm	Split	NA	pm+ov			
Protected Phases		2		1	6		8	8	1	4	4	
Permitted Phases			2			6			8			
Actuated Green, G (s)		10.2	10.2	36.8	53.0			76.8	113.6			
Effective Green, g (s)		12.2	12.2	38.8	55.0			76.6	117.6			
Actuated g/C Ratio		0.09	0.09	0.28	0.39			0.55	0.84			
Clearance Time (s)		6.0	6.0	6.0	6.0			4.2	6.0			
Vehicle Extension (s)		3.0	3.0	3.0	3.0			3.0	3.0			
Lane Grp Cap (vph)		308	137	951	731			968	2420			
v/s Ratio Prot		0.02		c0.22	c0.28			c0.71	0.10			
v/s Ratio Perm			0.00						0.22			
v/c Ratio		0.20	0.06	0.79	0.71			1.29	0.38			
Uniform Delay, d1		59.4	58.6	46.8	35.9			31.7	2.6			
Progression Factor		1.00	1.00	1.00	1.00			1.00	1.00			
Incremental Delay, d2		1.4	0.8	4.3	5.9			139.8	0.1			
Delay (s)		60.8	59.4	51.1	41.7			171.5	2.7			
Level of Service		E	E	D	D			F	A			
Approach Delay (s)		60.0			47.2			98.0			0.0	
Approach LOS		E			D			F			A	

Intersection Summary

HCM 2000 Control Delay	78.7	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.13		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	16.4
Intersection Capacity Utilization	97.1%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
25: Airway Blvd & I-580 WB Ramps

BART to Livermore Extension Project
2025 No Project AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↙	↖	↗		↕	↘		↕	↘
Traffic Volume (vph)	0	0	0	63	43	826	0	1299	343	0	281	553
Future Volume (vph)	0	0	0	63	43	826	0	1299	343	0	281	553
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0	4.0	4.0		4.0	4.0		4.0	
Lane Util. Factor				0.95	0.95	0.88		0.95	1.00		0.91	
Frt				1.00	1.00	0.85		1.00	0.85		0.90	
Flt Protected				0.95	0.98	1.00		1.00	1.00		1.00	
Satd. Flow (prot)				1681	1734	2787		3539	1583		4579	
Flt Permitted				0.95	0.98	1.00		1.00	1.00		1.00	
Satd. Flow (perm)				1681	1734	2787		3539	1583		4579	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	68	47	898	0	1412	373	0	305	601
RTOR Reduction (vph)	0	0	0	0	0	31	0	0	163	0	262	0
Lane Group Flow (vph)	0	0	0	36	79	867	0	1412	210	0	644	0
Turn Type				Split	NA	Perm		NA	Perm		NA	
Protected Phases				8	8			2			6	
Permitted Phases						8			2			
Actuated Green, G (s)				35.6	35.6	35.6		55.1	55.1		55.1	
Effective Green, g (s)				35.6	35.6	35.6		56.4	56.4		56.4	
Actuated g/C Ratio				0.36	0.36	0.36		0.56	0.56		0.56	
Clearance Time (s)				4.0	4.0	4.0		5.3	5.3		5.3	
Vehicle Extension (s)				2.0	2.0	2.0		4.0	4.0		4.0	
Lane Grp Cap (vph)				598	617	992		1995	892		2582	
v/s Ratio Prot				0.02	0.05			c0.40			0.14	
v/s Ratio Perm						c0.31			0.13			
v/c Ratio				0.06	0.13	0.87		0.71	0.24		0.25	
Uniform Delay, d1				21.2	21.7	30.1		15.8	11.0		11.1	
Progression Factor				1.00	1.00	1.00		1.00	1.00		1.00	
Incremental Delay, d2				0.0	0.0	8.4		2.2	0.6		0.2	
Delay (s)				21.2	21.8	38.5		18.0	11.6		11.3	
Level of Service				C	C	D		B	B		B	
Approach Delay (s)		0.0			36.6			16.6			11.3	
Approach LOS		A			D			B			B	

Intersection Summary

HCM 2000 Control Delay	20.8	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.77		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	71.5%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
26: Airway Blvd & I-580 EB Ramps/Kitty Hawk Rd



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↑	↖	↖	↑	↖	↖	↑↘		↖	↑↘	
Traffic Volume (vph)	644	191	163	22	34	101	26	507	158	82	117	152
Future Volume (vph)	644	191	163	22	34	101	26	507	158	82	117	152
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.4	4.4	4.4	4.0	4.0		4.0	4.0	
Lane Util. Factor	0.97	1.00	1.00	1.00	1.00	1.00	1.00	0.95		1.00	0.95	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.96		1.00	0.92	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	3433	1863	1583	1770	1863	1583	1770	3413		1770	3239	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	3433	1863	1583	1770	1863	1583	1770	3413		1770	3239	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	700	208	177	24	37	110	28	551	172	89	127	165
RTOR Reduction (vph)	0	0	132	0	0	92	0	33	0	0	102	0
Lane Group Flow (vph)	700	208	45	24	37	18	28	690	0	89	190	0
Turn Type	Split	NA	Perm	Split	NA	pm+ov	Prot	NA		Prot	NA	
Protected Phases	7	7		8	8	1	5	2		1	6	
Permitted Phases			7			8						
Actuated Green, G (s)	23.0	23.0	23.0	8.4	8.4	15.5	8.7	34.2		7.1	33.1	
Effective Green, g (s)	23.0	23.0	23.0	8.0	8.0	14.7	8.2	35.5		7.1	34.4	
Actuated g/C Ratio	0.26	0.26	0.26	0.09	0.09	0.16	0.09	0.39		0.08	0.38	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	3.5	5.3		4.0	5.3	
Vehicle Extension (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	3.5		2.0	4.0	
Lane Grp Cap (vph)	877	476	404	157	165	335	161	1346		139	1238	
v/s Ratio Prot	c0.20	0.11		0.01	c0.02	0.00	0.02	c0.20		c0.05	0.06	
v/s Ratio Perm			0.03			0.01						
v/c Ratio	0.80	0.44	0.11	0.15	0.22	0.05	0.17	0.51		0.64	0.15	
Uniform Delay, d1	31.3	28.1	25.7	37.9	38.1	31.8	37.8	20.7		40.2	18.2	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	4.8	0.2	0.0	0.2	0.3	0.0	0.2	1.4		7.3	0.3	
Delay (s)	36.1	28.3	25.7	38.0	38.4	31.8	38.0	22.1		47.5	18.5	
Level of Service	D	C	C	D	D	C	D	C		D	B	
Approach Delay (s)		32.9			34.1			22.7			25.3	
Approach LOS		C			C			C			C	

Intersection Summary

HCM 2000 Control Delay	28.6	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.59		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	16.8
Intersection Capacity Utilization	58.6%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 27: Collier Canyon Rd & N Canyons Pkwy/Portola Ave

BART to Livermore Extension Project
 2025 No Project AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↕	↖	↖	↕	↖	↖	↕		↖	↕	↖
Traffic Volume (vph)	191	218	104	228	828	59	49	5	113	64	14	130
Future Volume (vph)	191	218	104	228	828	59	49	5	113	64	14	130
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	5.2	5.2
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.86		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	1770	1594		1770	1863	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	1770	1594		1770	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	208	237	113	248	900	64	53	5	123	70	15	141
RTOR Reduction (vph)	0	0	77	0	0	39	0	103	0	0	0	116
Lane Group Flow (vph)	208	237	36	248	900	25	53	25	0	70	15	25
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA		Prot	NA	Perm
Protected Phases	1	6		5	2		3	8		7		4
Permitted Phases			6			2						4
Actuated Green, G (s)	10.4	21.8	21.8	16.4	27.8	27.8	3.6	11.2		5.6	13.6	13.6
Effective Green, g (s)	10.4	23.1	23.1	16.4	29.1	29.1	3.6	12.2		5.6	13.0	13.0
Actuated g/C Ratio	0.14	0.32	0.32	0.22	0.40	0.40	0.05	0.17		0.08	0.18	0.18
Clearance Time (s)	4.0	5.3	5.3	4.0	5.3	5.3	4.0	5.0		4.0	4.6	4.6
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	487	1115	498	396	1404	628	86	265		135	330	280
v/s Ratio Prot	0.06	0.07		c0.14	c0.25		0.03	c0.02		c0.04	0.01	
v/s Ratio Perm			0.02			0.02						0.02
v/c Ratio	0.43	0.21	0.07	0.63	0.64	0.04	0.62	0.10		0.52	0.05	0.09
Uniform Delay, d1	28.7	18.4	17.6	25.7	17.9	13.5	34.2	25.9		32.6	25.0	25.2
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	0.6	0.1	0.1	3.1	1.0	0.0	12.4	0.2		3.3	0.1	0.1
Delay (s)	29.3	18.5	17.6	28.8	18.9	13.6	46.6	26.0		35.9	25.1	25.3
Level of Service	C	B	B	C	B	B	D	C		D	C	C
Approach Delay (s)		22.4			20.6			32.1			28.6	
Approach LOS		C			C			C			C	

Intersection Summary		
HCM 2000 Control Delay	22.9	HCM 2000 Level of Service C
HCM 2000 Volume to Capacity ratio	0.54	
Actuated Cycle Length (s)	73.3	Sum of lost time (s) 17.2
Intersection Capacity Utilization	49.5%	ICU Level of Service A
Analysis Period (min)	15	

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
28: Isabel Ave/Campus Hill Dr & Portola Ave

BART to Livermore Extension Project
2025 No Project AM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	1	191	279	618	594	140	503	301	79	40	156	1
Future Volume (vph)	1	191	279	618	594	140	503	301	79	40	156	1
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	5.8	5.8
Lane Util. Factor	1.00	0.95	0.88	0.94	0.95		0.97	0.95	1.00	1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	0.97		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3539	2787	4990	3438		3433	3539	1583	1770	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	3539	2787	4990	3438		3433	3539	1583	1770	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	1	208	303	672	646	152	547	327	86	43	170	1
RTOR Reduction (vph)	0	0	235	0	14	0	0	0	57	0	0	1
Lane Group Flow (vph)	1	208	68	672	784	0	547	327	29	43	170	0
Turn Type	Prot	NA	Perm	Prot	NA		Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4						2			6
Actuated Green, G (s)	1.5	18.3	18.3	17.1	33.9		20.1	28.3	28.3	5.3	13.9	13.9
Effective Green, g (s)	1.5	19.6	19.6	17.1	35.2		20.1	29.6	29.6	5.3	13.0	13.0
Actuated g/C Ratio	0.02	0.22	0.22	0.20	0.40		0.23	0.34	0.34	0.06	0.15	0.15
Clearance Time (s)	4.0	5.3	5.3	4.0	5.3		4.0	5.3	5.3	4.0	4.9	4.9
Vehicle Extension (s)	2.0	3.0	3.0	2.0	3.0		2.0	3.0	3.0	2.0	3.0	3.0
Lane Grp Cap (vph)	30	791	623	974	1381		787	1195	534	107	525	234
v/s Ratio Prot	0.00	0.06		c0.13	c0.23		c0.16	c0.09		0.02	0.05	
v/s Ratio Perm			0.02						0.02			0.00
v/c Ratio	0.03	0.26	0.11	0.69	0.57		0.70	0.27	0.05	0.40	0.32	0.00
Uniform Delay, d1	42.3	28.0	27.1	32.8	20.3		30.9	21.2	19.6	39.6	33.4	31.8
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.2	0.2	0.1	1.6	0.5		2.2	0.1	0.0	0.9	0.4	0.0
Delay (s)	42.5	28.2	27.1	34.4	20.8		33.1	21.3	19.6	40.5	33.7	31.8
Level of Service	D	C	C	C	C		C	C	B	D	C	C
Approach Delay (s)		27.6			27.1			27.9			35.1	
Approach LOS		C			C			C			D	

Intersection Summary

HCM 2000 Control Delay	27.9	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.62		
Actuated Cycle Length (s)	87.6	Sum of lost time (s)	17.8
Intersection Capacity Utilization	67.6%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
29: Isabel Ave & I-580 WB Ramps

BART to Livermore Extension Project
2025 No Project AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↖↗		↖		↕	↖↗		↕	↖
Traffic Volume (vph)	0	0	0	652	0	417	0	494	0	0	501	596
Future Volume (vph)	0	0	0	652	0	417	0	494	0	0	501	596
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0		4.0		5.6			5.6	5.6
Lane Util. Factor				0.97		1.00		0.95			0.95	1.00
Frt				1.00		0.85		1.00			1.00	0.85
Flt Protected				0.95		1.00		1.00			1.00	1.00
Satd. Flow (prot)				3433		1583		3539			3539	1583
Flt Permitted				0.95		1.00		1.00			1.00	1.00
Satd. Flow (perm)				3433		1583		3539			3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	709	0	453	0	537	0	0	545	648
RTOR Reduction (vph)	0	0	0	0	0	151	0	0	0	0	0	330
Lane Group Flow (vph)	0	0	0	709	0	302	0	537	0	0	545	318
Turn Type				Prot		Prot		NA	Free		NA	Prot
Protected Phases				8		8		2			6	6
Permitted Phases									Free			
Actuated Green, G (s)				13.3		13.3		22.9			22.9	22.9
Effective Green, g (s)				13.3		13.3		22.1			22.1	22.1
Actuated g/C Ratio				0.30		0.30		0.49			0.49	0.49
Clearance Time (s)				4.0		4.0		4.8			4.8	4.8
Vehicle Extension (s)				2.0		2.0		4.0			4.0	4.0
Lane Grp Cap (vph)				1014		467		1738			1738	777
v/s Ratio Prot				c0.21		0.19		0.15			0.15	c0.20
v/s Ratio Perm												
v/c Ratio				0.70		0.65		0.31			0.31	0.41
Uniform Delay, d1				14.1		13.8		6.9			6.9	7.3
Progression Factor				1.00		1.00		1.00			1.00	1.00
Incremental Delay, d2				1.7		2.3		0.5			0.1	0.5
Delay (s)				15.8		16.1		7.3			7.0	7.8
Level of Service				B		B		A			A	A
Approach Delay (s)		0.0			15.9			7.3			7.4	
Approach LOS		A			B			A			A	























Intersection Summary

HCM 2000 Control Delay	10.8	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.52		
Actuated Cycle Length (s)	45.0	Sum of lost time (s)	9.6
Intersection Capacity Utilization	47.5%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 30: Isabel Ave & I-580 EB Ramps

BART to Livermore Extension Project
 2025 No Project AM

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations	 		 					 			 		
Traffic Volume (vph)	205	0	457	0	0	0	0	721	520	0	932	266	
Future Volume (vph)	205	0	457	0	0	0	0	721	520	0	932	266	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)	4.0		4.0					4.0	4.0		4.0	4.0	
Lane Util. Factor	0.97		0.88					0.95	1.00		0.95	1.00	
Frt	1.00		0.85					1.00	0.85		1.00	0.85	
Flt Protected	0.95		1.00					1.00	1.00		1.00	1.00	
Satd. Flow (prot)	3433		2787					3539	1583		3539	1583	
Flt Permitted	0.95		1.00					1.00	1.00		1.00	1.00	
Satd. Flow (perm)	3433		2787					3539	1583		3539	1583	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	
Adj. Flow (vph)	223	0	497	0	0	0	0	784	565	0	1013	289	
RTOR Reduction (vph)	0	0	181	0	0	0	0	0	0	0	0	0	
Lane Group Flow (vph)	223	0	316	0	0	0	0	784	565	0	1013	289	
Turn Type	Prot		Perm					NA	Free		NA	Free	
Protected Phases	4							2			6		
Permitted Phases			4						Free			Free	
Actuated Green, G (s)	9.2		9.2					31.8	50.0		31.8	50.0	
Effective Green, g (s)	9.2		9.2					32.8	50.0		32.8	50.0	
Actuated g/C Ratio	0.18		0.18					0.66	1.00		0.66	1.00	
Clearance Time (s)	4.0		4.0					5.0			5.0		
Vehicle Extension (s)	2.0		2.0					4.0			4.0		
Lane Grp Cap (vph)	631		512					2321	1583		2321	1583	
v/s Ratio Prot	0.06							0.22			c0.29		
v/s Ratio Perm			c0.11						0.36			0.18	
v/c Ratio	0.35		0.62					0.34	0.36		0.44	0.18	
Uniform Delay, d1	17.8		18.8					3.8	0.0		4.1	0.0	
Progression Factor	1.00		1.00					1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.1		1.6					0.1	0.6		0.6	0.3	
Delay (s)	17.9		20.3					3.9	0.6		4.7	0.3	
Level of Service	B		C					A	A		A	A	
Approach Delay (s)		19.6			0.0			2.5			3.7		
Approach LOS		B			A			A			A		
Intersection Summary													
HCM 2000 Control Delay			6.6									HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio			0.48										
Actuated Cycle Length (s)			50.0									Sum of lost time (s)	8.0
Intersection Capacity Utilization			48.4%									ICU Level of Service	A
Analysis Period (min)			15										
c Critical Lane Group													

HCM Signalized Intersection Capacity Analysis
 31: Isabel Ave & Airway Blvd

BART to Livermore Extension Project
 2025 No Project AM




































Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↑	↗	↖	↑	↗	↖	↑↑↑	↗	↖↗	↑↑↑	↗
Traffic Volume (vph)	0	59	185	142	248	101	318	1075	26	250	1300	31
Future Volume (vph)	0	59	185	142	248	101	318	1075	26	250	1300	31
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.2	5.6	5.2	5.2	5.6	4.0	4.0	4.0	4.0	4.0	5.0
Lane Util. Factor		1.00	1.00	1.00	1.00	1.00	1.00	0.91	1.00	0.97	0.91	1.00
Frt		1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1863	1583	1770	1863	1583	1770	5085	1583	3433	5085	1583
Flt Permitted		1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)		1863	1583	1770	1863	1583	1770	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	64	201	154	270	110	346	1168	28	272	1413	34
RTOR Reduction (vph)	0	0	72	0	0	70	0	0	15	0	0	22
Lane Group Flow (vph)	0	64	129	154	270	40	346	1168	13	272	1413	12
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4	5	3	8	1	5	2		1	NA	6
Permitted Phases			4			8			2			6
Actuated Green, G (s)		7.0	26.1	9.9	21.5	32.1	19.1	39.0	39.0	10.6	30.5	30.5
Effective Green, g (s)		6.4	24.9	9.3	20.9	30.9	20.1	40.0	40.0	11.6	31.5	30.5
Actuated g/C Ratio		0.07	0.29	0.11	0.24	0.36	0.23	0.47	0.47	0.14	0.37	0.36
Clearance Time (s)		4.6	5.0	4.6	4.6	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Extension (s)		3.0	3.0	3.0	3.0	3.0	3.0	5.0	5.0	3.0	5.0	5.0
Lane Grp Cap (vph)		139	459	192	454	570	415	2373	738	464	1869	563
v/s Ratio Prot		0.03	0.06	c0.09	c0.14	0.01	c0.20	0.23		0.08	c0.28	
v/s Ratio Perm			0.02			0.02			0.01			0.01
v/c Ratio		0.46	0.28	0.80	0.59	0.07	0.83	0.49	0.02	0.59	0.76	0.02
Uniform Delay, d1		38.0	23.5	37.3	28.7	18.0	31.2	15.8	12.3	34.8	23.7	17.9
Progression Factor		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2		2.4	0.3	20.9	2.1	0.1	13.4	0.3	0.0	1.9	2.1	0.0
Delay (s)		40.4	23.8	58.2	30.7	18.0	44.6	16.2	12.3	36.7	25.9	17.9
Level of Service		D	C	E	C	B	D	B	B	D	C	B
Approach Delay (s)		27.8			36.1			22.5			27.4	
Approach LOS		C			D			C			C	

Intersection Summary		
HCM 2000 Control Delay	26.7	HCM 2000 Level of Service C
HCM 2000 Volume to Capacity ratio	0.81	
Actuated Cycle Length (s)	85.7	Sum of lost time (s) 20.0
Intersection Capacity Utilization	68.3%	ICU Level of Service C
Analysis Period (min)	15	

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
32: Isabel Ave & Jack London Blvd

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 	 			 		 	  		 	  	
Traffic Volume (vph)	26	53	53	212	760	307	355	865	98	156	1143	279
Future Volume (vph)	26	53	53	212	760	307	355	865	98	156	1143	279
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.97	0.91	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	3433	5085	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	3433	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	28	58	58	230	826	334	386	940	107	170	1242	303
RTOR Reduction (vph)	0	0	47	0	0	73	0	0	70	0	0	121
Lane Group Flow (vph)	28	58	11	230	826	261	386	940	37	170	1242	182
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8	1	5	2		1	6	
Permitted Phases			4			8			2			6
Actuated Green, G (s)	3.7	17.7	17.7	13.8	27.8	37.3	10.1	32.3	32.3	9.5	31.7	31.7
Effective Green, g (s)	3.7	17.7	17.7	13.8	27.8	37.3	10.1	32.3	32.3	9.5	31.7	31.7
Actuated g/C Ratio	0.04	0.19	0.19	0.15	0.29	0.39	0.11	0.34	0.34	0.10	0.34	0.34
Clearance Time (s)	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	134	662	296	258	1041	713	366	1738	541	345	1705	531
v/s Ratio Prot	0.01	0.02		c0.13	c0.23	0.04	c0.11	0.18		0.05	c0.24	
v/s Ratio Perm			0.01			0.13			0.02			0.11
v/c Ratio	0.21	0.09	0.04	0.89	0.79	0.37	1.05	0.54	0.07	0.49	0.73	0.34
Uniform Delay, d1	44.0	31.7	31.4	39.6	30.7	20.2	42.2	25.1	21.0	40.2	27.6	23.6
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.8	0.1	0.1	29.5	4.2	0.3	62.1	0.3	0.1	1.1	1.6	0.4
Delay (s)	44.8	31.8	31.5	69.1	34.9	20.6	104.3	25.5	21.0	41.3	29.2	24.0
Level of Service	D	C	C	E	C	C	F	C	C	D	C	C
Approach Delay (s)		34.2			37.1			46.4			29.5	
Approach LOS		C			D			D			C	

Intersection Summary		
HCM 2000 Control Delay	37.1	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.85	D
Actuated Cycle Length (s)	94.5	Sum of lost time (s)
Intersection Capacity Utilization	66.5%	21.2
Analysis Period (min)	15	ICU Level of Service
		C

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 33: Isabel Ave Connector & Stanley Blvd



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑	↑	↑↓	↑↑	↑↓	↑↓
Traffic Volume (vph)	337	162	317	1958	384	205
Future Volume (vph)	337	162	317	1958	384	205
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	3.8	4.0	4.0	4.0	2.5
Lane Util. Factor	0.95	1.00	0.97	0.95	0.97	0.88
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	3539	1583	3433	3539	3433	2787
Flt Permitted	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (perm)	3539	1583	3433	3539	3433	2787
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	366	176	345	2128	417	223
RTOR Reduction (vph)	0	18	0	0	0	142
Lane Group Flow (vph)	366	158	345	2128	417	81
Turn Type	NA	pm+ov	Prot	NA	Prot	pm+ov
Protected Phases	2	8	1	6	8	1
Permitted Phases		2				8
Actuated Green, G (s)	38.0	51.8	11.9	53.9	13.8	25.7
Effective Green, g (s)	39.7	55.2	11.9	55.6	15.3	28.7
Actuated g/C Ratio	0.50	0.70	0.15	0.70	0.19	0.36
Clearance Time (s)	5.7	5.5	4.0	5.7	5.5	4.0
Vehicle Extension (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Grp Cap (vph)	1780	1107	517	2493	665	1013
v/s Ratio Prot	0.10	0.03	0.10	c0.60	c0.12	0.01
v/s Ratio Perm		0.07				0.02
v/c Ratio	0.21	0.14	0.67	0.85	0.63	0.08
Uniform Delay, d1	10.9	4.0	31.6	8.6	29.2	16.4
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.0	0.0	2.5	2.9	1.3	0.0
Delay (s)	10.9	4.0	34.2	11.6	30.5	16.5
Level of Service	B	A	C	B	C	B
Approach Delay (s)	8.6			14.7	25.6	
Approach LOS	A			B	C	

Intersection Summary

HCM 2000 Control Delay	15.7	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.85		
Actuated Cycle Length (s)	78.9	Sum of lost time (s)	12.0
Intersection Capacity Utilization	71.7%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 34: Murrieta Blvd/Driveway & Portola Ave



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗		↖	↗		↖	↗	↗		↗	
Traffic Volume (vph)	0	386	93	268	1212	1	188	6	148	1	3	0
Future Volume (vph)	0	386	93	268	1212	1	188	6	148	1	3	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.8		4.0	5.8		5.2	5.2	5.2		4.0	
Lane Util. Factor		0.95		1.00	0.95		0.95	0.95	1.00		1.00	
Frt		0.97		1.00	1.00		1.00	1.00	0.85		1.00	
Flt Protected		1.00		0.95	1.00		0.95	0.96	1.00		0.99	
Satd. Flow (prot)		3436		1770	3539		1681	1691	1583		1840	
Flt Permitted		1.00		0.95	1.00		0.95	0.96	1.00		0.99	
Satd. Flow (perm)		3436		1770	3539		1681	1691	1583		1840	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	420	101	291	1317	1	204	7	161	1	3	0
RTOR Reduction (vph)	0	27	0	0	0	0	0	0	138	0	0	0
Lane Group Flow (vph)	0	494	0	291	1318	0	106	105	23	0	4	0
Turn Type	Prot	NA		Prot	NA		Split	NA	Perm		Split	NA
Protected Phases	5	2		1	6		8	8			4	4
Permitted Phases									8			
Actuated Green, G (s)		12.5		14.5	31.0		8.1	8.1	8.1		0.6	
Effective Green, g (s)		11.6		14.5	30.1		7.5	7.5	7.5		0.6	
Actuated g/C Ratio		0.22		0.27	0.57		0.14	0.14	0.14		0.01	
Clearance Time (s)		4.9		4.0	4.9		4.6	4.6	4.6		4.0	
Vehicle Extension (s)		2.0		2.0	2.0		2.0	2.0	2.0		2.0	
Lane Grp Cap (vph)		749		482	2002		236	238	223		20	
v/s Ratio Prot		0.14		0.16	c0.37		c0.06	0.06			c0.00	
v/s Ratio Perm									0.01			
v/c Ratio		0.66		0.60	0.66		0.45	0.44	0.10		0.20	
Uniform Delay, d1		19.0		16.8	8.0		21.0	20.9	19.9		26.1	
Progression Factor		1.00		1.00	1.00		1.00	1.00	1.00		1.00	
Incremental Delay, d2		1.7		1.5	0.6		0.5	0.5	0.1		1.8	
Delay (s)		20.7		18.3	8.6		21.5	21.4	20.0		27.9	
Level of Service		C		B	A		C	C	B		C	
Approach Delay (s)		20.7			10.4			20.8			27.9	
Approach LOS		C			B			C			C	

Intersection Summary		
HCM 2000 Control Delay	14.1	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.68	B
Actuated Cycle Length (s)	53.2	Sum of lost time (s)
Intersection Capacity Utilization	61.4%	19.0
Analysis Period (min)	15	ICU Level of Service
		B

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
35: Murrieta Blvd & Jack London Blvd
































Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	76	257	623	206	246	167
Future Volume (vph)	76	257	623	206	246	167
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00	1.00	0.95	0.91	
Frt	1.00	0.85	1.00	1.00	0.94	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1770	1583	1770	3539	4776	
Flt Permitted	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	1770	1583	1770	3539	4776	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	83	279	677	224	267	182
RTOR Reduction (vph)	0	238	0	0	152	0
Lane Group Flow (vph)	83	41	677	224	297	0
Turn Type	Prot	Perm	Prot	NA	NA	
Protected Phases	4		5	2	6	
Permitted Phases		4				
Actuated Green, G (s)	8.5	8.5	27.3	40.8	9.5	
Effective Green, g (s)	8.5	8.5	27.3	40.8	9.5	
Actuated g/C Ratio	0.15	0.15	0.48	0.71	0.17	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	262	234	843	2519	791	
v/s Ratio Prot	c0.05		c0.38	0.06	c0.06	
v/s Ratio Perm		0.03				
v/c Ratio	0.32	0.18	0.80	0.09	0.38	
Uniform Delay, d1	21.8	21.3	12.7	2.5	21.3	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.7	0.4	5.6	0.0	0.3	
Delay (s)	22.5	21.7	18.3	2.6	21.6	
Level of Service	C	C	B	A	C	
Approach Delay (s)	21.9			14.4	21.6	
Approach LOS	C			B	C	

Intersection Summary

HCM 2000 Control Delay	17.9	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.62		
Actuated Cycle Length (s)	57.3	Sum of lost time (s)	12.0
Intersection Capacity Utilization	57.2%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
36: Murrieta Blvd & Stanley Blvd

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 	 			 		 	 			 	
Traffic Volume (vph)	210	434	222	17	819	113	431	334	8	153	224	448
Future Volume (vph)	210	434	222	17	819	113	431	334	8	153	224	448
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.9	4.9	4.0	4.9	4.9	4.9	4.9		4.9	4.9	4.0
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.97	0.95		1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	3433	3526		1770	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	3433	3526		1770	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	228	472	241	18	890	123	468	363	9	166	243	487
RTOR Reduction (vph)	0	0	154	0	0	66	0	2	0	0	0	116
Lane Group Flow (vph)	228	472	87	18	890	57	468	370	0	166	243	371
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Prot	NA		Prot	NA	Perm
Protected Phases	7	4		3	8	1	5	2		1	6	
Permitted Phases			4			8						6
Actuated Green, G (s)	5.0	25.4	25.4	0.8	21.2	30.6	10.0	16.6		9.4	16.0	16.0
Effective Green, g (s)	5.0	24.5	24.5	0.8	20.3	28.8	9.1	15.7		8.5	15.1	16.0
Actuated g/C Ratio	0.07	0.36	0.36	0.01	0.30	0.42	0.13	0.23		0.12	0.22	0.23
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	251	1271	568	20	1053	782	458	811		220	783	371
v/s Ratio Prot	c0.07	0.13		0.01	c0.25	0.01	c0.14	0.10		0.09	0.07	
v/s Ratio Perm			0.05			0.03						c0.23
v/c Ratio	0.91	0.37	0.15	0.90	0.85	0.07	1.02	0.46		0.75	0.31	1.00
Uniform Delay, d1	31.4	16.2	14.8	33.7	22.5	11.7	29.6	22.6		28.8	22.2	26.1
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	33.1	0.2	0.1	153.9	6.4	0.0	47.7	0.4		13.7	0.2	47.0
Delay (s)	64.5	16.3	14.9	187.6	28.8	11.8	77.3	23.0		42.5	22.4	73.1
Level of Service	E	B	B	F	C	B	E	C		D	C	E
Approach Delay (s)		27.6			29.6			53.2			53.7	
Approach LOS		C			C			D			D	

Intersection Summary		
HCM 2000 Control Delay	40.3	HCM 2000 Level of Service D
HCM 2000 Volume to Capacity ratio	0.95	
Actuated Cycle Length (s)	68.2	Sum of lost time (s) 18.7
Intersection Capacity Utilization	74.2%	ICU Level of Service D
Analysis Period (min)	15	

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
37: Livermore Ave & I-580 WB Ramps



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↶	↷		↶	↷			↶	↷
Traffic Volume (vph)	0	0	0	344	88	28	444	79	0	0	151	0
Future Volume (vph)	0	0	0	344	88	28	444	79	0	0	151	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)					4.0		4.0	4.0			4.0	
Lane Util. Factor					0.95		0.97	1.00			0.95	
Frt					0.99		1.00	1.00			1.00	
Flt Protected					0.96		0.95	1.00			1.00	
Satd. Flow (prot)					1690		3433	1863			3539	
Flt Permitted					0.96		0.95	1.00			1.00	
Satd. Flow (perm)					1690		3433	1863			3539	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	374	96	30	483	86	0	0	164	0
RTOR Reduction (vph)	0	0	0	0	5	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	0	495	0	483	86	0	0	164	0
Turn Type				Split	NA		Prot	NA			NA	
Protected Phases				8	8		5	2			6	
Permitted Phases												
Actuated Green, G (s)					21.1		12.0	29.2			13.7	
Effective Green, g (s)					21.1		11.5	30.9			15.4	
Actuated g/C Ratio					0.35		0.19	0.51			0.26	
Clearance Time (s)					4.0		3.5	5.7			5.7	
Vehicle Extension (s)					2.0		2.0	2.5			2.5	
Lane Grp Cap (vph)					594		657	959			908	
v/s Ratio Prot					c0.29		c0.14	0.05			c0.05	
v/s Ratio Perm												
v/c Ratio					0.83		0.74	0.09			0.18	
Uniform Delay, d1					17.8		22.8	7.4			17.4	
Progression Factor					1.00		0.73	0.26			1.00	
Incremental Delay, d2					9.4		3.4	0.2			0.4	
Delay (s)					27.2		20.0	2.1			17.8	
Level of Service					C		C	A			B	
Approach Delay (s)		0.0			27.2			17.3			17.8	
Approach LOS		A			C			B			B	

Intersection Summary

HCM 2000 Control Delay	21.4	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.60		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	47.0%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
38: Livermore Ave & I-580 EB Ramps



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕	↗					↕		↗	↕	
Traffic Volume (vph)	15	1	599	0	0	0	0	506	201	17	482	0
Future Volume (vph)	15	1	599	0	0	0	0	506	201	17	482	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0					4.0		4.0	4.0	
Lane Util. Factor		0.95	0.95					0.95		1.00	0.95	
Frt		0.86	0.85					0.96		1.00	1.00	
Flt Protected		1.00	1.00					1.00		0.95	1.00	
Satd. Flow (prot)		1514	1504					3389		1770	3539	
Flt Permitted		1.00	1.00					1.00		0.95	1.00	
Satd. Flow (perm)		1514	1504					3389		1770	3539	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	16	1	651	0	0	0	0	550	218	18	524	0
RTOR Reduction (vph)	0	224	224	0	0	0	0	52	0	0	0	0
Lane Group Flow (vph)	0	112	108	0	0	0	0	716	0	18	524	0
Turn Type	Prot	NA	Perm					NA		Prot	NA	
Protected Phases	7	4						2		1	6	
Permitted Phases			4									
Actuated Green, G (s)		15.9	15.9					30.8		1.3	35.1	
Effective Green, g (s)		15.9	15.9					31.8		0.3	36.1	
Actuated g/C Ratio		0.27	0.27					0.53		0.00	0.60	
Clearance Time (s)		4.0	4.0					5.0		3.0	5.0	
Vehicle Extension (s)		2.0	2.0					2.5		2.0	2.5	
Lane Grp Cap (vph)		401	398					1796		8	2129	
v/s Ratio Prot								c0.21		c0.01	0.15	
v/s Ratio Perm		0.07	0.07									
v/c Ratio		0.28	0.27					0.40		2.25	0.25	
Uniform Delay, d1		17.5	17.5					8.4		29.9	5.6	
Progression Factor		1.00	1.00					1.00		1.10	0.23	
Incremental Delay, d2		0.1	0.1					0.7		803.6	0.2	
Delay (s)		17.6	17.6					9.1		836.3	1.5	
Level of Service		B	B					A		F	A	
Approach Delay (s)		17.6			0.0			9.1			29.2	
Approach LOS		B			A			A			C	





























Intersection Summary

HCM 2000 Control Delay	17.5	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.37		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	47.0%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 39: Livermore Ave & Portola Ave

BART to Livermore Extension Project
 2025 No Project AM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 	 			 			 			 	
Traffic Volume (vph)	216	264	99	30	730	62	329	430	84	99	550	346
Future Volume (vph)	216	264	99	30	730	62	329	430	84	99	550	346
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	5.3	4.0	4.0	5.3	4.0	5.8		4.0	5.8	4.9
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	1.00	0.95		1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.98		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	1770	3453		1770	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	1770	3453		1770	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	235	287	108	33	793	67	358	467	91	108	598	376
RTOR Reduction (vph)	0	0	71	0	0	49	0	14	0	0	0	90
Lane Group Flow (vph)	235	287	37	33	793	18	358	544	0	108	598	286
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA		Prot	NA	pm+ov
Protected Phases	3	8		7	4		1	6		5	2	3
Permitted Phases			8			4						2
Actuated Green, G (s)	11.0	37.0	37.0	3.3	29.3	29.3	24.9	37.9		11.3	24.3	35.3
Effective Green, g (s)	11.0	38.3	37.0	3.3	30.6	29.3	24.9	37.0		11.3	23.4	33.5
Actuated g/C Ratio	0.10	0.36	0.34	0.03	0.28	0.27	0.23	0.34		0.10	0.22	0.31
Clearance Time (s)	4.0	5.3	5.3	4.0	5.3	5.3	4.0	4.9		4.0	4.9	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	350	1258	543	54	1005	430	409	1186		185	768	492
v/s Ratio Prot	c0.07	0.08		0.02	c0.22		c0.20	0.16		0.06	c0.17	0.05
v/s Ratio Perm			0.02			0.01						0.13
v/c Ratio	0.67	0.23	0.07	0.61	0.79	0.04	0.88	0.46		0.58	0.78	0.58
Uniform Delay, d1	46.6	24.3	23.8	51.6	35.6	28.9	39.9	27.5		46.0	39.7	31.2
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	5.0	0.1	0.1	18.7	4.2	0.0	18.4	0.3		4.6	5.0	1.8
Delay (s)	51.6	24.4	23.8	70.3	39.8	28.9	58.3	27.8		50.6	44.7	33.0
Level of Service	D	C	C	E	D	C	E	C		D	D	C
Approach Delay (s)		34.5			40.1			39.7			41.2	
Approach LOS		C			D			D			D	

Intersection Summary		
HCM 2000 Control Delay	39.3	HCM 2000 Level of Service D
HCM 2000 Volume to Capacity ratio	0.80	
Actuated Cycle Length (s)	107.7	Sum of lost time (s) 18.7
Intersection Capacity Utilization	74.6%	ICU Level of Service D
Analysis Period (min)	15	

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
40: First St/Springtown Blvd & I-580 WB Ramps

BART to Livermore Extension Project
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
















Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations			↗↗			↗	↗↗	↑			↖↖	↗
Traffic Volume (vph)	0	0	443	0	0	0	341	375	0	0	875	621
Future Volume (vph)	0	0	443	0	0	0	341	375	0	0	875	621
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)			4.0				4.0	4.0			5.0	5.0
Lane Util. Factor			0.88				0.97	1.00			0.95	1.00
Frt			0.85				1.00	1.00			1.00	0.85
Flt Protected			1.00				0.95	1.00			1.00	1.00
Satd. Flow (prot)			2787				3433	1863			3539	1583
Flt Permitted			1.00				0.95	1.00			1.00	1.00
Satd. Flow (perm)			2787				3433	1863			3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	482	0	0	0	371	408	0	0	951	675
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	62
Lane Group Flow (vph)	0	0	482	0	0	0	371	408	0	0	951	613
Turn Type			Over			Free	Prot	NA			NA	Perm
Protected Phases			5				5	2			6	
Permitted Phases						Free						6
Actuated Green, G (s)			21.7				21.7	100.0			70.3	70.3
Effective Green, g (s)			21.2				21.2	100.0			69.8	69.8
Actuated g/C Ratio			0.21				0.21	1.00			0.70	0.70
Clearance Time (s)			3.5				3.5	4.0			4.5	4.5
Vehicle Extension (s)			2.0				2.0	0.2			4.0	4.0
Lane Grp Cap (vph)			590				727	1863			2470	1104
v/s Ratio Prot			c0.17				0.11	0.22			0.27	
v/s Ratio Perm												c0.39
v/c Ratio			0.82				0.51	0.22			0.39	0.56
Uniform Delay, d1			37.6				34.8	0.0			6.2	7.4
Progression Factor			1.00				1.02	1.00			1.00	1.00
Incremental Delay, d2			8.2				0.2	0.3			0.1	0.8
Delay (s)			45.7				35.9	0.3			6.4	8.2
Level of Service			D				D	A			A	A
Approach Delay (s)		45.7			0.0			17.2			7.1	
Approach LOS		D			A			B			A	

Intersection Summary

HCM 2000 Control Delay	16.3	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.62		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	55.7%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 41: First St & I-580 EB Ramps

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations													
Traffic Volume (vph)	95	1	355	0	0	0	0	628	313	65	1223	0	
Future Volume (vph)	95	1	355	0	0	0	0	628	313	65	1223	0	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)		4.0	4.0					5.0	5.0	4.0	5.0		
Lane Util. Factor		1.00	0.88					0.95	1.00	1.00	0.95		
Frt		1.00	0.85					1.00	0.85	1.00	1.00		
Flt Protected		0.95	1.00					1.00	1.00	0.95	1.00		
Satd. Flow (prot)		1775	2787					3539	1583	1770	3539		
Flt Permitted		0.95	1.00					1.00	1.00	0.95	1.00		
Satd. Flow (perm)		1775	2787					3539	1583	1770	3539		
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	
Adj. Flow (vph)	103	1	386	0	0	0	0	683	340	71	1329	0	
RTOR Reduction (vph)	0	0	108	0	0	0	0	0	169	0	0	0	
Lane Group Flow (vph)	0	104	278	0	0	0	0	683	171	71	1329	0	
Turn Type	Perm	NA	Perm					NA	Perm	Prot	NA		
Protected Phases		4						2		1	6		
Permitted Phases	4		4						2				
Actuated Green, G (s)		9.2	9.2					25.7	25.7	4.1	32.8		
Effective Green, g (s)		8.7	8.7					25.2	25.2	3.1	32.3		
Actuated g/C Ratio		0.17	0.17					0.50	0.50	0.06	0.65		
Clearance Time (s)		3.5	3.5					4.5	4.5	3.0	4.5		
Vehicle Extension (s)		2.5	2.5					4.0	4.0	2.0	4.0		
Lane Grp Cap (vph)		308	484					1783	797	109	2286		
v/s Ratio Prot								0.19		0.04	c0.38		
v/s Ratio Perm		0.06	c0.10						0.11				
v/c Ratio		0.34	0.57					0.38	0.22	0.65	0.58		
Uniform Delay, d1		18.1	18.9					7.6	6.9	22.9	5.0		
Progression Factor		1.00	1.00					1.00	1.00	1.00	1.03		
Incremental Delay, d2		0.5	1.4					0.6	0.6	9.2	1.0		
Delay (s)		18.6	20.3					8.2	7.5	32.1	6.1		
Level of Service		B	C					A	A	C	A		
Approach Delay (s)		19.9			0.0			8.0			7.5		
Approach LOS		B			A			A			A		
Intersection Summary													
HCM 2000 Control Delay			9.8									HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio			0.64										
Actuated Cycle Length (s)			50.0									Sum of lost time (s)	13.0
Intersection Capacity Utilization			53.7%									ICU Level of Service	A
Analysis Period (min)			15										
c Critical Lane Group													

HCM Signalized Intersection Capacity Analysis
42: 1st St & Mines Rd






















Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗		↖↗	↑	↖	↖	↑↑↑		↖↗	↑↑↑	
Traffic Volume (vph)	33	70	42	539	108	333	18	839	304	214	1245	20
Future Volume (vph)	33	70	42	539	108	333	18	839	304	214	1245	20
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		0.97	1.00	1.00	1.00	0.91		0.97	0.91	
Frt	1.00	0.94		1.00	1.00	0.85	1.00	0.96		1.00	1.00	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1757		3433	1863	1583	1770	4883		3433	5073	
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	1757		3433	1863	1583	1770	4883		3433	5073	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	36	76	46	586	117	362	20	912	330	233	1353	22
RTOR Reduction (vph)	0	35	0	0	0	77	0	86	0	0	2	0
Lane Group Flow (vph)	36	87	0	586	117	285	20	1156	0	233	1373	0
Turn Type	Prot	NA		Prot	NA	pm+ov	Prot	NA		Prot	NA	
Protected Phases	7	4		3	8	1	5	2		1	6	
Permitted Phases						8						
Actuated Green, G (s)	1.8	8.5		12.2	18.9	25.0	0.7	22.7		6.1	28.1	
Effective Green, g (s)	1.8	8.5		12.2	18.9	25.0	0.7	22.7		6.1	28.1	
Actuated g/C Ratio	0.03	0.13		0.19	0.29	0.38	0.01	0.35		0.09	0.43	
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	48	228		639	537	700	18	1692		319	2176	
v/s Ratio Prot	0.02	0.05		c0.17	0.06	c0.04	0.01	0.24		c0.07	c0.27	
v/s Ratio Perm						0.14						
v/c Ratio	0.75	0.38		0.92	0.22	0.41	1.11	0.68		0.73	0.63	
Uniform Delay, d1	31.6	26.1		26.2	17.7	14.8	32.4	18.3		28.9	14.6	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	48.1	1.1		18.0	0.2	0.4	250.0	1.2		8.3	0.6	
Delay (s)	79.7	27.2		44.1	17.9	15.2	282.4	19.5		37.2	15.2	
Level of Service	E	C		D	B	B	F	B		D	B	
Approach Delay (s)		39.1			31.4			23.6			18.4	
Approach LOS		D			C			C			B	

Intersection Summary




















HCM 2000 Control Delay	24.2	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.75		
Actuated Cycle Length (s)	65.5	Sum of lost time (s)	16.0
Intersection Capacity Utilization	61.2%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Unsignalized Intersection Capacity Analysis
43: Vasco Rd & I-580 WB Ramps

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations								 				
Traffic Volume (veh/h)	0	0	0	0	0	169	0	827	0	0	1533	0
Future Volume (Veh/h)	0	0	0	0	0	169	0	827	0	0	1533	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	0	0	0	184	0	899	0	0	1666	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage (veh)												
Upstream signal (ft)											487	
pX, platoon unblocked												
vC, conflicting volume	2300	2565	1666	2565	2565	450	1666			899		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	2300	2565	1666	2565	2565	450	1666			899		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	100	100	67	100			100		
cM capacity (veh/h)	14	26	86	13	26	557	382			751		
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	SB 1	SB 2					
Volume Total	0	184	450	450	0	1666	0					
Volume Left	0	0	0	0	0	0	0					
Volume Right	0	184	0	0	0	0	0					
cSH	1700	557	1700	1700	1700	1700	1700					
Volume to Capacity	0.00	0.33	0.26	0.26	0.00	0.98	0.00					
Queue Length 95th (ft)	0	36	0	0	0	0	0					
Control Delay (s)	0.0	14.6	0.0	0.0	0.0	0.0	0.0					
Lane LOS	A	B										
Approach Delay (s)	0.0	14.6	0.0			0.0						
Approach LOS	A	B										
Intersection Summary												
Average Delay			1.0									
Intersection Capacity Utilization			84.0%	ICU Level of Service	E							
Analysis Period (min)			15									

HCM Unsignalized Intersection Capacity Analysis
44: Vasco Rd & I-580 EB Ramps

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	0	0	0	0	1151	0	73	1757	0
Future Volume (Veh/h)	0	0	0	0	0	0	0	1151	0	73	1757	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	0	0	0	0	0	1251	0	79	1910	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	2694	3319	1910	3319	3319	626	1910			1251		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	2694	3319	1910	3319	3319	626	1910			1251		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	100	100	100	100			86		
cM capacity (veh/h)	9	7	58	3	7	427	307			552		
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2						
Volume Total	0	0	834	417	79	1910						
Volume Left	0	0	0	0	79	0						
Volume Right	0	0	0	0	0	0						
cSH	1700	1700	1700	1700	552	1700						
Volume to Capacity	0.00	0.00	0.49	0.25	0.14	1.12						
Queue Length 95th (ft)	0	0	0	0	12	0						
Control Delay (s)	0.0	0.0	0.0	0.0	12.6	0.0						
Lane LOS	A	A			B							
Approach Delay (s)	0.0	0.0	0.0		0.5							
Approach LOS	A	A										
Intersection Summary												
Average Delay			0.3									
Intersection Capacity Utilization			95.8%	ICU Level of Service	F							
Analysis Period (min)			15									

HCM Signalized Intersection Capacity Analysis
45: Vasco Rd & East Ave

BART to Livermore Extension Project
2025 No Project AM



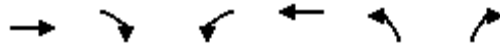
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	278	325	50	7	17	14	62	250	182	235	286	278
Future Volume (vph)	278	325	50	7	17	14	62	250	182	235	286	278
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	0.95		0.97	1.00	1.00
Frt	1.00	0.98		1.00	0.93		1.00	0.94		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	3469		1770	3298		1770	3316		3433	1863	1583
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1770	3469		1770	3298		1770	3316		3433	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	302	353	54	8	18	15	67	272	198	255	311	302
RTOR Reduction (vph)	0	21	0	0	14	0	0	145	0	0	0	203
Lane Group Flow (vph)	302	386	0	8	19	0	67	325	0	255	311	99
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												6
Actuated Green, G (s)	12.2	14.3		0.6	2.7		2.2	13.2		5.2	16.2	16.2
Effective Green, g (s)	12.2	14.3		0.6	2.7		2.2	13.2		5.2	16.2	16.2
Actuated g/C Ratio	0.25	0.29		0.01	0.05		0.04	0.27		0.11	0.33	0.33
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	438	1006		21	180		78	887		362	612	520
v/s Ratio Prot	c0.17	c0.11		0.00	0.01		0.04	0.10		c0.07	c0.17	
v/s Ratio Perm												0.06
v/c Ratio	0.69	0.38		0.38	0.10		0.86	0.37		0.70	0.51	0.19
Uniform Delay, d1	16.8	14.0		24.2	22.2		23.4	14.7		21.3	13.3	11.9
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	4.5	0.2		11.2	0.3		56.5	0.3		6.1	0.7	0.2
Delay (s)	21.3	14.2		35.3	22.4		79.9	14.9		27.4	14.0	12.0
Level of Service	C	B		D	C		E	B		C	B	B
Approach Delay (s)		17.2			24.9			23.0			17.3	
Approach LOS		B			C			C			B	

Intersection Summary

HCM 2000 Control Delay	18.8	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.64		
Actuated Cycle Length (s)	49.3	Sum of lost time (s)	16.0
Intersection Capacity Utilization	51.5%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Unsignalized Intersection Capacity Analysis
 46: I-580 WB Ramps & Northfront Rd/Northfront Road



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↻			↻	↻	↻
Traffic Volume (veh/h)	117	224	1333	123	65	540
Future Volume (Veh/h)	117	224	1333	123	65	540
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	127	243	1449	134	71	587
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None		None			
Median storage (veh)						
Upstream signal (ft)	1007					
pX, platoon unblocked					0.50	
vC, conflicting volume			127	3280		248
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			127	5036	248	
tC, single (s)			4.1	6.4	6.2	
tC, 2 stage (s)						
tF (s)			2.2	3.5	3.3	
p0 queue free %			1	0	26	
cM capacity (veh/h)			1459	0	790	
Direction, Lane #	EB 1	WB 1	NB 1	NB 2		
Volume Total	370	1583	71	587		
Volume Left	0	1449	71	0		
Volume Right	243	0	0	587		
cSH	1700	1459	0	790		
Volume to Capacity	0.22	0.99	Err	0.74		
Queue Length 95th (ft)	0	567	Err	171		
Control Delay (s)	0.0	39.1	Err	21.5		
Lane LOS	E		F	C		
Approach Delay (s)	0.0	39.1	1098.1			
Approach LOS	F					
Intersection Summary						
Average Delay	300.5					
Intersection Capacity Utilization	113.8%		ICU Level of Service		H	
Analysis Period (min)	15					

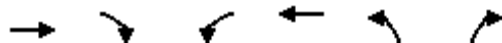
Intersection	
Intersection Delay, s/veh	10
Intersection LOS	A

Movement	EBU	EBL	EBT	WBU	WBT	WBR	SBU	SBL	SBR
Lane Configurations		↘	↗↗		↗	↘		↘↘	↗
Traffic Vol, veh/h	0	42	27	0	166	106	0	310	83
Future Vol, veh/h	0	42	27	0	166	106	0	310	83
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	46	29	0	180	115	0	337	90
Number of Lanes	0	1	2	0	1	1	0	2	1

Approach	EB	WB	SB
Opposing Approach	WB	EB	
Opposing Lanes	2	3	0
Conflicting Approach Left	SB		WB
Conflicting Lanes Left	3	0	2
Conflicting Approach Right		SB	EB
Conflicting Lanes Right	0	3	3
HCM Control Delay	9.5	10.2	10
HCM LOS	A	B	A

Lane	EBLn1	EBLn2	EBLn3	WBLn1	WBLn2	SBLn1	SBLn2	SBLn3
Vol Left, %	100%	0%	0%	0%	0%	100%	100%	0%
Vol Thru, %	0%	100%	100%	100%	0%	0%	0%	0%
Vol Right, %	0%	0%	0%	0%	100%	0%	0%	100%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	42	14	14	166	106	155	155	83
LT Vol	42	0	0	0	0	155	155	0
Through Vol	0	14	14	166	0	0	0	0
RT Vol	0	0	0	0	106	0	0	83
Lane Flow Rate	46	15	15	180	115	168	168	90
Geometry Grp	8	8	8	8	8	7	7	7
Degree of Util (X)	0.087	0.026	0.019	0.293	0.164	0.279	0.279	0.076
Departure Headway (Hd)	6.894	6.388	4.634	5.838	5.132	5.955	5.955	3.019
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cap	523	564	777	610	691	598	598	1163
Service Time	4.594	4.088	2.334	3.627	2.92	3.737	3.737	0.8
HCM Lane V/C Ratio	0.088	0.027	0.019	0.295	0.166	0.281	0.281	0.077
HCM Control Delay	10.2	9.3	7.4	11.1	8.9	11.1	11.1	6.1
HCM Lane LOS	B	A	A	B	A	B	B	A
HCM 95th-tile Q	0.3	0.1	0.1	1.2	0.6	1.1	1.1	0.2

HCM Signalized Intersection Capacity Analysis
48: Greenville Rd & Northfront Road/Altamont Pass Road



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↑	↑	↑	↑	↑
Traffic Volume (vph)	4	652	270	860	613	62
Future Volume (vph)	4	652	270	860	613	62
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	1863	1583	1770	1863	1770	1583
Flt Permitted	1.00	1.00	0.76	1.00	0.95	1.00
Satd. Flow (perm)	1863	1583	1407	1863	1770	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	4	709	293	935	666	67
RTOR Reduction (vph)	0	335	0	0	0	22
Lane Group Flow (vph)	4	374	293	935	666	45
Turn Type	NA	Perm	Perm	NA	Prot	Perm
Protected Phases	4			8	2	
Permitted Phases		4	8			2
Actuated Green, G (s)	60.0	60.0	60.0	60.0	45.7	45.7
Effective Green, g (s)	60.0	60.0	60.0	60.0	45.7	45.7
Actuated g/C Ratio	0.53	0.53	0.53	0.53	0.40	0.40
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	983	835	742	983	711	636
v/s Ratio Prot	0.00			c0.50	c0.38	
v/s Ratio Perm		0.24	0.21			0.03
v/c Ratio	0.00	0.45	0.39	0.95	0.94	0.07
Uniform Delay, d1	12.7	16.6	16.0	25.5	32.6	20.9
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.0	0.4	0.3	18.0	19.7	0.0
Delay (s)	12.7	17.0	16.4	43.5	52.3	21.0
Level of Service	B	B	B	D	D	C
Approach Delay (s)	17.0			37.0	49.4	
Approach LOS	B			D	D	

Intersection Summary

HCM 2000 Control Delay	35.1	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.94		
Actuated Cycle Length (s)	113.7	Sum of lost time (s)	8.0
Intersection Capacity Utilization	85.9%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	119	230	138	550	745	130
Future Volume (vph)	119	230	138	550	745	130
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.2	5.2	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.88	0.97	0.95	0.95	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	3433	2787	3433	3539	3539	1583
Flt Permitted	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (perm)	3433	2787	3433	3539	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	129	250	150	598	810	141
RTOR Reduction (vph)	0	218	0	0	0	75
Lane Group Flow (vph)	129	32	150	598	810	66
Turn Type	Prot	Perm	Prot	NA	NA	Perm
Protected Phases	8		1	6	2	
Permitted Phases		8				2
Actuated Green, G (s)	5.7	5.7	3.1	24.4	17.3	17.3
Effective Green, g (s)	5.1	5.1	3.1	26.1	19.0	19.0
Actuated g/C Ratio	0.13	0.13	0.08	0.65	0.47	0.47
Clearance Time (s)	4.6	4.6	4.0	5.7	5.7	5.7
Vehicle Extension (s)	5.0	5.0	6.0	2.5	2.5	2.5
Lane Grp Cap (vph)	433	351	263	2286	1664	744
v/s Ratio Prot	c0.04		c0.04	0.17	c0.23	
v/s Ratio Perm		0.01				0.04
v/c Ratio	0.30	0.09	0.57	0.26	0.49	0.09
Uniform Delay, d1	16.0	15.6	18.0	3.0	7.4	5.9
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.8	0.2	5.8	0.0	0.2	0.0
Delay (s)	16.8	15.8	23.8	3.1	7.5	6.0
Level of Service	B	B	C	A	A	A
Approach Delay (s)	16.2			7.3	7.3	
Approach LOS	B			A	A	

Intersection Summary

HCM 2000 Control Delay	8.9	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.46		
Actuated Cycle Length (s)	40.4	Sum of lost time (s)	13.2
Intersection Capacity Utilization	38.9%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
50: Greenville Rd & Patterson Pass Rd

BART to Livermore Extension Project
2025 No Project AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	29	3	25	226	404	587	9	145	1	9	340	53
Future Volume (vph)	29	3	25	226	404	587	9	145	1	9	340	53
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.86		1.00	0.91		1.00	1.00		1.00	0.98	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1611		1770	1697		1770	1861		1770	1825	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	1611		1770	1697		1770	1861		1770	1825	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	32	3	27	246	439	638	10	158	1	10	370	58
RTOR Reduction (vph)	0	20	0	0	41	0	0	0	0	0	5	0
Lane Group Flow (vph)	32	10	0	246	1036	0	10	159	0	10	423	0
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												
Actuated Green, G (s)	2.3	30.6		40.9	69.2		0.7	27.1		0.7	27.1	
Effective Green, g (s)	2.3	30.6		40.9	69.2		0.7	27.1		0.7	27.1	
Actuated g/C Ratio	0.02	0.27		0.35	0.60		0.01	0.24		0.01	0.24	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	35	427		627	1018		10	437		10	428	
v/s Ratio Prot	c0.02	0.01		0.14	c0.61		c0.01	0.09		0.01	c0.23	
v/s Ratio Perm												
v/c Ratio	0.91	0.02		0.39	1.02		1.00	0.36		1.00	0.99	
Uniform Delay, d1	56.4	31.3		27.9	23.0		57.3	36.9		57.3	44.0	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	116.7	0.0		0.4	32.7		284.6	2.3		284.6	40.9	
Delay (s)	173.1	31.3		28.3	55.7		341.9	39.2		341.9	84.9	
Level of Service	F	C		C	E		F	D		F	F	
Approach Delay (s)		104.5			50.6			57.1			90.7	
Approach LOS		F			D			E			F	

Intersection Summary

HCM 2000 Control Delay	61.7	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.01		
Actuated Cycle Length (s)	115.3	Sum of lost time (s)	16.0
Intersection Capacity Utilization	85.0%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
1: Dougherty Rd & Amador Valley Rd



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	330	454	599	1923	1077	208
Future Volume (vph)	330	454	599	1923	1077	208
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5	5.7	5.7	
Lane Util. Factor	1.00	1.00	0.97	0.91	0.91	
Frt	1.00	0.85	1.00	1.00	0.98	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1770	1583	3433	5085	4962	
Flt Permitted	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	1770	1583	3433	5085	4962	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	359	493	651	2090	1171	226
RTOR Reduction (vph)	0	228	0	0	29	0
Lane Group Flow (vph)	359	265	651	2090	1368	0
Turn Type	Perm	Perm	Prot	NA	NA	
Protected Phases			5	2	6	
Permitted Phases	4	4				
Actuated Green, G (s)	21.1	21.1	13.6	54.7	36.6	
Effective Green, g (s)	21.1	21.1	13.6	54.7	36.6	
Actuated g/C Ratio	0.25	0.25	0.16	0.64	0.43	
Clearance Time (s)	4.5	4.5	4.5	5.7	5.7	
Vehicle Extension (s)	1.8	1.8	2.0	4.0	4.0	
Lane Grp Cap (vph)	434	388	542	3234	2111	
v/s Ratio Prot			c0.19	c0.41	0.28	
v/s Ratio Perm	c0.20	0.17				
v/c Ratio	0.83	0.68	1.20	0.65	0.65	
Uniform Delay, d1	30.7	29.4	36.2	9.7	19.6	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	11.7	3.9	107.2	0.5	0.8	
Delay (s)	42.4	33.4	143.4	10.2	20.4	
Level of Service	D	C	F	B	C	
Approach Delay (s)	37.2			41.8	20.4	
Approach LOS	D			D	C	

Intersection Summary

HCM 2000 Control Delay	35.0	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.83		
Actuated Cycle Length (s)	86.0	Sum of lost time (s)	14.7
Intersection Capacity Utilization	73.1%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
2: Dougherty Rd & Dublin Blvd



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↑↑↑	↖↗	↖↗↘	↑↑↑	↖	↖↗↘	↑↑↑	↖↗	↖↗	↑↑↑	↖↗
Traffic Volume (vph)	81	1026	929	536	801	654	843	1851	308	622	1256	35
Future Volume (vph)	81	1026	929	536	801	654	843	1851	308	622	1256	35
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	6.0	5.0	5.0	5.5	5.0	5.0	5.5	5.0	5.0	5.5	
Lane Util. Factor	0.97	0.91	0.88	0.94	0.91	1.00	0.94	0.91	0.88	0.97	0.86	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	3433	5085	2787	4990	5085	1583	4990	5085	2787	3433	6382	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	3433	5085	2787	4990	5085	1583	4990	5085	2787	3433	6382	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	88	1115	1010	583	871	711	916	2012	335	676	1365	38
RTOR Reduction (vph)	0	0	36	0	0	61	0	0	34	0	3	0
Lane Group Flow (vph)	88	1115	974	583	871	650	916	2012	301	676	1400	0
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	
Protected Phases	5	2	3	1	6	7	3	8	1	7	4	
Permitted Phases			2			6			8			
Actuated Green, G (s)	15.0	35.0	54.8	17.5	38.0	52.1	19.8	45.0	62.5	14.1	39.3	
Effective Green, g (s)	15.0	35.0	54.8	17.5	38.0	52.1	19.8	45.0	62.5	14.1	39.3	
Actuated g/C Ratio	0.11	0.26	0.41	0.13	0.29	0.39	0.15	0.34	0.47	0.11	0.30	
Clearance Time (s)	5.0	6.0	5.0	5.0	5.5	5.0	5.0	5.5	5.0	5.0	5.5	
Vehicle Extension (s)	2.0	4.5	2.0	2.0	4.5	2.0	2.0	4.5	2.0	2.0	4.5	
Lane Grp Cap (vph)	386	1337	1147	656	1451	619	742	1719	1308	363	1884	
v/s Ratio Prot	0.03	0.22	0.13	c0.12	0.17	c0.11	c0.18	c0.40	0.03	c0.20	0.22	
v/s Ratio Perm			0.22			0.30			0.08			
v/c Ratio	0.23	0.83	0.85	0.89	0.60	1.05	1.23	1.17	0.23	1.86	0.74	
Uniform Delay, d1	53.8	46.3	35.4	56.8	41.0	40.5	56.6	44.0	21.0	59.5	42.3	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.1	5.0	5.8	13.5	0.9	49.8	117.0	83.3	0.0	398.4	1.8	
Delay (s)	53.9	51.3	41.2	70.4	41.9	90.3	173.7	127.4	21.0	457.9	44.2	
Level of Service	D	D	D	E	D	F	F	F	C	F	D	
Approach Delay (s)		46.8			65.5			129.5			178.7	
Approach LOS		D			E			F			F	

Intersection Summary

HCM 2000 Control Delay	106.9	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.21		
Actuated Cycle Length (s)	133.1	Sum of lost time (s)	21.5
Intersection Capacity Utilization	103.7%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
3: Dougherty Rd & I-580 WB Ramps



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations				↔↔		↔↔		↑↑↑			↑↑↑	↔	
Traffic Volume (vph)	0	0	0	314	0	667	0	2364	0	0	1646	0	
Future Volume (vph)	0	0	0	314	0	667	0	2364	0	0	1646	0	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)				4.0		4.0		4.0			4.0		
Lane Util. Factor				0.97		0.88		0.91			0.86		
Frt				1.00		0.85		1.00			1.00		
Flt Protected				0.95		1.00		1.00			1.00		
Satd. Flow (prot)				3433		2787		5085			4806		
Flt Permitted				0.95		1.00		1.00			1.00		
Satd. Flow (perm)				3433		2787		5085			4806		
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	
Adj. Flow (vph)	0	0	0	341	0	725	0	2570	0	0	1789	0	
RTOR Reduction (vph)	0	0	0	0	0	17	0	0	0	0	0	0	
Lane Group Flow (vph)	0	0	0	341	0	708	0	2570	0	0	1789	0	
Turn Type				Prot		Prot		NA			NA	Perm	
Protected Phases				4		4		2			6		
Permitted Phases												6	
Actuated Green, G (s)				32.0		32.0		67.2			67.2		
Effective Green, g (s)				33.4		33.4		68.6			68.6		
Actuated g/C Ratio				0.30		0.30		0.62			0.62		
Clearance Time (s)				5.4		5.4		5.4			5.4		
Vehicle Extension (s)				3.0		3.0		3.0			3.0		
Lane Grp Cap (vph)				1042		846		3171			2997		
v/s Ratio Prot				0.10		c0.25		c0.51			0.37		
v/s Ratio Perm													
v/c Ratio				0.33		0.84		0.81			0.60		
Uniform Delay, d1				29.6		35.8		15.8			12.4		
Progression Factor				1.00		1.00		0.67			1.00		
Incremental Delay, d2				0.2		7.2		0.8			0.9		
Delay (s)				29.8		43.0		11.3			13.3		
Level of Service				C		D		B			B		
Approach Delay (s)		0.0			38.8			11.3			13.3		
Approach LOS		A			D			B			B		
Intersection Summary													
HCM 2000 Control Delay			17.4		HCM 2000 Level of Service						B		
HCM 2000 Volume to Capacity ratio			0.82										
Actuated Cycle Length (s)			110.0		Sum of lost time (s)						8.0		
Intersection Capacity Utilization			75.7%		ICU Level of Service						D		
Analysis Period (min)			15										

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 4: Hopyard Rd/Dougherty Rd & I-580 EB Ramps



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗		↖↗					↑↑↑	↖		↑↑↑	↖
Traffic Volume (vph)	1106	0	855	0	0	0	0	2466	0	0	1146	0
Future Volume (vph)	1106	0	855	0	0	0	0	2466	0	0	1146	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0					4.0			4.0	
Lane Util. Factor	0.97		0.88					0.91			0.86	
Frt	1.00		0.85					1.00			1.00	
Flt Protected	0.95		1.00					1.00			1.00	
Satd. Flow (prot)	3433		2787					5085			4806	
Flt Permitted	0.95		1.00					1.00			1.00	
Satd. Flow (perm)	3433		2787					5085			4806	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	1202	0	929	0	0	0	0	2680	0	0	1246	0
RTOR Reduction (vph)	0	0	60	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	1202	0	869	0	0	0	0	2680	0	0	1246	0
Turn Type	Prot		Prot					NA	Free		NA	Perm
Protected Phases	4		4					2			6	
Permitted Phases									Free			6
Actuated Green, G (s)	39.6		39.6					59.6			59.6	
Effective Green, g (s)	41.0		41.0					61.0			61.0	
Actuated g/C Ratio	0.37		0.37					0.55			0.55	
Clearance Time (s)	5.4		5.4					5.4			5.4	
Vehicle Extension (s)	3.0		3.0					3.0			3.0	
Lane Grp Cap (vph)	1279		1038					2819			2665	
v/s Ratio Prot	c0.35		0.31					c0.53			0.26	
v/s Ratio Perm												
v/c Ratio	0.94		0.84					0.95			0.47	
Uniform Delay, d1	33.3		31.5					23.1			14.7	
Progression Factor	1.00		1.00					1.00			1.41	
Incremental Delay, d2	13.1		6.0					8.8			0.5	
Delay (s)	46.4		37.5					31.9			21.3	
Level of Service	D		D					C			C	
Approach Delay (s)		42.5			0.0			31.9			21.3	
Approach LOS		D			A			C			C	

Intersection Summary		
HCM 2000 Control Delay	33.5	HCM 2000 Level of Service C
HCM 2000 Volume to Capacity ratio	0.95	
Actuated Cycle Length (s)	110.0	Sum of lost time (s) 8.0
Intersection Capacity Utilization	85.9%	ICU Level of Service E
Analysis Period (min)	15	

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
5: Hopyard Rd & Owens Rd

BART to Livermore Extension Project
2025 No Project PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↘	↔↗		↘	↔	↗	↘	↑↑↑	↗	↗↘	↑↑↗	
Traffic Volume (vph)	369	247	300	520	285	286	274	895	259	337	1469	242
Future Volume (vph)	369	247	300	520	285	286	274	895	259	337	1469	242
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	2.7	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	0.91	0.91		1.00	0.95	0.95	1.00	0.91	1.00	0.97	0.91	
Frt	1.00	0.94		1.00	0.96	0.85	1.00	1.00	0.85	1.00	0.98	
Flt Protected	0.95	0.99		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1610	3140		1770	1707	1504	1770	5085	1583	3433	4977	
Flt Permitted	0.95	0.99		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1610	3140		1770	1707	1504	1770	5085	1583	3433	4977	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	401	268	326	565	310	311	298	973	282	366	1597	263
RTOR Reduction (vph)	0	99	0	0	9	77	0	0	186	0	19	0
Lane Group Flow (vph)	221	675	0	565	397	138	298	973	96	366	1841	0
Turn Type	Split	NA		Split	NA	pm+ov	Prot	NA	Perm	Prot	NA	
Protected Phases	8	8		4	4	1	5	2		1	6	
Permitted Phases						4			2			
Actuated Green, G (s)	16.7	16.7		26.7	26.7	43.8	15.0	39.2	39.2	17.1	41.3	
Effective Green, g (s)	18.0	18.0		28.0	28.0	46.4	15.0	40.9	40.9	17.1	43.0	
Actuated g/C Ratio	0.15	0.15		0.23	0.23	0.39	0.12	0.34	0.34	0.14	0.36	
Clearance Time (s)	5.3	5.3		5.3	5.3	4.0	4.0	5.7	5.7	4.0	5.7	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	241	471		413	398	581	221	1733	539	489	1783	
v/s Ratio Prot	0.14	c0.22		c0.32	0.23	0.04	c0.17	0.19		0.11	c0.37	
v/s Ratio Perm						0.06			0.06			
v/c Ratio	0.92	1.43		1.37	1.00	0.24	1.35	0.56	0.18	0.75	1.03	
Uniform Delay, d1	50.3	51.0		46.0	46.0	24.9	52.5	32.2	27.8	49.4	38.5	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	36.0	207.2		180.5	44.0	0.2	183.7	1.3	0.7	6.2	30.2	
Delay (s)	86.2	258.2		226.5	90.0	25.1	236.2	33.6	28.5	55.6	68.7	
Level of Service	F	F		F	F	C	F	C	C	E	E	
Approach Delay (s)		220.0			143.2			71.5			66.6	
Approach LOS		F			F			E			E	

Intersection Summary

HCM 2000 Control Delay	108.7	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.24		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	109.2%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
6: Hopyard Rd & Stoneridge Dr

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	265	1381	703	119	1309	188	592	823	103	288	853	185
Future Volume (vph)	265	1381	703	119	1309	188	592	823	103	288	853	185
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.91	1.00	0.97	0.91	1.00	0.94	0.95	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5085	1583	3433	5085	1583	4990	3539	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5085	1583	3433	5085	1583	4990	3539	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	288	1501	764	129	1423	204	643	895	112	313	927	201
RTOR Reduction (vph)	0	0	193	0	0	136	0	0	80	0	0	155
Lane Group Flow (vph)	288	1501	571	129	1423	68	643	895	32	313	927	46
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8			2			6
Actuated Green, G (s)	9.0	35.0	35.0	4.0	30.0	30.0	13.8	25.5	25.5	9.0	20.7	20.7
Effective Green, g (s)	9.0	35.0	35.0	4.0	30.0	30.0	13.8	25.5	25.5	9.0	20.7	20.7
Actuated g/C Ratio	0.10	0.39	0.39	0.04	0.34	0.34	0.15	0.28	0.28	0.10	0.23	0.23
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	345	1988	619	153	1704	530	769	1008	451	345	1176	366
v/s Ratio Prot	c0.08	0.30		0.04	0.28		c0.13	c0.25		0.09	0.18	
v/s Ratio Perm			c0.36			0.04			0.02			0.03
v/c Ratio	0.83	0.76	0.92	0.84	0.84	0.13	0.84	0.89	0.07	0.91	0.79	0.13
Uniform Delay, d1	39.5	23.5	26.0	42.4	27.5	20.7	36.8	30.6	23.4	39.8	32.3	27.2
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	15.8	1.7	19.4	32.3	3.7	0.1	7.9	9.6	0.1	26.3	3.6	0.2
Delay (s)	55.3	25.2	45.3	74.7	31.2	20.8	44.6	40.2	23.4	66.1	35.9	27.4
Level of Service	E	C	D	E	C	C	D	D	C	E	D	C
Approach Delay (s)		34.6			33.2			40.8			41.3	
Approach LOS		C			C			D			D	

Intersection Summary

HCM 2000 Control Delay	37.0	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.95		
Actuated Cycle Length (s)	89.5	Sum of lost time (s)	16.0
Intersection Capacity Utilization	77.2%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
7: Hopyard Rd & Las Positas Blvd

BART to Livermore Extension Project
2025 No Project PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↑↑	↖	↖↗	↑↑	↖	↖↗	↑↑↑	↖	↖↗	↑↑↑	↖
Traffic Volume (vph)	100	250	423	538	407	51	343	939	244	72	1384	73
Future Volume (vph)	100	250	423	538	407	51	343	939	244	72	1384	73
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.95	1.00	0.97	0.95	1.00	0.97	0.91	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	3433	3539	1583	3433	5085	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	3433	3539	1583	3433	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	109	272	460	585	442	55	373	1021	265	78	1504	79
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	52
Lane Group Flow (vph)	109	272	460	585	442	55	373	1021	265	78	1504	27
Turn Type	Prot	NA	Free	Prot	NA	Free	Prot	NA	Free	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1		6
Permitted Phases			Free			Free			Free			6
Actuated Green, G (s)	4.0	11.9	76.8	14.0	21.9	76.8	9.0	30.9	76.8	4.0	25.9	25.9
Effective Green, g (s)	4.0	11.9	76.8	14.0	21.9	76.8	9.0	30.9	76.8	4.0	25.9	25.9
Actuated g/C Ratio	0.05	0.15	1.00	0.18	0.29	1.00	0.12	0.40	1.00	0.05	0.34	0.34
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	178	548	1583	625	1009	1583	402	2045	1583	178	1714	533
v/s Ratio Prot	0.03	0.08		c0.17	c0.12		c0.11	0.20		0.02	c0.30	
v/s Ratio Perm			0.29			0.03			0.17			0.02
v/c Ratio	0.61	0.50	0.29	0.94	0.44	0.03	0.93	0.50	0.17	0.44	0.88	0.05
Uniform Delay, d1	35.6	29.7	0.0	31.0	22.4	0.0	33.6	17.2	0.0	35.3	24.0	17.2
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	6.1	0.7	0.5	21.4	0.3	0.0	27.3	0.2	0.2	1.7	5.4	0.0
Delay (s)	41.8	30.4	0.5	52.4	22.7	0.0	60.9	17.4	0.2	37.0	29.4	17.2
Level of Service	D	C	A	D	C	A	E	B	A	D	C	B
Approach Delay (s)		15.5			37.6			24.4			29.2	
Approach LOS		B			D			C			C	


































Intersection Summary

HCM 2000 Control Delay	27.2	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.83		
Actuated Cycle Length (s)	76.8	Sum of lost time (s)	16.0
Intersection Capacity Utilization	72.1%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
8: Willow Rd & Owens Rd

BART to Livermore Extension Project
2025 No Project PM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 	  		 	  			 		 	 	 
Traffic Volume (vph)	78	636	162	122	613	83	161	78	0	176	67	111
Future Volume (vph)	78	636	162	122	613	83	161	78	0	176	67	111
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	5.3	4.0		5.3	4.0	4.0
Lane Util. Factor	0.97	0.91		0.97	0.91	1.00	1.00	0.95		1.00	1.00	1.00
Frt	1.00	0.97		1.00	1.00	0.85	1.00	1.00		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	4930		3433	5085	1583	1770	3539		1770	1863	1583
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.71	1.00		0.70	1.00	1.00
Satd. Flow (perm)	3433	4930		3433	5085	1583	1322	3539		1302	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	85	691	176	133	666	90	175	85	0	191	73	121
RTOR Reduction (vph)	0	27	0	0	0	37	0	0	0	0	0	95
Lane Group Flow (vph)	85	840	0	133	666	53	175	85	0	191	73	26
Turn Type	Prot	NA		Prot	NA	Perm	Perm	NA	Perm	Perm	NA	Perm
Protected Phases	1	6		5	2			4			8	
Permitted Phases						2	4		4	8		8
Actuated Green, G (s)	10.1	62.5		10.4	62.8	62.8	22.1	22.1		22.1	22.1	22.1
Effective Green, g (s)	10.1	64.2		10.4	64.5	64.5	22.1	23.4		22.1	23.4	23.4
Actuated g/C Ratio	0.09	0.58		0.09	0.59	0.59	0.20	0.21		0.20	0.21	0.21
Clearance Time (s)	4.0	5.7		4.0	5.7	5.7	5.3	5.3		5.3	5.3	5.3
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	315	2877		324	2981	928	265	752		261	396	336
v/s Ratio Prot	0.02	c0.17		c0.04	0.13			0.02			0.04	
v/s Ratio Perm						0.03	0.13			c0.15		0.02
v/c Ratio	0.27	0.29		0.41	0.22	0.06	0.66	0.11		0.73	0.18	0.08
Uniform Delay, d1	46.5	11.5		46.9	10.8	9.7	40.5	34.9		41.2	35.5	34.7
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	0.5	0.3		0.8	0.2	0.1	6.0	0.1		10.1	0.2	0.1
Delay (s)	47.0	11.8		47.8	11.0	9.9	46.5	35.0		51.3	35.7	34.8
Level of Service	D	B		D	B	A	D	C		D	D	C
Approach Delay (s)		14.9			16.4			42.8			43.1	
Approach LOS		B			B			D			D	

Intersection Summary		
HCM 2000 Control Delay	22.7	HCM 2000 Level of Service C
HCM 2000 Volume to Capacity ratio	0.40	
Actuated Cycle Length (s)	110.0	Sum of lost time (s) 12.0
Intersection Capacity Utilization	45.8%	ICU Level of Service A
Analysis Period (min)	15	

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
9: Hacienda Dr & Dublin Blvd

BART to Livermore Extension Project
2025 No Project PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↑↑↑	↖↗	↖↗	↑↑↑		↖↗	↑↑	↖↗	↖↗	↑↑↑	↖
Traffic Volume (vph)	50	1019	127	227	486	34	222	582	467	43	629	166
Future Volume (vph)	50	1019	127	227	486	34	222	582	467	43	629	166
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	6.0	5.0	4.5	6.0		5.0	6.0	6.0	4.5	5.5	5.5
Lane Util. Factor	0.97	0.91	0.88	0.97	0.91		0.94	0.95	0.88	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5085	2787	3433	5035		4990	3539	2787	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5085	2787	3433	5035		4990	3539	2787	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	54	1108	138	247	528	37	241	633	508	47	684	180
RTOR Reduction (vph)	0	0	64	0	7	0	0	0	233	0	0	139
Lane Group Flow (vph)	54	1108	74	247	558	0	241	633	275	47	684	41
Turn Type	Prot	NA	pm+ov	Prot	NA		Prot	NA	Perm	Prot	NA	Perm
Protected Phases	5	2	3	1	6		3	8		7	NA	4
Permitted Phases			2						8			4
Actuated Green, G (s)	4.1	29.8	40.7	10.9	36.6		10.9	29.7	29.7	2.8	21.6	21.6
Effective Green, g (s)	4.1	29.8	40.7	10.9	36.6		10.9	29.7	29.7	2.8	21.6	21.6
Actuated g/C Ratio	0.04	0.32	0.43	0.12	0.39		0.12	0.32	0.32	0.03	0.23	0.23
Clearance Time (s)	4.5	6.0	5.0	4.5	6.0		5.0	6.0	6.0	4.5	5.5	5.5
Vehicle Extension (s)	2.0	3.5	2.0	2.0	3.5		2.0	3.5	3.5	2.0	3.5	3.5
Lane Grp Cap (vph)	149	1608	1352	397	1956		577	1115	878	102	1165	362
v/s Ratio Prot	0.02	c0.22	0.01	c0.07	0.11		0.05	c0.18		0.01	c0.13	
v/s Ratio Perm			0.02						0.10			0.03
v/c Ratio	0.36	0.69	0.05	0.62	0.29		0.42	0.57	0.31	0.46	0.59	0.11
Uniform Delay, d1	43.8	28.1	15.6	39.7	19.8		38.7	26.9	24.5	45.0	32.3	28.7
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.5	1.3	0.0	2.2	0.1		0.2	0.7	0.2	1.2	0.8	0.2
Delay (s)	44.3	29.4	15.6	41.9	19.9		38.9	27.6	24.7	46.2	33.1	28.9
Level of Service	D	C	B	D	B		D	C	C	D	C	C
Approach Delay (s)		28.6			26.6			28.5			33.0	
Approach LOS		C			C			C			C	

Intersection Summary

HCM 2000 Control Delay	29.1	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.64		
Actuated Cycle Length (s)	94.2	Sum of lost time (s)	21.0
Intersection Capacity Utilization	63.3%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 10: Hacienda Dr & Martinelli Blvd/Hacienda Crossings



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗	↘↙	↘↙	↗		↘↙↘	↖↖↖	↗	↘↙	↖↖↖	
Traffic Volume (vph)	24	51	396	290	37	21	421	1257	467	59	909	72
Future Volume (vph)	24	51	396	290	37	21	421	1257	467	59	909	72
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	3.0	3.0	5.5	3.0		3.5	3.0	3.0	5.0	3.5	
Lane Util. Factor	1.00	0.91	0.91	0.97	1.00		0.94	0.91	1.00	0.97	0.86	
Frt	1.00	0.93	0.85	1.00	0.95		1.00	1.00	0.85	1.00	0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1770	1584	2882	3433	1761		4990	5085	1583	3433	6338	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1770	1584	2882	3433	1761		4990	5085	1583	3433	6338	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	26	55	430	315	40	23	458	1366	508	64	988	78
RTOR Reduction (vph)	0	29	201	0	17	0	0	0	213	0	9	0
Lane Group Flow (vph)	26	69	186	315	46	0	458	1366	295	64	1057	0
Turn Type	Prot	NA	Perm	Prot	NA		Prot	NA	pm+ov	Prot	NA	
Protected Phases	5	2		1	6		3	8	1	7	4	
Permitted Phases			2						8			
Actuated Green, G (s)	7.6	16.8	16.8	12.3	22.0		8.6	34.8	47.1	4.6	30.8	
Effective Green, g (s)	7.1	18.8	18.8	11.8	24.0		9.6	36.8	51.1	4.1	32.3	
Actuated g/C Ratio	0.08	0.21	0.21	0.13	0.27		0.11	0.42	0.58	0.05	0.37	
Clearance Time (s)	4.5	5.0	5.0	5.0	5.0		4.5	5.0	5.0	4.5	5.0	
Vehicle Extension (s)	3.0	4.0	4.0	2.0	4.0		3.0	4.0	2.0	3.0	4.0	
Lane Grp Cap (vph)	142	338	615	460	480		544	2126	973	159	2326	
v/s Ratio Prot	0.01	0.04		c0.09	0.03		c0.09	c0.27	0.05	0.02	0.17	
v/s Ratio Perm			c0.06						0.14			
v/c Ratio	0.18	0.20	0.30	0.68	0.10		0.84	0.64	0.30	0.40	0.45	
Uniform Delay, d1	37.7	28.4	29.1	36.3	23.9		38.5	20.4	9.4	40.8	21.2	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.6	0.4	0.4	3.4	0.1		11.3	0.8	0.1	1.7	0.2	
Delay (s)	38.4	28.9	29.5	39.7	24.0		49.8	21.1	9.5	42.4	21.3	
Level of Service	D	C	C	D	C		D	C	A	D	C	
Approach Delay (s)		29.8			37.1			24.2			22.5	
Approach LOS		C			D			C			C	

Intersection Summary

HCM 2000 Control Delay	25.5	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.62		
Actuated Cycle Length (s)	88.0	Sum of lost time (s)	16.5
Intersection Capacity Utilization	62.6%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 11: Hacienda Dr & I-580 WB Ramps



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↔↔		↔↔		↑↑↑			↑↑↑	↔
Traffic Volume (vph)	0	0	0	358	0	366	0	1516	756	0	804	752
Future Volume (vph)	0	0	0	358	0	366	0	1516	756	0	804	752
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0		4.0		4.0			4.0	4.0
Lane Util. Factor				0.97		0.88		0.91			0.86	0.86
Frt				1.00		0.85		0.95			0.95	0.85
Flt Protected				0.95		1.00		1.00			1.00	1.00
Satd. Flow (prot)				3433		2787		4831			4576	1362
Flt Permitted				0.95		1.00		1.00			1.00	1.00
Satd. Flow (perm)				3433		2787		4831			4576	1362
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	389	0	398	0	1648	822	0	874	817
RTOR Reduction (vph)	0	0	0	0	0	46	0	160	0	0	145	145
Lane Group Flow (vph)	0	0	0	389	0	352	0	2310	0	0	1138	263
Turn Type				Prot		Prot		NA			NA	Perm
Protected Phases				4		4		2			6	
Permitted Phases												6
Actuated Green, G (s)				10.1		10.1		33.6			33.6	33.6
Effective Green, g (s)				11.5		11.5		35.5			35.5	35.5
Actuated g/C Ratio				0.21		0.21		0.65			0.65	0.65
Clearance Time (s)				5.4		5.4		5.9			5.9	5.9
Vehicle Extension (s)				3.0		3.0		3.0			3.0	3.0
Lane Grp Cap (vph)				717		582		3118			2953	879
v/s Ratio Prot				0.11		c0.13		c0.48			0.25	
v/s Ratio Perm												0.19
v/c Ratio				0.54		0.61		0.74			0.39	0.30
Uniform Delay, d1				19.4		19.7		6.6			4.6	4.3
Progression Factor				1.00		1.00		0.87			1.00	1.00
Incremental Delay, d2				0.8		1.8		1.1			0.4	0.9
Delay (s)				20.2		21.5		6.9			5.0	5.2
Level of Service				C		C		A			A	A
Approach Delay (s)		0.0			20.9			6.9			5.0	
Approach LOS		A			C			A			A	

Intersection Summary			
HCM 2000 Control Delay	8.5	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.71		
Actuated Cycle Length (s)	55.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	65.7%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 12: Hacienda Dr & I-580 EB Ramps



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	885	0	435	0	0	0	0	1558	860	0	744	313
Future Volume (vph)	885	0	435	0	0	0	0	1558	860	0	744	313
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0					4.0	4.0		4.0	
Lane Util. Factor	0.97		0.88					0.86	0.86		0.91	
Frt	1.00		0.85					0.98	0.85		0.96	
Flt Protected	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (prot)	3433		2787					4700	1362		4860	
Flt Permitted	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (perm)	3433		2787					4700	1362		4860	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	962	0	473	0	0	0	0	1693	935	0	809	340
RTOR Reduction (vph)	0	0	180	0	0	0	0	18	266	0	63	0
Lane Group Flow (vph)	962	0	293	0	0	0	0	1965	379	0	1086	0
Turn Type	Prot		Prot					NA	Perm		NA	
Protected Phases	4		4					2			6	
Permitted Phases									2			
Actuated Green, G (s)	35.9		35.9					62.8	62.8		62.8	
Effective Green, g (s)	37.3		37.3					64.7	64.7		64.7	
Actuated g/C Ratio	0.34		0.34					0.59	0.59		0.59	
Clearance Time (s)	5.4		5.4					5.9	5.9		5.9	
Vehicle Extension (s)	2.0		2.0					2.0	2.0		2.0	
Lane Grp Cap (vph)	1164		945					2764	801		2858	
v/s Ratio Prot	c0.28		0.10					c0.42			0.22	
v/s Ratio Perm									0.28			
v/c Ratio	0.83		0.31					0.71	0.47		0.38	
Uniform Delay, d1	33.4		26.8					16.0	12.9		12.0	
Progression Factor	1.00		1.00					1.00	1.00		0.83	
Incremental Delay, d2	4.7		0.1					1.6	2.0		0.4	
Delay (s)	38.1		26.9					17.6	14.9		10.4	
Level of Service	D		C					B	B		B	
Approach Delay (s)		34.4			0.0			17.0			10.4	
Approach LOS		C			A			B			B	

Intersection Summary

HCM 2000 Control Delay	20.3	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.75		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	68.4%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
13: Hacienda Dr & Owens Rd

BART to Livermore Extension Project
2025 No Project PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↕↕↕	↖	↖↗	↕↕↕	↖	↖↗	↕↕↕	↖	↖↗	↕↕↕	↖
Traffic Volume (vph)	683	732	53	119	306	747	35	974	270	438	466	260
Future Volume (vph)	683	732	53	119	306	747	35	974	270	438	466	260
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	2.3	4.0	4.0	2.3	4.0	4.0	2.7	4.0	4.0	2.7
Lane Util. Factor	0.97	0.91	1.00	0.97	0.91	1.00	0.97	0.91	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5085	1583	3433	5085	1583	3433	5085	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5085	1583	3433	5085	1583	3433	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	742	796	58	129	333	812	38	1059	293	476	507	283
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	742	796	58	129	333	812	38	1059	293	476	507	283
Turn Type	Prot	NA	Free	Prot	NA	Free	Prot	NA	Free	Prot	NA	Free
Protected Phases	1	6		5	2		7	4		3	8	
Permitted Phases			Free			Free			Free			Free
Actuated Green, G (s)	37.9	41.4	115.0	7.8	11.3	115.0	2.6	31.7	115.0	15.1	44.2	115.0
Effective Green, g (s)	37.9	43.1	115.0	7.8	13.0	115.0	2.6	33.0	115.0	15.1	45.5	115.0
Actuated g/C Ratio	0.33	0.37	1.00	0.07	0.11	1.00	0.02	0.29	1.00	0.13	0.40	1.00
Clearance Time (s)	4.0	5.7		4.0	5.7		4.0	5.3		4.0	5.3	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	1131	1905	1583	232	574	1583	77	1459	1583	450	2011	1583
v/s Ratio Prot	c0.22	0.16		0.04	0.07		0.01	c0.21		c0.14	0.10	
v/s Ratio Perm			0.04			c0.51			0.19			0.18
v/c Ratio	0.66	0.42	0.04	0.56	0.58	0.51	0.49	0.73	0.19	1.06	0.25	0.18
Uniform Delay, d1	33.0	26.7	0.0	51.9	48.4	0.0	55.5	36.9	0.0	50.0	23.3	0.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.4	0.7	0.0	2.9	4.2	1.2	4.9	1.8	0.3	58.5	0.1	0.2
Delay (s)	34.4	27.3	0.0	54.8	52.6	1.2	60.5	38.8	0.3	108.5	23.4	0.2
Level of Service	C	C	A	D	D	A	E	D	A	F	C	A
Approach Delay (s)		29.6			20.1			31.2			50.2	
Approach LOS		C			C			C			D	

Intersection Summary		
HCM 2000 Control Delay	32.5	HCM 2000 Level of Service C
HCM 2000 Volume to Capacity ratio	0.75	
Actuated Cycle Length (s)	115.0	Sum of lost time (s) 16.0
Intersection Capacity Utilization	70.0%	ICU Level of Service C
Analysis Period (min)	15	

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 14: Tassajara Rd & Dublin Blvd

BART to Livermore Extension Project
 2025 No Project PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↑↑	↖↗	↖↗↘	↑↓		↖↗↘	↑↑↑	↖	↖↗	↑↑↑	↖↗
Traffic Volume (vph)	247	784	447	246	292	19	380	876	491	30	787	137
Future Volume (vph)	247	784	447	246	292	19	380	876	491	30	787	137
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	6.0	6.0	5.0	6.0		5.0	6.0	6.0	5.0	6.0	6.0
Lane Util. Factor	0.97	0.95	0.88	0.94	0.95		0.94	0.91	1.00	0.97	0.86	0.88
Frt	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	2787	4990	3506		4990	5085	1583	3433	6408	2787
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	2787	4990	3506		4990	5085	1583	3433	6408	2787
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	268	852	486	267	317	21	413	952	534	33	855	149
RTOR Reduction (vph)	0	0	287	0	3	0	0	0	252	0	0	108
Lane Group Flow (vph)	268	852	199	267	335	0	413	952	282	33	855	41
Turn Type	Prot	NA	Perm	Prot	NA		Prot	NA	Perm	Prot	NA	Perm
Protected Phases	5	2		1	6		3	8		7		4
Permitted Phases			2						8			4
Actuated Green, G (s)	17.0	40.8	40.8	16.4	40.2		17.1	45.8	45.8	8.1	36.8	36.8
Effective Green, g (s)	17.0	40.8	40.8	16.4	40.2		17.1	45.8	45.8	8.1	36.8	36.8
Actuated g/C Ratio	0.13	0.31	0.31	0.12	0.30		0.13	0.34	0.34	0.06	0.28	0.28
Clearance Time (s)	5.0	6.0	6.0	5.0	6.0		5.0	6.0	6.0	5.0	6.0	6.0
Vehicle Extension (s)	2.0	3.0	3.0	2.0	3.0		2.0	4.0	4.0	2.0	4.0	4.0
Lane Grp Cap (vph)	438	1084	854	614	1058		641	1749	544	208	1771	770
v/s Ratio Prot	c0.08	c0.24		0.05	0.10		c0.08	c0.19		0.01	0.13	
v/s Ratio Perm			0.07						0.18			0.01
v/c Ratio	0.61	0.79	0.23	0.43	0.32		0.64	0.54	0.52	0.16	0.48	0.05
Uniform Delay, d1	54.9	42.2	34.5	54.1	35.8		55.1	35.2	34.8	59.3	40.2	35.4
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.8	3.8	0.1	0.2	0.2		1.7	0.4	1.1	0.1	0.3	0.0
Delay (s)	56.7	46.0	34.6	54.2	36.0		56.8	35.7	36.0	59.4	40.5	35.4
Level of Service	E	D	C	D	D		E	D	D	E	D	D
Approach Delay (s)		44.3			44.1			40.3			40.4	
Approach LOS		D			D			D			D	

Intersection Summary			
HCM 2000 Control Delay	42.0	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.67		
Actuated Cycle Length (s)	133.1	Sum of lost time (s)	22.0
Intersection Capacity Utilization	82.8%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 15: Tassajara Rd & I-580 WB Ramps



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↔↔		↔↔		↑↑	↔		↑↑↔	↔
Traffic Volume (vph)	0	0	0	489	0	228	0	1357	645	0	1180	614
Future Volume (vph)	0	0	0	489	0	228	0	1357	645	0	1180	614
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0		4.0		4.0	4.0		4.0	4.0
Lane Util. Factor				0.97		0.88		0.95	1.00		0.86	0.86
Frt				1.00		0.85		1.00	0.85		0.98	0.85
Flt Protected				0.95		1.00		1.00	1.00		1.00	1.00
Satd. Flow (prot)				3433		2787		3539	1583		4698	1362
Flt Permitted				0.95		1.00		1.00	1.00		1.00	1.00
Satd. Flow (perm)				3433		2787		3539	1583		4698	1362
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	532	0	248	0	1475	701	0	1283	667
RTOR Reduction (vph)	0	0	0	0	0	42	0	0	275	0	37	173
Lane Group Flow (vph)	0	0	0	532	0	206	0	1475	426	0	1473	267
Turn Type				Perm		Perm		NA	Perm		NA	Perm
Protected Phases								2			6	
Permitted Phases				8		8			2			6
Actuated Green, G (s)				13.6		13.6		33.4	33.4		33.4	33.4
Effective Green, g (s)				13.6		13.6		33.4	33.4		33.4	33.4
Actuated g/C Ratio				0.25		0.25		0.61	0.61		0.61	0.61
Clearance Time (s)				4.0		4.0		4.0	4.0		4.0	4.0
Vehicle Extension (s)				3.0		3.0		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)				848		689		2149	961		2852	827
v/s Ratio Prot								c0.42			0.31	
v/s Ratio Perm				c0.15		0.07			0.27			0.20
v/c Ratio				0.63		0.30		0.69	0.44		0.52	0.32
Uniform Delay, d1				18.4		16.8		7.3	5.8		6.2	5.3
Progression Factor				1.00		1.00		1.00	1.00		1.00	1.00
Incremental Delay, d2				1.5		0.2		1.8	1.5		0.7	1.0
Delay (s)				19.9		17.1		9.1	7.3		6.9	6.3
Level of Service				B		B		A	A		A	A
Approach Delay (s)		0.0			19.0			8.5			6.7	
Approach LOS		A			B			A			A	

Intersection Summary			
HCM 2000 Control Delay	9.5	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.67		
Actuated Cycle Length (s)	55.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	58.1%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 16: Santa Rita Rd & I-580 EB Ramps/Pimilco Dr



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	388	90	235	144	0	314	0	1197	181	319	953	0
Future Volume (vph)	388	90	235	144	0	314	0	1197	181	319	953	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0		4.0		4.0		4.0	4.0	
Lane Util. Factor	0.97	1.00	1.00	0.97		0.88		0.86		1.00	0.95	
Frt	1.00	1.00	0.85	1.00		0.85		0.98		1.00	1.00	
Flt Protected	0.95	1.00	1.00	0.95		1.00		1.00		0.95	1.00	
Satd. Flow (prot)	3433	1863	1583	3433		2787		6281		1770	3539	
Flt Permitted	0.95	1.00	1.00	0.95		1.00		1.00		0.95	1.00	
Satd. Flow (perm)	3433	1863	1583	3433		2787		6281		1770	3539	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	422	98	255	157	0	341	0	1301	197	347	1036	0
RTOR Reduction (vph)	0	0	98	0	0	35	0	22	0	0	0	0
Lane Group Flow (vph)	422	98	157	157	0	306	0	1476	0	347	1036	0
Turn Type	Perm	NA	Perm	Prot		pm+ov		NA		Prot	NA	Perm
Protected Phases		4		3		1		2		1	6	
Permitted Phases	4		4			3						6
Actuated Green, G (s)	19.1	19.1	19.1	7.5		33.5		41.4		26.0	71.4	
Effective Green, g (s)	19.1	19.1	19.1	7.5		33.5		41.4		26.0	71.4	
Actuated g/C Ratio	0.17	0.17	0.17	0.07		0.30		0.38		0.24	0.65	
Clearance Time (s)	4.0	4.0	4.0	4.0		4.0		4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0		3.0		3.0		3.0	3.0	
Lane Grp Cap (vph)	596	323	274	234		848		2363		418	2297	
v/s Ratio Prot		0.05		c0.05		0.09		c0.23		c0.20	0.29	
v/s Ratio Perm	c0.12		0.10			0.02						
v/c Ratio	0.71	0.30	0.57	0.67		0.36		0.62		0.83	0.45	
Uniform Delay, d1	42.8	39.6	41.7	50.0		29.9		28.0		39.9	9.6	
Progression Factor	1.00	1.00	1.00	1.00		1.00		1.00		1.00	1.00	
Incremental Delay, d2	3.8	0.5	2.9	7.4		0.3		1.3		13.1	0.6	
Delay (s)	46.7	40.2	44.6	57.4		30.2		29.2		53.0	10.2	
Level of Service	D	D	D	E		C		C		D	B	
Approach Delay (s)		45.2			38.7			29.2			20.9	
Approach LOS		D			D			C			C	

Intersection Summary		
HCM 2000 Control Delay	30.6	HCM 2000 Level of Service C
HCM 2000 Volume to Capacity ratio	0.70	
Actuated Cycle Length (s)	110.0	Sum of lost time (s) 16.0
Intersection Capacity Utilization	60.2%	ICU Level of Service B
Analysis Period (min)	15	

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 17: Santa Rita Rd & Valley Ave

BART to Livermore Extension Project
 2025 No Project PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	357	483	115	128	313	776	151	766	132	1010	1091	244
Future Volume (vph)	357	483	115	128	313	776	151	766	132	1010	1091	244
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.97	0.95		0.97	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.98		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	3433	3461		3433	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	3433	3461		3433	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	388	525	125	139	340	843	164	833	143	1098	1186	265
RTOR Reduction (vph)	0	0	104	0	0	0	0	13	0	0	0	124
Lane Group Flow (vph)	388	525	21	139	340	843	164	963	0	1098	1186	141
Turn Type	Prot	NA	Perm	Prot	NA	Free	Prot	NA		Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1		6
Permitted Phases			4			Free						6
Actuated Green, G (s)	12.0	18.5	18.5	9.0	15.5	109.5	8.7	31.0		35.0	57.3	57.3
Effective Green, g (s)	12.0	18.5	18.5	9.0	15.5	109.5	8.7	31.0		35.0	57.3	57.3
Actuated g/C Ratio	0.11	0.17	0.17	0.08	0.14	1.00	0.08	0.28		0.32	0.52	0.52
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	376	597	267	145	500	1583	272	979		1097	1851	828
v/s Ratio Prot	c0.11	c0.15		0.08	0.10		0.05	c0.28		c0.32	0.34	
v/s Ratio Perm			0.01			c0.53						0.09
v/c Ratio	1.03	0.88	0.08	0.96	0.68	0.53	0.60	0.98		1.00	0.64	0.17
Uniform Delay, d1	48.8	44.4	38.3	50.1	44.6	0.0	48.7	39.0		37.2	18.7	13.7
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	54.9	13.9	0.1	61.5	3.8	1.3	3.7	24.7		27.4	0.8	0.1
Delay (s)	103.6	58.3	38.5	111.6	48.4	1.3	52.5	63.7		64.6	19.5	13.8
Level of Service	F	E	D	F	D	A	D	E		E	B	B
Approach Delay (s)		72.8			25.0			62.0			38.3	
Approach LOS		E			C			E			D	

Intersection Summary

HCM 2000 Control Delay	45.8	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	1.00		
Actuated Cycle Length (s)	109.5	Sum of lost time (s)	16.0
Intersection Capacity Utilization	88.0%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
18: Bernal Ave/Valley Ave & Stanley Blvd



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↑↑	↖	↖↗	↑↔	↖	↖	↑↑	↖	↖↗	↑↔	
Traffic Volume (vph)	204	834	62	106	231	341	86	328	302	826	582	120
Future Volume (vph)	204	834	62	106	231	341	86	328	302	826	582	120
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	0.97	0.95	1.00	0.97	0.91	0.91	1.00	0.95	1.00	0.97	0.95	
Frt	1.00	1.00	0.85	1.00	0.94	0.85	1.00	1.00	0.85	1.00	0.97	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	3433	3539	1583	3433	3182	1441	1770	3539	1583	3433	3449	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	3433	3539	1583	3433	3182	1441	1770	3539	1583	3433	3449	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	222	907	67	115	251	371	93	357	328	898	633	130
RTOR Reduction (vph)	0	0	42	0	115	52	0	0	168	0	19	0
Lane Group Flow (vph)	222	907	25	115	310	145	93	357	160	898	744	0
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	
Protected Phases	7	4	5	3	8	1	5	2		1	6	
Permitted Phases			4			8			2			
Actuated Green, G (s)	9.4	25.1	32.5	4.0	19.7	44.8	7.4	15.8	15.8	25.1	33.5	
Effective Green, g (s)	9.4	25.1	32.5	4.0	19.7	44.8	7.4	15.8	15.8	25.1	33.5	
Actuated g/C Ratio	0.11	0.29	0.38	0.05	0.23	0.52	0.09	0.18	0.18	0.29	0.39	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	375	1032	671	159	728	817	152	650	290	1001	1343	
v/s Ratio Prot	c0.06	c0.26	0.00	0.03	0.10	0.05	0.05	0.10		c0.26	c0.22	
v/s Ratio Perm			0.01			0.05			0.10			
v/c Ratio	0.59	0.88	0.04	0.72	0.43	0.18	0.61	0.55	0.55	0.90	0.55	
Uniform Delay, d1	36.5	29.0	16.9	40.5	28.3	10.9	37.9	31.9	31.9	29.2	20.4	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	2.5	8.7	0.0	15.0	0.4	0.1	7.1	1.0	2.3	10.5	0.5	
Delay (s)	39.0	37.7	16.9	55.5	28.7	11.0	45.0	32.8	34.1	39.7	20.9	
Level of Service	D	D	B	E	C	B	D	C	C	D	C	
Approach Delay (s)		36.7			28.2			34.8			31.1	
Approach LOS		D			C			C			C	








































Intersection Summary

HCM 2000 Control Delay	32.8	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.83		
Actuated Cycle Length (s)	86.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	75.3%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
19: Fallon Rd & Dublin Blvd

BART to Livermore Extension Project
2025 No Project PM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 	  	 	  	  		 	  	 	 	  	
Traffic Volume (vph)	212	612	417	48	18	55	193	619	171	112	587	27
Future Volume (vph)	212	612	417	48	18	55	193	619	171	112	587	27
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.3	5.3	5.3	4.0	4.0	4.0	5.3	4.9	4.9	5.3	4.9	4.9
Lane Util. Factor	0.97	0.91	0.88	0.94	0.91	1.00	0.97	0.91	0.88	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3090	4577	2508	4491	4577	1425	3090	4577	2508	3090	4577	1425
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3090	4577	2508	4491	4577	1425	3090	4577	2508	3090	4577	1425
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	230	665	453	52	20	60	210	673	186	122	638	29
RTOR Reduction (vph)	0	0	118	0	0	57	0	0	122	0	0	21
Lane Group Flow (vph)	230	665	335	52	20	3	210	673	64	122	638	8
Turn Type	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	5	2	3	1	6		3	8		7	4	
Permitted Phases			2			6			8			4
Actuated Green, G (s)	18.0	19.2	29.0	2.6	3.8	3.8	9.8	24.7	24.7	6.1	21.0	21.0
Effective Green, g (s)	18.0	19.2	29.0	2.6	3.8	3.8	9.8	24.7	24.7	6.1	21.0	21.0
Actuated g/C Ratio	0.25	0.27	0.40	0.04	0.05	0.05	0.14	0.34	0.34	0.08	0.29	0.29
Clearance Time (s)	5.3	5.3	5.3	4.0	4.0	4.0	5.3	4.9	4.9	5.3	4.9	4.9
Vehicle Extension (s)	2.0	4.0	2.0	2.0	2.0	2.0	2.0	4.0	4.0	2.0	4.0	4.0
Lane Grp Cap (vph)	771	1218	1008	161	241	75	420	1567	859	261	1333	415
v/s Ratio Prot	c0.07	c0.15	0.05	0.01	0.00		c0.07	c0.15		0.04	0.14	
v/s Ratio Perm			0.09			0.00			0.03			0.01
v/c Ratio	0.30	0.55	0.33	0.32	0.08	0.04	0.50	0.43	0.07	0.47	0.48	0.02
Uniform Delay, d1	21.9	22.7	14.9	33.9	32.5	32.4	28.9	18.3	16.0	31.5	21.0	18.2
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.1	0.6	0.1	0.4	0.1	0.1	0.3	0.3	0.1	0.5	0.4	0.0
Delay (s)	22.0	23.3	14.9	34.3	32.5	32.5	29.2	18.5	16.0	31.9	21.4	18.2
Level of Service	C	C	B	C	C	C	C	B	B	C	C	B
Approach Delay (s)		20.3			33.2			20.2			22.9	
Approach LOS		C			C			C			C	

Intersection Summary		
HCM 2000 Control Delay	21.4	HCM 2000 Level of Service C
HCM 2000 Volume to Capacity ratio	0.51	
Actuated Cycle Length (s)	72.1	Sum of lost time (s) 19.5
Intersection Capacity Utilization	45.8%	ICU Level of Service A
Analysis Period (min)	15	

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 20: El Charro Rd/Fallon Rd & I-580 WB Ramps



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↵	↵	↵↵		↵	↵		↵↵	↵
Traffic Volume (vph)	0	0	0	266	0	444	0	665	245	0	857	375
Future Volume (vph)	0	0	0	266	0	444	0	665	245	0	857	375
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0	4.0	4.0		4.0	4.0		4.0	4.0
Lane Util. Factor				0.95	0.95	0.88		0.95	0.95		0.95	1.00
Frt				1.00	1.00	0.85		0.99	0.85		1.00	0.85
Flt Protected				0.95	0.95	1.00		1.00	1.00		1.00	1.00
Satd. Flow (prot)				1681	1681	2787		1760	1504		3539	1583
Flt Permitted				0.95	0.95	1.00		1.00	1.00		1.00	1.00
Satd. Flow (perm)				1681	1681	2787		1760	1504		3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	289	0	483	0	723	266	0	932	408
RTOR Reduction (vph)	0	0	0	0	0	351	0	2	80	0	0	136
Lane Group Flow (vph)	0	0	0	147	142	132	0	748	159	0	932	272
Turn Type				Perm	NA	Perm		NA	Perm		NA	Perm
Protected Phases					8			2			6	
Permitted Phases				8		8			2			6
Actuated Green, G (s)				10.9	10.9	10.9		36.6	36.6		36.6	36.6
Effective Green, g (s)				10.4	10.4	10.4		36.6	36.6		36.6	36.6
Actuated g/C Ratio				0.19	0.19	0.19		0.67	0.67		0.67	0.67
Clearance Time (s)				3.5	3.5	3.5		4.0	4.0		4.0	4.0
Vehicle Extension (s)				2.0	2.0	2.0		2.0	2.0		2.0	2.0
Lane Grp Cap (vph)				317	317	526		1171	1000		2355	1053
v/s Ratio Prot								c0.42			0.26	
v/s Ratio Perm				c0.09	0.08	0.05			0.11			0.17
v/c Ratio				0.46	0.45	0.25		0.64	0.16		0.40	0.26
Uniform Delay, d1				19.8	19.8	19.0		5.4	3.4		4.2	3.7
Progression Factor				1.00	1.00	1.00		1.03	2.29		1.00	1.00
Incremental Delay, d2				0.4	0.4	0.1		2.5	0.3		0.5	0.6
Delay (s)				20.2	20.1	19.1		8.0	8.2		4.7	4.3
Level of Service				C	C	B		A	A		A	A
Approach Delay (s)		0.0			19.5			8.0			4.6	
Approach LOS		A			B			A			A	

Intersection Summary			
HCM 2000 Control Delay	9.4	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.60		
Actuated Cycle Length (s)	55.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	62.2%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 21: El Charro Rd & I-580 EB Ramps

BART to Livermore Extension Project
 2025 No Project PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔		↔					↕	↗		↕	↗
Traffic Volume (vph)	321	0	357	0	0	0	0	906	281	0	874	0
Future Volume (vph)	321	0	357	0	0	0	0	906	281	0	874	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0					4.0	4.0		4.0	
Lane Util. Factor	0.97		0.88					0.91	0.91		0.91	
Frt	1.00		0.85					0.99	0.85		1.00	
Flt Protected	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (prot)	3433		2787					3372	1441		3390	
Flt Permitted	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (perm)	3433		2787					3372	1441		3390	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	349	0	388	0	0	0	0	985	305	0	950	0
RTOR Reduction (vph)	0	0	195	0	0	0	0	4	87	0	0	0
Lane Group Flow (vph)	349	0	193	0	0	0	0	1018	181	0	950	0
Turn Type	Prot		Perm					NA	Perm		NA	Perm
Protected Phases	4							2			6	
Permitted Phases			4						2			6
Actuated Green, G (s)	9.9		9.9					37.1	37.1		37.1	
Effective Green, g (s)	9.9		9.9					37.1	37.1		37.1	
Actuated g/C Ratio	0.18		0.18					0.67	0.67		0.67	
Clearance Time (s)	4.0		4.0					4.0	4.0		4.0	
Vehicle Extension (s)	2.0		2.0					3.0	3.0		3.0	
Lane Grp Cap (vph)	617		501					2274	972		2286	
v/s Ratio Prot	c0.10							c0.30			0.28	
v/s Ratio Perm			0.07						0.13			
v/c Ratio	0.57		0.38					0.45	0.19		0.42	
Uniform Delay, d1	20.6		19.9					4.2	3.3		4.0	
Progression Factor	1.00		1.00					1.00	1.00		0.73	
Incremental Delay, d2	0.7		0.2					0.6	0.4		0.5	
Delay (s)	21.3		20.0					4.8	3.8		3.5	
Level of Service	C		C					A	A		A	
Approach Delay (s)		20.6			0.0			4.6			3.5	
Approach LOS		C			A			A			A	

Intersection Summary

HCM 2000 Control Delay	8.2	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.47		
Actuated Cycle Length (s)	55.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	43.9%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 22: El Charro Rd & Stoneridge Dr/Jack London Blvd



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔↔↔	↑↑	↗	↖	↑↑	↗↗	↖	↑↑		↗↗↗	↑	↗↗
Traffic Volume (vph)	260	561	4	3	311	469	2	33	3	746	26	137
Future Volume (vph)	260	561	4	3	311	469	2	33	3	746	26	137
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	0.94	0.95	1.00	1.00	0.95	0.88	1.00	0.95		0.94	1.00	0.88
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	4491	3185	1425	1593	3185	2508	1593	3149		4491	1676	2508
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	4491	3185	1425	1593	3185	2508	1593	3149		4491	1676	2508
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	283	610	4	3	338	510	2	36	3	811	28	149
RTOR Reduction (vph)	0	0	3	0	0	234	0	3	0	0	0	91
Lane Group Flow (vph)	283	610	1	3	338	276	2	36	0	811	28	58
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Prot	NA		Prot	NA	Perm
Protected Phases	7	4		3	8	1	5	2		1	6	
Permitted Phases			4			8						6
Actuated Green, G (s)	8.5	23.3	23.3	0.7	15.5	36.2	0.7	6.3		20.7	26.3	26.3
Effective Green, g (s)	8.5	23.3	23.3	0.7	15.5	36.2	0.7	6.3		20.7	26.3	26.3
Actuated g/C Ratio	0.13	0.35	0.35	0.01	0.23	0.54	0.01	0.09		0.31	0.39	0.39
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	569	1107	495	16	736	1355	16	296		1387	657	984
v/s Ratio Prot	0.06	c0.19		0.00	c0.11	0.06	0.00	c0.01		c0.18	0.02	
v/s Ratio Perm			0.00			0.05						0.02
v/c Ratio	0.50	0.55	0.00	0.19	0.46	0.20	0.12	0.12		0.58	0.04	0.06
Uniform Delay, d1	27.3	17.6	14.3	32.9	22.1	8.0	32.8	27.8		19.5	12.6	12.7
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	0.7	0.6	0.0	5.6	0.5	0.1	3.5	0.2		0.6	0.0	0.0
Delay (s)	27.9	18.2	14.3	38.5	22.6	8.0	36.4	28.0		20.2	12.6	12.7
Level of Service	C	B	B	D	C	A	D	C		C	B	B
Approach Delay (s)		21.3			13.9			28.4			18.8	
Approach LOS		C			B			C			B	

Intersection Summary		
HCM 2000 Control Delay	18.3	HCM 2000 Level of Service B
HCM 2000 Volume to Capacity ratio	0.53	
Actuated Cycle Length (s)	67.0	Sum of lost time (s) 16.0
Intersection Capacity Utilization	53.0%	ICU Level of Service A
Analysis Period (min)	15	

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
24: Airway Blvd/Driveway & N Canyons Pkwy



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑	↑	↑↑	↑	↑		↑	↑↑		↑	
Traffic Volume (vph)	0	535	310	809	69	0	48	0	744	0	0	0
Future Volume (vph)	0	535	310	809	69	0	48	0	744	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0	4.0	4.0			4.4	4.0			
Lane Util. Factor		0.95	1.00	0.97	1.00			1.00	0.88			
Frt		1.00	0.85	1.00	1.00			1.00	0.85			
Flt Protected		1.00	1.00	0.95	1.00			0.95	1.00			
Satd. Flow (prot)		3539	1583	3433	1863			1770	2787			
Flt Permitted		1.00	1.00	0.95	1.00			0.95	1.00			
Satd. Flow (perm)		3539	1583	3433	1863			1770	2787			
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	582	337	879	75	0	52	0	809	0	0	0
RTOR Reduction (vph)	0	0	226	0	0	0	0	0	400	0	0	0
Lane Group Flow (vph)	0	582	111	879	75	0	0	52	409	0	0	0
Turn Type		NA	Perm	Prot	NA	Perm	Split	NA	pm+ov			
Protected Phases		2		1	6		8	8	1	4	4	
Permitted Phases			2			6			8			
Actuated Green, G (s)		18.3	18.3	23.2	47.5			4.0	27.2			
Effective Green, g (s)		20.3	20.3	25.2	49.5			3.8	31.2			
Actuated g/C Ratio		0.33	0.33	0.41	0.80			0.06	0.51			
Clearance Time (s)		6.0	6.0	6.0	6.0			4.2	6.0			
Vehicle Extension (s)		3.0	3.0	3.0	3.0			3.0	3.0			
Lane Grp Cap (vph)		1164	520	1402	1494			109	1589			
v/s Ratio Prot		c0.16		c0.26	0.04			0.03	c0.11			
v/s Ratio Perm			0.07						0.04			
v/c Ratio		0.50	0.21	0.63	0.05			0.48	0.26			
Uniform Delay, d1		16.6	14.9	14.5	1.3			28.0	8.7			
Progression Factor		1.00	1.00	1.00	1.00			1.00	1.00			
Incremental Delay, d2		0.3	0.2	0.9	0.0			3.3	0.1			
Delay (s)		17.0	15.1	15.4	1.3			31.3	8.8			
Level of Service		B	B	B	A			C	A			
Approach Delay (s)		16.3			14.3			10.1			0.0	
Approach LOS		B			B			B			A	

Intersection Summary

HCM 2000 Control Delay	13.6	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.62		
Actuated Cycle Length (s)	61.7	Sum of lost time (s)	16.4
Intersection Capacity Utilization	51.5%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 25: Airway Blvd & I-580 WB Ramps

BART to Livermore Extension Project
 2025 No Project PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↙	↖	↗		↑↑	↗		↑↑↑	
Traffic Volume (vph)	0	0	0	69	28	152	0	695	336	0	549	640
Future Volume (vph)	0	0	0	69	28	152	0	695	336	0	549	640
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0	4.0	4.0		4.0	4.0		4.0	
Lane Util. Factor				0.95	0.95	0.88		0.95	1.00		0.91	
Frt				1.00	1.00	0.85		1.00	0.85		0.92	
Flt Protected				0.95	0.97	1.00		1.00	1.00		1.00	
Satd. Flow (prot)				1681	1723	2787		3539	1583		4675	
Flt Permitted				0.95	0.97	1.00		1.00	1.00		1.00	
Satd. Flow (perm)				1681	1723	2787		3539	1583		4675	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	75	30	165	0	755	365	0	597	696
RTOR Reduction (vph)	0	0	0	0	0	150	0	0	71	0	135	0
Lane Group Flow (vph)	0	0	0	40	65	15	0	755	294	0	1158	0
Turn Type				Split	NA	Perm		NA	Perm		NA	
Protected Phases				8	8			2			6	
Permitted Phases						8			2			
Actuated Green, G (s)				7.5	7.5	7.5		63.2	63.2		63.2	
Effective Green, g (s)				7.5	7.5	7.5		64.5	64.5		64.5	
Actuated g/C Ratio				0.09	0.09	0.09		0.81	0.81		0.81	
Clearance Time (s)				4.0	4.0	4.0		5.3	5.3		5.3	
Vehicle Extension (s)				2.0	2.0	2.0		4.0	4.0		4.0	
Lane Grp Cap (vph)				157	161	261		2853	1276		3769	
v/s Ratio Prot				0.02	c0.04			0.21			c0.25	
v/s Ratio Perm						0.01			0.19			
v/c Ratio				0.25	0.40	0.06		0.26	0.23		0.31	
Uniform Delay, d1				33.7	34.1	33.0		1.9	1.8		2.0	
Progression Factor				1.00	1.00	1.00		1.00	1.00		1.00	
Incremental Delay, d2				0.3	0.6	0.0		0.2	0.4		0.2	
Delay (s)				34.0	34.7	33.1		2.1	2.3		2.2	
Level of Service				C	C	C		A	A		A	
Approach Delay (s)		0.0			33.6			2.2			2.2	
Approach LOS		A			C			A			A	

Intersection Summary		
HCM 2000 Control Delay	5.4	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.32	A
Actuated Cycle Length (s)	80.0	Sum of lost time (s)
Intersection Capacity Utilization	35.0%	8.0
Analysis Period (min)	15	ICU Level of Service
		A

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 26: Airway Blvd & I-580 EB Ramps/Kitty Hawk Rd



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔↔	↑	↔	↔	↑	↔	↔	↕↕		↔	↕↕	
Traffic Volume (vph)	575	223	305	65	74	143	27	340	138	106	244	232
Future Volume (vph)	575	223	305	65	74	143	27	340	138	106	244	232
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.4	4.4	4.4	4.0	4.0		4.0	4.0	
Lane Util. Factor	0.97	1.00	1.00	1.00	1.00	1.00	1.00	0.95		1.00	0.95	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.96		1.00	0.93	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	3433	1863	1583	1770	1863	1583	1770	3386		1770	3280	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	3433	1863	1583	1770	1863	1583	1770	3386		1770	3280	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	625	242	332	71	80	155	29	370	150	115	265	252
RTOR Reduction (vph)	0	0	247	0	0	121	0	53	0	0	147	0
Lane Group Flow (vph)	625	242	85	71	80	34	29	467	0	115	370	0
Turn Type	Split	NA	Perm	Split	NA	pm+ov	Prot	NA		Prot	NA	
Protected Phases	7	7		8	8	1	5	2		1	6	
Permitted Phases			7			8						
Actuated Green, G (s)	23.1	23.1	23.1	11.2	11.2	20.8	2.6	28.8		9.6	36.3	
Effective Green, g (s)	23.1	23.1	23.1	10.8	10.8	20.0	2.1	30.1		9.6	37.6	
Actuated g/C Ratio	0.26	0.26	0.26	0.12	0.12	0.22	0.02	0.33		0.11	0.42	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	3.5	5.3		4.0	5.3	
Vehicle Extension (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	3.5		2.0	4.0	
Lane Grp Cap (vph)	881	478	406	212	223	351	41	1132		188	1370	
v/s Ratio Prot	c0.18	0.13		0.04	c0.04	0.01	0.02	c0.14		c0.06	0.11	
v/s Ratio Perm			0.05			0.01						
v/c Ratio	0.71	0.51	0.21	0.33	0.36	0.10	0.71	0.41		0.61	0.27	
Uniform Delay, d1	30.4	28.6	26.3	36.3	36.4	27.8	43.6	23.1		38.4	17.2	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	2.2	0.3	0.1	0.3	0.4	0.0	36.5	1.1		4.1	0.5	
Delay (s)	32.6	28.9	26.4	36.6	36.8	27.9	80.2	24.2		42.5	17.7	
Level of Service	C	C	C	D	D	C	F	C		D	B	
Approach Delay (s)		30.1			32.2			27.2			22.2	
Approach LOS		C			C			C			C	

Intersection Summary

HCM 2000 Control Delay	27.9	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.53		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	16.8
Intersection Capacity Utilization	61.4%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 27: Collier Canyon Rd & N Canyons Pkwy/Portola Ave

BART to Livermore Extension Project
 2025 No Project PM


























Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↖↖	↖	↖	↖↖	↖	↖	↖		↖	↖	↖
Traffic Volume (vph)	305	691	149	83	251	24	49	7	303	129	13	98
Future Volume (vph)	305	691	149	83	251	24	49	7	303	129	13	98
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	5.2	5.2
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.85		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	1770	1590		1770	1863	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	1770	1590		1770	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	332	751	162	90	273	26	53	8	329	140	14	107
RTOR Reduction (vph)	0	0	106	0	0	18	0	238	0	0	0	76
Lane Group Flow (vph)	332	751	56	90	273	8	53	99	0	140	14	31
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA		Prot	NA	Perm
Protected Phases	1	6		5	2		3	8		7	NA	4
Permitted Phases			6			2						4
Actuated Green, G (s)	11.5	25.6	25.6	7.3	21.4	21.4	3.8	15.9		10.2	22.7	22.7
Effective Green, g (s)	11.5	26.9	26.9	7.3	22.7	22.7	3.8	16.9		10.2	22.1	22.1
Actuated g/C Ratio	0.15	0.35	0.35	0.09	0.29	0.29	0.05	0.22		0.13	0.29	0.29
Clearance Time (s)	4.0	5.3	5.3	4.0	5.3	5.3	4.0	5.0		4.0	4.6	4.6
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	510	1231	550	167	1039	464	87	347		233	532	452
v/s Ratio Prot	c0.10	c0.21		0.05	0.08		0.03	c0.06		c0.08	0.01	
v/s Ratio Perm			0.04			0.00						0.02
v/c Ratio	0.65	0.61	0.10	0.54	0.26	0.02	0.61	0.28		0.60	0.03	0.07
Uniform Delay, d1	31.0	20.9	17.0	33.4	20.9	19.4	36.0	25.2		31.6	19.9	20.1
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	3.0	0.9	0.1	3.3	0.1	0.0	11.5	0.5		4.3	0.0	0.1
Delay (s)	34.0	21.8	17.1	36.7	21.0	19.4	47.5	25.6		35.9	19.9	20.2
Level of Service	C	C	B	D	C	B	D	C		D	B	C
Approach Delay (s)		24.4			24.6			28.6			28.6	
Approach LOS		C			C			C			C	

Intersection Summary		
HCM 2000 Control Delay	25.6	HCM 2000 Level of Service C
HCM 2000 Volume to Capacity ratio	0.56	
Actuated Cycle Length (s)	77.3	Sum of lost time (s) 17.2
Intersection Capacity Utilization	63.3%	ICU Level of Service B
Analysis Period (min)	15	

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
28: Isabel Ave/Campus Hill Dr & Portola Ave

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	4	626	517	244	179	104	231	340	84	126	278	2
Future Volume (vph)	4	626	517	244	179	104	231	340	84	126	278	2
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	5.8	5.8
Lane Util. Factor	1.00	0.95	0.88	0.94	0.95		0.97	0.95	1.00	1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	0.94		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3539	2787	4990	3344		3433	3539	1583	1770	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	3539	2787	4990	3344		3433	3539	1583	1770	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	4	680	562	265	195	113	251	370	91	137	302	2
RTOR Reduction (vph)	0	0	361	0	59	0	0	0	73	0	0	2
Lane Group Flow (vph)	4	680	201	265	249	0	251	370	18	137	302	0
Turn Type	Prot	NA	Perm	Prot	NA		Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4						2			6
Actuated Green, G (s)	1.4	27.7	27.7	9.2	35.5		9.2	14.6	14.6	11.1	16.9	16.9
Effective Green, g (s)	1.4	29.0	29.0	9.2	36.8		9.2	15.9	15.9	11.1	16.0	16.0
Actuated g/C Ratio	0.02	0.36	0.36	0.11	0.45		0.11	0.20	0.20	0.14	0.20	0.20
Clearance Time (s)	4.0	5.3	5.3	4.0	5.3		4.0	5.3	5.3	4.0	4.9	4.9
Vehicle Extension (s)	2.0	3.0	3.0	2.0	3.0		2.0	3.0	3.0	2.0	3.0	3.0
Lane Grp Cap (vph)	30	1263	995	565	1515		388	692	309	241	697	311
v/s Ratio Prot	0.00	c0.19		c0.05	0.07		0.07	c0.10		c0.08	0.09	
v/s Ratio Perm			0.07						0.01			0.00
v/c Ratio	0.13	0.54	0.20	0.47	0.16		0.65	0.53	0.06	0.57	0.43	0.00
Uniform Delay, d1	39.3	20.8	18.1	33.7	13.1		34.4	29.3	26.6	32.8	28.6	26.2
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.7	0.4	0.1	0.2	0.1		2.8	0.8	0.1	1.8	0.4	0.0
Delay (s)	40.0	21.2	18.2	33.9	13.2		37.2	30.1	26.6	34.6	29.1	26.2
Level of Service	D	C	B	C	B		D	C	C	C	C	C
Approach Delay (s)		19.9			22.8			32.2			30.8	
Approach LOS		B			C			C			C	
Intersection Summary												
HCM 2000 Control Delay			25.0			HCM 2000 Level of Service			C			
HCM 2000 Volume to Capacity ratio			0.54									
Actuated Cycle Length (s)			81.2			Sum of lost time (s)			17.8			
Intersection Capacity Utilization			57.1%			ICU Level of Service			B			
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis
 29: Isabel Ave & I-580 WB Ramps

BART to Livermore Extension Project
 2025 No Project PM

























Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↖↗		↖		↕↕	↖↗		↕↕	↖
Traffic Volume (vph)	0	0	0	680	0	269	0	364	0	0	615	421
Future Volume (vph)	0	0	0	680	0	269	0	364	0	0	615	421
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0		4.0		5.6			5.6	5.6
Lane Util. Factor				0.97		1.00		0.95			0.95	1.00
Frt				1.00		0.85		1.00			1.00	0.85
Flt Protected				0.95		1.00		1.00			1.00	1.00
Satd. Flow (prot)				3433		1583		3539			3539	1583
Flt Permitted				0.95		1.00		1.00			1.00	1.00
Satd. Flow (perm)				3433		1583		3539			3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	739	0	292	0	396	0	0	668	458
RTOR Reduction (vph)	0	0	0	0	0	209	0	0	0	0	0	240
Lane Group Flow (vph)	0	0	0	739	0	83	0	396	0	0	668	218
Turn Type				Prot		Prot		NA	Free		NA	Prot
Protected Phases				8		8		2			6	6
Permitted Phases									Free			
Actuated Green, G (s)				11.4		11.4		19.8			19.8	19.8
Effective Green, g (s)				11.4		11.4		19.0			19.0	19.0
Actuated g/C Ratio				0.29		0.29		0.48			0.48	0.48
Clearance Time (s)				4.0		4.0		4.8			4.8	4.8
Vehicle Extension (s)				2.0		2.0		4.0			4.0	4.0
Lane Grp Cap (vph)				978		451		1681			1681	751
v/s Ratio Prot				c0.22		0.05		0.11			c0.19	0.14
v/s Ratio Perm												
v/c Ratio				0.76		0.18		0.24			0.40	0.29
Uniform Delay, d1				13.0		10.8		6.2			6.8	6.4
Progression Factor				1.00		1.00		0.98			1.00	1.00
Incremental Delay, d2				3.0		0.1		0.3			0.2	0.3
Delay (s)				16.0		10.9		6.4			7.0	6.7
Level of Service				B		B		A			A	A
Approach Delay (s)		0.0			14.6			6.4			6.9	
Approach LOS		A			B			A			A	

Intersection Summary			
HCM 2000 Control Delay	9.9	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.53		
Actuated Cycle Length (s)	40.0	Sum of lost time (s)	9.6
Intersection Capacity Utilization	44.4%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 30: Isabel Ave & I-580 EB Ramps

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations	 		 					 			 		
Traffic Volume (vph)	187	0	347	0	0	0	0	692	699	0	890	631	
Future Volume (vph)	187	0	347	0	0	0	0	692	699	0	890	631	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)	4.0		4.0					4.0	4.0		4.0	4.0	
Lane Util. Factor	0.97		0.88					0.95	1.00		0.95	1.00	
Frt	1.00		0.85					1.00	0.85		1.00	0.85	
Flt Protected	0.95		1.00					1.00	1.00		1.00	1.00	
Satd. Flow (prot)	3433		2787					3539	1583		3539	1583	
Flt Permitted	0.95		1.00					1.00	1.00		1.00	1.00	
Satd. Flow (perm)	3433		2787					3539	1583		3539	1583	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	
Adj. Flow (vph)	203	0	377	0	0	0	0	752	760	0	967	686	
RTOR Reduction (vph)	0	0	211	0	0	0	0	0	0	0	0	0	
Lane Group Flow (vph)	203	0	166	0	0	0	0	752	760	0	967	686	
Turn Type	Prot		Perm					NA	Free		NA	Free	
Protected Phases	4							2			6		
Permitted Phases			4						Free			Free	
Actuated Green, G (s)	9.6		9.6					61.4	80.0		61.4	80.0	
Effective Green, g (s)	9.6		9.6					62.4	80.0		62.4	80.0	
Actuated g/C Ratio	0.12		0.12					0.78	1.00		0.78	1.00	
Clearance Time (s)	4.0		4.0					5.0			5.0		
Vehicle Extension (s)	2.0		2.0					4.0			4.0		
Lane Grp Cap (vph)	411		334					2760	1583		2760	1583	
v/s Ratio Prot	0.06							0.21			0.27		
v/s Ratio Perm			0.06						c0.48			0.43	
v/c Ratio	0.49		0.50					0.27	0.48		0.35	0.43	
Uniform Delay, d1	32.9		32.9					2.5	0.0		2.7	0.0	
Progression Factor	1.00		1.00					1.00	1.00		0.65	1.00	
Incremental Delay, d2	0.3		0.4					0.1	1.0		0.3	0.8	
Delay (s)	33.3		33.4					2.5	1.0		2.0	0.8	
Level of Service	C		C					A	A		A	A	
Approach Delay (s)		33.3			0.0			1.8			1.5		
Approach LOS		C			A			A			A		
Intersection Summary													
HCM 2000 Control Delay			6.6									HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio			0.53										
Actuated Cycle Length (s)			80.0									Sum of lost time (s)	8.0
Intersection Capacity Utilization			43.4%									ICU Level of Service	A
Analysis Period (min)			15										
c Critical Lane Group													

HCM Signalized Intersection Capacity Analysis
31: Isabel Ave & Airway Blvd



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↑	↗	↖	↑	↗	↖	↑↑↑	↗	↖↗	↑↑↑	↗
Traffic Volume (vph)	8	110	504	41	62	201	326	1032	116	276	1352	16
Future Volume (vph)	8	110	504	41	62	201	326	1032	116	276	1352	16
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.2	5.2	5.6	5.2	5.2	5.6	4.0	4.0	4.0	4.0	4.0	5.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.91	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	1863	1583	1770	1863	1583	1770	5085	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	1863	1583	1770	1863	1583	1770	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	9	120	548	45	67	218	354	1122	126	300	1470	17
RTOR Reduction (vph)	0	0	38	0	0	61	0	0	66	0	0	11
Lane Group Flow (vph)	9	120	510	45	67	157	354	1122	60	300	1470	6
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4	5	3	8	1	5	2		1	6	
Permitted Phases			4			8			2			6
Actuated Green, G (s)	0.8	13.7	34.8	3.4	16.3	28.9	21.1	42.1	42.1	12.6	33.6	33.6
Effective Green, g (s)	0.2	13.1	33.6	2.8	15.7	27.7	22.1	43.1	43.1	13.6	34.6	33.6
Actuated g/C Ratio	0.00	0.14	0.37	0.03	0.17	0.30	0.24	0.47	0.47	0.15	0.38	0.37
Clearance Time (s)	4.6	4.6	5.0	4.6	4.6	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	5.0	5.0	3.0	5.0	5.0
Lane Grp Cap (vph)	3	268	584	54	321	481	429	2408	749	513	1933	584
v/s Ratio Prot	0.01	0.06	c0.20	c0.03	0.04	c0.04	c0.20	0.22		0.09	c0.29	
v/s Ratio Perm			0.13			0.06			0.04			0.00
v/c Ratio	3.00	0.45	0.87	0.83	0.21	0.33	0.83	0.47	0.08	0.58	0.76	0.01
Uniform Delay, d1	45.4	35.6	26.7	43.9	32.3	24.5	32.6	16.2	13.1	36.1	24.6	18.2
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1456.2	1.2	13.6	65.0	0.3	0.4	12.2	0.3	0.1	1.7	2.1	0.0
Delay (s)	1501.6	36.8	40.3	108.9	32.6	24.9	44.8	16.5	13.2	37.8	26.7	18.2
Level of Service	F	D	D	F	C	C	D	B	B	D	C	B
Approach Delay (s)		59.1			37.9			22.5			28.5	
Approach LOS		E			D			C			C	

Intersection Summary

HCM 2000 Control Delay	31.7	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.83		
Actuated Cycle Length (s)	91.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	73.0%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
32: Isabel Ave & Jack London Blvd

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	127	673	254	202	145	297	89	1103	327	450	1244	61
Future Volume (vph)	127	673	254	202	145	297	89	1103	327	450	1244	61
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.97	0.91	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	3433	5085	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	3433	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	138	732	276	220	158	323	97	1199	355	489	1352	66
RTOR Reduction (vph)	0	0	161	0	0	36	0	0	173	0	0	42
Lane Group Flow (vph)	138	732	115	220	158	287	97	1199	182	489	1352	24
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8	1	5	2		1	NA	6
Permitted Phases			4			8			2			6
Actuated Green, G (s)	8.9	28.6	28.6	16.3	36.0	54.4	7.1	30.5	30.5	18.4	41.8	41.8
Effective Green, g (s)	8.9	28.6	28.6	16.3	36.0	54.4	7.1	30.5	30.5	18.4	41.8	41.8
Actuated g/C Ratio	0.08	0.25	0.25	0.14	0.31	0.47	0.06	0.27	0.27	0.16	0.36	0.36
Clearance Time (s)	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	265	880	393	250	1107	821	211	1348	419	549	1848	575
v/s Ratio Prot	0.04	c0.21		c0.12	0.04	0.06	0.03	c0.24		c0.14	0.27	
v/s Ratio Perm			0.07			0.13			0.11			0.02
v/c Ratio	0.52	0.83	0.29	0.88	0.14	0.35	0.46	0.89	0.43	0.89	0.73	0.04
Uniform Delay, d1	51.0	40.9	35.0	48.4	28.4	19.1	52.1	40.6	35.1	47.3	31.7	23.7
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.8	6.8	0.4	28.1	0.1	0.3	1.6	7.5	0.7	16.5	1.5	0.0
Delay (s)	52.8	47.7	35.4	76.5	28.5	19.4	53.7	48.2	35.8	63.8	33.3	23.7
Level of Service	D	D	D	E	C	B	D	D	D	E	C	C
Approach Delay (s)		45.4			39.3			45.8			40.8	
Approach LOS		D			D			D			D	

Intersection Summary		
HCM 2000 Control Delay	43.1	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.87	D
Actuated Cycle Length (s)	115.0	Sum of lost time (s)
Intersection Capacity Utilization	81.6%	21.2
Analysis Period (min)	15	ICU Level of Service
		D

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 33: Isabel Ave Connector & Stanley Blvd



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑	↑	↑↓	↑↑	↑↓	↑↓
Traffic Volume (vph)	1683	441	229	559	153	377
Future Volume (vph)	1683	441	229	559	153	377
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	3.8	4.0	4.0	4.0	2.5
Lane Util. Factor	0.95	1.00	0.97	0.95	0.97	0.88
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	3539	1583	3433	3539	3433	2787
Flt Permitted	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (perm)	3539	1583	3433	3539	3433	2787
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	1829	479	249	608	166	410
RTOR Reduction (vph)	0	1	0	0	0	8
Lane Group Flow (vph)	1829	478	249	608	166	402
Turn Type	NA	pm+ov	Prot	NA	Prot	pm+ov
Protected Phases	2	8	1	6	8	1
Permitted Phases		2				8
Actuated Green, G (s)	43.8	52.4	6.0	53.8	8.6	14.6
Effective Green, g (s)	45.5	55.8	6.0	55.5	10.1	17.6
Actuated g/C Ratio	0.62	0.76	0.08	0.75	0.14	0.24
Clearance Time (s)	5.7	5.5	4.0	5.7	5.5	4.0
Vehicle Extension (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Grp Cap (vph)	2187	1200	279	2668	471	666
v/s Ratio Prot	c0.52	0.06	c0.07	0.17	0.05	c0.06
v/s Ratio Perm		0.25				0.08
v/c Ratio	0.84	0.40	0.89	0.23	0.35	0.60
Uniform Delay, d1	11.1	3.1	33.5	2.7	28.8	24.9
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	2.8	0.1	27.4	0.0	0.2	1.1
Delay (s)	13.9	3.2	60.9	2.7	29.0	26.0
Level of Service	B	A	E	A	C	C
Approach Delay (s)	11.7			19.6	26.8	
Approach LOS	B			B	C	

Intersection Summary

HCM 2000 Control Delay	15.8	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.80		
Actuated Cycle Length (s)	73.6	Sum of lost time (s)	12.0
Intersection Capacity Utilization	69.7%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 34: Murrieta Blvd/Driveway & Portola Ave



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗		↖	↗		↖	↗	↗		↗	
Traffic Volume (vph)	0	962	122	221	612	1	130	5	317	4	7	0
Future Volume (vph)	0	962	122	221	612	1	130	5	317	4	7	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.8		4.0	5.8		5.2	5.2	5.2		4.0	
Lane Util. Factor		0.95		1.00	0.95		0.95	0.95	1.00		1.00	
Frt		0.98		1.00	1.00		1.00	1.00	0.85		1.00	
Flt Protected		1.00		0.95	1.00		0.95	0.96	1.00		0.98	
Satd. Flow (prot)		3479		1770	3538		1681	1691	1583		1832	
Flt Permitted		1.00		0.95	1.00		0.95	0.96	1.00		0.98	
Satd. Flow (perm)		3479		1770	3538		1681	1691	1583		1832	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	1046	133	240	665	1	141	5	345	4	8	0
RTOR Reduction (vph)	0	10	0	0	0	0	0	0	266	0	0	0
Lane Group Flow (vph)	0	1169	0	240	666	0	73	73	79	0	12	0
Turn Type	Prot	NA		Prot	NA		Split	NA	Perm		Split	NA
Protected Phases	5	2		1	6		8	8			4	4
Permitted Phases									8			
Actuated Green, G (s)		30.0		12.2	46.2		8.8	8.8	8.8		0.6	
Effective Green, g (s)		29.1		12.2	45.3		8.2	8.2	8.2		0.6	
Actuated g/C Ratio		0.42		0.18	0.66		0.12	0.12	0.12		0.01	
Clearance Time (s)		4.9		4.0	4.9		4.6	4.6	4.6		4.0	
Vehicle Extension (s)		2.0		2.0	2.0		2.0	2.0	2.0		2.0	
Lane Grp Cap (vph)		1465		312	2319		199	200	187		15	
v/s Ratio Prot		c0.34		c0.14	0.19		0.04	0.04			c0.01	
v/s Ratio Perm									c0.05			
v/c Ratio		0.80		0.77	0.29		0.37	0.36	0.42		0.80	
Uniform Delay, d1		17.4		27.1	5.0		28.1	28.1	28.2		34.2	
Progression Factor		1.00		1.00	1.00		1.00	1.00	1.00		1.00	
Incremental Delay, d2		2.9		9.8	0.0		0.4	0.4	0.6		127.3	
Delay (s)		20.4		36.9	5.1		28.5	28.5	28.8		161.4	
Level of Service		C		D	A		C	C	C		F	
Approach Delay (s)		20.4			13.5			28.7			161.4	
Approach LOS		C			B			C			F	

Intersection Summary		
HCM 2000 Control Delay	20.2	HCM 2000 Level of Service C
HCM 2000 Volume to Capacity ratio	0.73	
Actuated Cycle Length (s)	69.1	Sum of lost time (s) 19.0
Intersection Capacity Utilization	65.9%	ICU Level of Service C
Analysis Period (min)	15	

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 35: Murrieta Blvd & Jack London Blvd
































Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	257	751	434	246	279	128
Future Volume (vph)	257	751	434	246	279	128
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00	1.00	0.95	0.91	
Frt	1.00	0.85	1.00	1.00	0.95	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1770	1583	1770	3539	4845	
Flt Permitted	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	1770	1583	1770	3539	4845	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	279	816	472	267	303	139
RTOR Reduction (vph)	0	508	0	0	115	0
Lane Group Flow (vph)	279	308	472	267	327	0
Turn Type	Prot	Perm	Prot	NA	NA	
Protected Phases	4		5	2	6	
Permitted Phases		4				
Actuated Green, G (s)	15.3	15.3	19.1	32.9	9.8	
Effective Green, g (s)	15.3	15.3	19.1	32.9	9.8	
Actuated g/C Ratio	0.27	0.27	0.34	0.59	0.17	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	481	430	601	2071	844	
v/s Ratio Prot	0.16		c0.27	0.08	c0.07	
v/s Ratio Perm		c0.19				
v/c Ratio	0.58	0.72	0.79	0.13	0.39	
Uniform Delay, d1	17.7	18.5	16.7	5.2	20.5	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	1.8	5.6	6.7	0.0	0.3	
Delay (s)	19.5	24.1	23.4	5.3	20.8	
Level of Service	B	C	C	A	C	
Approach Delay (s)	22.9			16.8	20.8	
Approach LOS	C			B	C	

Intersection Summary

HCM 2000 Control Delay	20.5	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.67		
Actuated Cycle Length (s)	56.2	Sum of lost time (s)	12.0
Intersection Capacity Utilization	61.4%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
36: Murrieta Blvd & Stanley Blvd

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 	 			 		 	 			 	
Traffic Volume (vph)	273	1059	490	42	544	161	228	377	18	251	333	183
Future Volume (vph)	273	1059	490	42	544	161	228	377	18	251	333	183
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.9	4.9	4.0	4.9	4.9	4.9	4.9		4.9	4.9	4.0
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.97	0.95		1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	3433	3515		1770	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	3433	3515		1770	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	297	1151	533	46	591	175	248	410	20	273	362	199
RTOR Reduction (vph)	0	0	309	0	0	69	0	4	0	0	0	150
Lane Group Flow (vph)	297	1151	224	46	591	106	248	426	0	273	362	49
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Prot	NA		Prot	NA	Perm
Protected Phases	7	4		3	8	1	5	2		1	6	
Permitted Phases			4			8						6
Actuated Green, G (s)	10.2	28.7	28.7	2.2	20.7	35.1	9.9	13.9		14.4	18.4	18.4
Effective Green, g (s)	10.2	27.8	27.8	2.2	19.8	33.3	9.0	13.0		13.5	17.5	18.4
Actuated g/C Ratio	0.14	0.37	0.37	0.03	0.26	0.44	0.12	0.17		0.18	0.23	0.24
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	465	1308	585	51	931	804	410	607		317	823	387
v/s Ratio Prot	c0.09	c0.33		0.03	0.17	0.02	0.07	c0.12		c0.15	c0.10	
v/s Ratio Perm			0.14			0.04						0.03
v/c Ratio	0.64	0.88	0.38	0.90	0.63	0.13	0.60	0.70		0.86	0.44	0.13
Uniform Delay, d1	30.8	22.1	17.4	36.4	24.5	12.4	31.4	29.3		29.9	24.7	22.1
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	2.9	7.1	0.4	89.8	1.4	0.1	2.5	3.7		20.6	0.4	0.1
Delay (s)	33.6	29.2	17.8	126.2	25.9	12.5	33.9	32.9		50.5	25.0	22.3
Level of Service	C	C	B	F	C	B	C	C		D	C	C
Approach Delay (s)		26.8			28.7			33.3			32.7	
Approach LOS		C			C			C			C	

Intersection Summary

HCM 2000 Control Delay	29.3	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.82		
Actuated Cycle Length (s)	75.2	Sum of lost time (s)	18.7
Intersection Capacity Utilization	73.1%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
37: Livermore Ave & I-580 WB Ramps



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	264	17	17	827	460	0	0	112	0
Future Volume (vph)	0	0	0	264	17	17	827	460	0	0	112	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)					4.0		4.0	4.0			4.0	
Lane Util. Factor					0.95		0.97	1.00			0.95	
Frt					0.99		1.00	1.00			1.00	
Flt Protected					0.96		0.95	1.00			1.00	
Satd. Flow (prot)					1680		3433	1863			3539	
Flt Permitted					0.96		0.95	1.00			1.00	
Satd. Flow (perm)					1680		3433	1863			3539	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	287	18	18	899	500	0	0	122	0
RTOR Reduction (vph)	0	0	0	0	4	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	0	319	0	899	500	0	0	122	0
Turn Type				Split	NA		Prot	NA			NA	
Protected Phases				8	8		5	2			6	
Permitted Phases												
Actuated Green, G (s)					15.9		14.5	34.4			16.4	
Effective Green, g (s)					15.9		14.0	36.1			18.1	
Actuated g/C Ratio					0.27		0.23	0.60			0.30	
Clearance Time (s)					4.0		3.5	5.7			5.7	
Vehicle Extension (s)					2.0		2.0	2.5			2.5	
Lane Grp Cap (vph)					445		801	1120			1067	
v/s Ratio Prot					c0.19		c0.26	c0.27			0.03	
v/s Ratio Perm												
v/c Ratio					0.72		1.12	0.45			0.11	
Uniform Delay, d1					20.0		23.0	6.5			15.2	
Progression Factor					1.00		0.52	0.26			1.00	
Incremental Delay, d2					4.5		56.9	0.1			0.2	
Delay (s)					24.5		68.7	1.8			15.4	
Level of Service					C		E	A			B	
Approach Delay (s)		0.0			24.5			44.8			15.4	
Approach LOS		A			C			D			B	

Intersection Summary

HCM 2000 Control Delay	39.3	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.75		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	102.8%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
38: Livermore Ave & I-580 EB Ramps
























Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔	↗					↕		↘	↕	
Traffic Volume (vph)	283	11	1247	0	0	0	0	1016	232	58	320	0
Future Volume (vph)	283	11	1247	0	0	0	0	1016	232	58	320	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0					4.0		4.0	4.0	
Lane Util. Factor		0.95	0.95					0.95		1.00	0.95	
Frt		0.90	0.85					0.97		1.00	1.00	
Flt Protected		0.98	1.00					1.00		0.95	1.00	
Satd. Flow (prot)		1566	1504					3441		1770	3539	
Flt Permitted		0.98	1.00					1.00		0.95	1.00	
Satd. Flow (perm)		1566	1504					3441		1770	3539	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	308	12	1355	0	0	0	0	1104	252	63	348	0
RTOR Reduction (vph)	0	125	314	0	0	0	0	30	0	0	0	0
Lane Group Flow (vph)	0	859	377	0	0	0	0	1326	0	63	348	0
Turn Type	Prot	NA	Perm					NA		Prot	NA	
Protected Phases	7	4						2		1	6	
Permitted Phases			4									
Actuated Green, G (s)		20.0	20.0					23.9		4.1	31.0	
Effective Green, g (s)		20.0	20.0					24.9		3.1	32.0	
Actuated g/C Ratio		0.33	0.33					0.41		0.05	0.53	
Clearance Time (s)		4.0	4.0					5.0		3.0	5.0	
Vehicle Extension (s)		2.0	2.0					2.5		2.0	2.5	
Lane Grp Cap (vph)		522	501					1428		91	1887	
v/s Ratio Prot								c0.39		c0.04	0.10	
v/s Ratio Perm		0.55	0.25									
v/c Ratio		1.65	0.75					0.93		0.69	0.18	
Uniform Delay, d1		20.0	17.8					16.7		28.0	7.2	
Progression Factor		1.00	1.00					1.00		0.79	0.33	
Incremental Delay, d2		299.3	5.6					11.9		16.0	0.2	
Delay (s)		319.3	23.4					28.6		38.0	2.6	
Level of Service		F	C					C		D	A	
Approach Delay (s)		197.3			0.0			28.6			8.0	
Approach LOS		F			A			C			A	

Intersection Summary

HCM 2000 Control Delay	108.2	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.21		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	102.8%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
39: Livermore Ave & Portola Ave

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	493	489	142	18	322	59	177	494	79	203	870	408
Future Volume (vph)	493	489	142	18	322	59	177	494	79	203	870	408
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	5.8		4.0	5.8	4.9
Lane Util. Factor	0.97	0.95		1.00	0.95		1.00	0.95		1.00	0.95	1.00
Frt	1.00	0.97		1.00	0.98		1.00	0.98		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3420		1770	3457		1770	3466		1770	3539	1583
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3420		1770	3457		1770	3466		1770	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	536	532	154	20	350	64	192	537	86	221	946	443
RTOR Reduction (vph)	0	25	0	0	16	0	0	10	0	0	0	101
Lane Group Flow (vph)	536	661	0	20	398	0	192	613	0	221	946	342
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	pm+ov
Protected Phases	3	8		7	4		1	6		5	2	3
Permitted Phases												2
Actuated Green, G (s)	19.6	34.3		1.9	16.6		12.1	30.7		13.1	31.7	51.3
Effective Green, g (s)	19.6	35.6		1.9	17.9		12.1	29.8		13.1	30.8	49.5
Actuated g/C Ratio	0.20	0.36		0.02	0.18		0.12	0.30		0.13	0.31	0.50
Clearance Time (s)	4.0	5.3		4.0	5.3		4.0	4.9		4.0	4.9	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	685	1239		34	630		218	1051		236	1109	797
v/s Ratio Prot	c0.16	0.19		0.01	c0.12		0.11	0.18		c0.12	c0.27	0.08
v/s Ratio Perm												0.13
v/c Ratio	0.78	0.53		0.59	0.63		0.88	0.58		0.94	0.85	0.43
Uniform Delay, d1	37.3	24.7		47.8	37.1		42.3	28.9		42.1	31.6	15.4
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	5.8	0.4		23.4	2.1		31.2	0.8		41.0	6.5	0.4
Delay (s)	43.1	25.2		71.1	39.2		73.5	29.8		83.1	38.1	15.8
Level of Service	D	C		E	D		E	C		F	D	B
Approach Delay (s)		33.0			40.7			40.1			38.1	
Approach LOS		C			D			D			D	

Intersection Summary		
HCM 2000 Control Delay	37.3	HCM 2000 Level of Service D
HCM 2000 Volume to Capacity ratio	0.82	
Actuated Cycle Length (s)	98.2	Sum of lost time (s) 18.7
Intersection Capacity Utilization	73.5%	ICU Level of Service D
Analysis Period (min)	15	

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
40: First St/Springtown Blvd & I-580 WB Ramps

BART to Livermore Extension Project
2025 No Project PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations			↗↗			↗	↗↗	↑			↖↖	↖
Traffic Volume (vph)	0	0	262	0	0	0	387	1493	0	0	421	192
Future Volume (vph)	0	0	262	0	0	0	387	1493	0	0	421	192
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)			4.0				4.0	4.0			5.0	5.0
Lane Util. Factor			0.88				0.97	1.00			0.95	1.00
Frt			0.85				1.00	1.00			1.00	0.85
Flt Protected			1.00				0.95	1.00			1.00	1.00
Satd. Flow (prot)			2787				3433	1863			3539	1583
Flt Permitted			1.00				0.95	1.00			1.00	1.00
Satd. Flow (perm)			2787				3433	1863			3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	285	0	0	0	421	1623	0	0	458	209
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	34
Lane Group Flow (vph)	0	0	285	0	0	0	421	1623	0	0	458	175
Turn Type			Over			Free	Prot	NA			NA	Perm
Protected Phases			5				5	2			6	
Permitted Phases						Free						6
Actuated Green, G (s)			34.3				34.3	80.0			37.7	37.7
Effective Green, g (s)			33.8				33.8	80.0			37.2	37.2
Actuated g/C Ratio			0.42				0.42	1.00			0.47	0.47
Clearance Time (s)			3.5				3.5	4.0			4.5	4.5
Vehicle Extension (s)			2.0				2.0	0.2			4.0	4.0
Lane Grp Cap (vph)			1177				1450	1863			1645	736
v/s Ratio Prot			0.10				0.12	c0.87			0.13	
v/s Ratio Perm												0.11
v/c Ratio			0.24				0.29	0.87			0.28	0.24
Uniform Delay, d1			14.9				15.2	0.0			13.2	12.9
Progression Factor			1.00				0.97	1.00			1.00	1.00
Incremental Delay, d2			0.0				0.0	1.9			0.1	0.2
Delay (s)			14.9				14.8	1.9			13.3	13.1
Level of Service			B				B	A			B	B
Approach Delay (s)		14.9			0.0			4.6			13.2	
Approach LOS		B			A			A			B	

Intersection Summary

HCM 2000 Control Delay	7.5	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.98		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	81.9%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
41: First St & I-580 EB Ramps



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕	↗↘					↕↕	↗	↘	↕↕	
Traffic Volume (vph)	553	5	750	0	0	0	0	1351	460	83	826	0
Future Volume (vph)	553	5	750	0	0	0	0	1351	460	83	826	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0					5.0	5.0	4.0	5.0	
Lane Util. Factor		1.00	0.88					0.95	1.00	1.00	0.95	
Frt		1.00	0.85					1.00	0.85	1.00	1.00	
Flt Protected		0.95	1.00					1.00	1.00	0.95	1.00	
Satd. Flow (prot)		1775	2787					3539	1583	1770	3539	
Flt Permitted		0.95	1.00					1.00	1.00	0.95	1.00	
Satd. Flow (perm)		1775	2787					3539	1583	1770	3539	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	601	5	815	0	0	0	0	1468	500	90	898	0
RTOR Reduction (vph)	0	0	135	0	0	0	0	0	283	0	0	0
Lane Group Flow (vph)	0	606	680	0	0	0	0	1468	218	90	898	0
Turn Type	Perm	NA	Perm					NA	Perm	Prot	NA	
Protected Phases		4						2		1	6	
Permitted Phases	4		4						2			
Actuated Green, G (s)		28.7	28.7					35.3	35.3	5.0	43.3	
Effective Green, g (s)		28.2	28.2					34.8	34.8	4.0	42.8	
Actuated g/C Ratio		0.35	0.35					0.43	0.43	0.05	0.53	
Clearance Time (s)		3.5	3.5					4.5	4.5	3.0	4.5	
Vehicle Extension (s)		2.5	2.5					4.0	4.0	2.0	4.0	
Lane Grp Cap (vph)		625	982					1539	688	88	1893	
v/s Ratio Prot								c0.41		c0.05	0.25	
v/s Ratio Perm		0.34	0.24						0.14			
v/c Ratio		0.97	0.69					0.95	0.32	1.02	0.47	
Uniform Delay, d1		25.5	22.2					21.8	14.8	38.0	11.6	
Progression Factor		1.00	1.00					1.00	1.00	0.89	0.64	
Incremental Delay, d2		28.1	2.0					14.3	1.2	102.0	0.9	
Delay (s)		53.6	24.1					36.1	16.0	135.9	8.3	
Level of Service		D	C					D	B	F	A	
Approach Delay (s)		36.7			0.0			31.0			19.9	
Approach LOS		D			A			C			B	

Intersection Summary

HCM 2000 Control Delay	30.4	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.96		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	13.0
Intersection Capacity Utilization	83.7%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
42: 1st St & Mines Rd





















Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	70	237	58	419	298	393	74	1467	849	356	856	50
Future Volume (vph)	70	237	58	419	298	393	74	1467	849	356	856	50
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	0.97	1.00	1.00	1.00	0.91	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	1863	1583	3433	1863	1583	1770	5085	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	1863	1583	3433	1863	1583	1770	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	76	258	63	455	324	427	80	1595	923	387	930	54
RTOR Reduction (vph)	0	0	53	0	0	36	0	0	170	0	0	28
Lane Group Flow (vph)	76	258	10	455	324	391	80	1595	753	387	930	26
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8	1	5	2		1	6	
Permitted Phases			4			8			2			6
Actuated Green, G (s)	5.6	16.4	16.4	13.0	23.8	34.8	7.6	44.8	44.8	11.0	48.2	48.2
Effective Green, g (s)	5.6	16.4	16.4	13.0	23.8	34.8	7.6	44.8	44.8	11.0	48.2	48.2
Actuated g/C Ratio	0.06	0.16	0.16	0.13	0.24	0.34	0.08	0.44	0.44	0.11	0.48	0.48
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	97	301	256	440	438	606	132	2251	700	373	2421	753
v/s Ratio Prot	0.04	c0.14		c0.13	0.17	0.07	0.05	0.31		c0.11	c0.18	
v/s Ratio Perm			0.01			0.18			c0.48			0.02
v/c Ratio	0.78	0.86	0.04	1.03	0.74	0.65	0.61	0.71	1.08	1.04	0.38	0.03
Uniform Delay, d1	47.2	41.3	35.8	44.1	35.8	28.0	45.3	22.9	28.2	45.1	17.0	14.1
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	32.8	20.6	0.1	52.0	6.4	2.4	7.6	1.0	56.2	56.7	0.1	0.0
Delay (s)	80.0	61.9	35.8	96.1	42.3	30.4	53.0	23.9	84.4	101.8	17.1	14.1
Level of Service	E	E	D	F	D	C	D	C	F	F	B	B
Approach Delay (s)		61.2			58.4			46.3			40.9	
Approach LOS		E			E			D			D	



















Intersection Summary		
HCM 2000 Control Delay	48.6	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	1.00	D
Actuated Cycle Length (s)	101.2	Sum of lost time (s)
Intersection Capacity Utilization	85.2%	16.0
Analysis Period (min)	15	ICU Level of Service
		E

c Critical Lane Group



























HCM Unsignalized Intersection Capacity Analysis
43: Vasco Rd & I-580 WB Ramps

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	0	0	88	0	1844	0	0	427	0
Future Volume (Veh/h)	0	0	0	0	0	88	0	1844	0	0	427	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	0	0	0	96	0	2004	0	0	464	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage (veh)												
Upstream signal (ft)											487	
pX, platoon unblocked												
vC, conflicting volume	1562	2468	464	2468	2468	1002	464			2004		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1562	2468	464	2468	2468	1002	464			2004		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	100	100	60	100			100		
cM capacity (veh/h)	46	30	545	15	30	241	1094			282		
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	SB 1	SB 2					
Volume Total	0	96	1002	1002	0	464	0					
Volume Left	0	0	0	0	0	0	0					
Volume Right	0	96	0	0	0	0	0					
cSH	1700	241	1700	1700	1700	1700	1700					
Volume to Capacity	0.00	0.40	0.59	0.59	0.00	0.27	0.00					
Queue Length 95th (ft)	0	45	0	0	0	0	0					
Control Delay (s)	0.0	29.5	0.0	0.0	0.0	0.0	0.0					
Lane LOS	A	D										
Approach Delay (s)	0.0	29.5	0.0			0.0						
Approach LOS	A	D										
Intersection Summary												
Average Delay			1.1									
Intersection Capacity Utilization			63.1%	ICU Level of Service	B							
Analysis Period (min)			15									

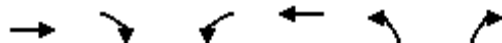
HCM Unsignalized Intersection Capacity Analysis
 44: Vasco Rd & I-580 EB Ramps

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	0	0	0	0	2092	0	64	557	0
Future Volume (Veh/h)	0	0	0	0	0	0	0	2092	0	64	557	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	0	0	0	0	0	2274	0	70	605	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1882	3019	605	3019	3019	1137	605			2274		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1882	3019	605	3019	3019	1137	605			2274		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	100	100	100	100			68		
cM capacity (veh/h)	33	9	441	4	9	196	969			221		
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2						
Volume Total	0	0	1516	758	70	605						
Volume Left	0	0	0	0	70	0						
Volume Right	0	0	0	0	0	0						
cSH	1700	1700	1700	1700	221	1700						
Volume to Capacity	0.00	0.00	0.89	0.45	0.32	0.36						
Queue Length 95th (ft)	0	0	0	0	33	0						
Control Delay (s)	0.0	0.0	0.0	0.0	28.7	0.0						
Lane LOS	A	A			D							
Approach Delay (s)	0.0	0.0	0.0		3.0							
Approach LOS	A	A										
Intersection Summary												
Average Delay			0.7									
Intersection Capacity Utilization			61.2%	ICU Level of Service	B							
Analysis Period (min)			15									

HCM Signalized Intersection Capacity Analysis
45: Vasco Rd & East Ave

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations		 			 			 		 		 	
Traffic Volume (vph)	477	27	97	141	367	236	103	339	12	12	345	363	
Future Volume (vph)	477	27	97	141	367	236	103	339	12	12	345	363	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	0.95		0.97	1.00	1.00	
Frt	1.00	0.88		1.00	0.94		1.00	0.99		1.00	1.00	0.85	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00	
Satd. Flow (prot)	1770	3123		1770	3331		1770	3521		3433	1863	1583	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00	
Satd. Flow (perm)	1770	3123		1770	3331		1770	3521		3433	1863	1583	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	
Adj. Flow (vph)	518	29	105	153	399	257	112	368	13	13	375	395	
RTOR Reduction (vph)	0	66	0	0	132	0	0	3	0	0	0	296	
Lane Group Flow (vph)	518	68	0	153	524	0	112	378	0	13	375	99	
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	Perm	
Protected Phases	7	4		3	8		5	2		1	6		
Permitted Phases												6	
Actuated Green, G (s)	24.0	30.6		9.5	16.1		6.0	25.9		0.8	20.7	20.7	
Effective Green, g (s)	24.0	30.6		9.5	16.1		6.0	25.9		0.8	20.7	20.7	
Actuated g/C Ratio	0.29	0.37		0.11	0.19		0.07	0.31		0.01	0.25	0.25	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0	
Lane Grp Cap (vph)	513	1154		203	647		128	1101		33	465	395	
v/s Ratio Prot	c0.29	0.02		0.09	c0.16		c0.06	0.11		0.00	c0.20		
v/s Ratio Perm												0.06	
v/c Ratio	1.01	0.06		0.75	0.81		0.88	0.34		0.39	0.81	0.25	
Uniform Delay, d1	29.4	16.8		35.5	31.9		38.0	21.9		40.8	29.2	24.8	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00	
Incremental Delay, d2	42.2	0.0		14.6	7.4		43.8	0.2		7.6	9.9	0.3	
Delay (s)	71.6	16.8		50.1	39.3		81.9	22.1		48.3	39.0	25.2	
Level of Service	E	B		D	D		F	C		D	D	C	
Approach Delay (s)		60.3			41.3			35.7			32.2		
Approach LOS		E			D			D			C		
Intersection Summary													
HCM 2000 Control Delay			42.2									HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio			0.89										
Actuated Cycle Length (s)			82.8									Sum of lost time (s)	16.0
Intersection Capacity Utilization			81.3%									ICU Level of Service	D
Analysis Period (min)			15										

c Critical Lane Group



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	→			←	↔	↔
Traffic Volume (veh/h)	628	36	219	207	5	131
Future Volume (Veh/h)	628	36	219	207	5	131
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	683	39	238	225	5	142
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume			683	1404		702
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			683	1404		702
tC, single (s)			4.1	6.4		6.2
tC, 2 stage (s)						
tF (s)			2.2	3.5		3.3
p0 queue free %			74	96		68
cM capacity (veh/h)			910	114		438
Direction, Lane #	EB 1	WB 1	NB 1	NB 2		
Volume Total	722	463	5	142		
Volume Left	0	238	5	0		
Volume Right	39	0	0	142		
cSH	1700	910	114	438		
Volume to Capacity	0.42	0.26	0.04	0.32		
Queue Length 95th (ft)	0	26	3	35		
Control Delay (s)	0.0	6.8	38.1	17.1		
Lane LOS	A		E	C		
Approach Delay (s)	0.0	6.8	17.8			
Approach LOS			C			
Intersection Summary						
Average Delay			4.3			
Intersection Capacity Utilization			71.6%	ICU Level of Service		C
Analysis Period (min)			15			

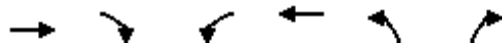
Intersection	
Intersection Delay, s/veh	13.8
Intersection LOS	B

Movement	EBU	EBL	EBT	WBU	WBT	WBR	SBU	SBL	SBR
Lane Configurations		↘	↗↗		↗	↘		↘↘	↗
Traffic Vol, veh/h	0	293	253	0	84	267	0	190	7
Future Vol, veh/h	0	293	253	0	84	267	0	190	7
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	318	275	0	91	290	0	207	8
Number of Lanes	0	1	2	0	1	1	0	2	1

Approach	EB	WB	SB
Opposing Approach	WB	EB	
Opposing Lanes	2	3	0
Conflicting Approach Left	SB		WB
Conflicting Lanes Left	3	0	2
Conflicting Approach Right		SB	EB
Conflicting Lanes Right	0	3	3
HCM Control Delay	14.8	13.3	11.9
HCM LOS	B	B	B

Lane	EBLn1	EBLn2	EBLn3	WBLn1	WBLn2	SBLn1	SBLn2	SBLn3
Vol Left, %	100%	0%	0%	0%	0%	100%	100%	0%
Vol Thru, %	0%	100%	100%	100%	0%	0%	0%	0%
Vol Right, %	0%	0%	0%	0%	100%	0%	0%	100%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	293	127	127	84	267	95	95	7
LT Vol	293	0	0	0	0	95	95	0
Through Vol	0	127	127	84	0	0	0	0
RT Vol	0	0	0	0	267	0	0	7
Lane Flow Rate	318	138	138	91	290	103	103	8
Geometry Grp	8	8	8	8	8	7	7	7
Degree of Util (X)	0.599	0.239	0.173	0.169	0.48	0.212	0.212	0.009
Departure Headway (Hd)	6.775	6.27	4.517	6.656	5.948	7.377	7.377	4.412
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cap	532	571	789	537	604	485	485	806
Service Time	4.531	4.025	2.272	4.418	3.71	5.137	5.137	2.169
HCM Lane V/C Ratio	0.598	0.242	0.175	0.169	0.48	0.212	0.212	0.01
HCM Control Delay	19.2	11	8.2	10.8	14.1	12.1	12.1	7.2
HCM Lane LOS	C	B	A	B	B	B	B	A
HCM 95th-tile Q	3.9	0.9	0.6	0.6	2.6	0.8	0.8	0

HCM Signalized Intersection Capacity Analysis
48: Greenville Rd & Northfront Road/Altamont Pass Road



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↑	↑	↑	↑	↑
Traffic Volume (vph)	607	147	1	52	391	1039
Future Volume (vph)	607	147	1	52	391	1039
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	1863	1583	1770	1863	1770	1583
Flt Permitted	1.00	1.00	0.10	1.00	0.95	1.00
Satd. Flow (perm)	1863	1583	191	1863	1770	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	660	160	1	57	425	1129
RTOR Reduction (vph)	0	65	0	0	0	29
Lane Group Flow (vph)	660	95	1	57	425	1100
Turn Type	NA	Perm	Perm	NA	Prot	Perm
Protected Phases	4			8	2	
Permitted Phases		4	8			2
Actuated Green, G (s)	39.0	39.0	39.0	39.0	73.0	73.0
Effective Green, g (s)	39.0	39.0	39.0	39.0	73.0	73.0
Actuated g/C Ratio	0.32	0.32	0.32	0.32	0.61	0.61
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	605	514	62	605	1076	962
v/s Ratio Prot	c0.35			0.03	0.24	
v/s Ratio Perm		0.06	0.01			c0.69
v/c Ratio	1.09	0.18	0.02	0.09	0.39	1.14
Uniform Delay, d1	40.5	29.1	27.5	28.2	12.1	23.5
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	63.8	0.2	0.1	0.1	0.2	77.2
Delay (s)	104.3	29.2	27.6	28.3	12.4	100.7
Level of Service	F	C	C	C	B	F
Approach Delay (s)	89.7			28.3	76.6	
Approach LOS	F			C	E	

Intersection Summary

HCM 2000 Control Delay	79.8	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.12		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	102.9%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	416	113	242	986	67	81
Future Volume (vph)	416	113	242	986	67	81
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.2	5.2	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.88	0.97	0.95	0.95	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	3433	2787	3433	3539	3539	1583
Flt Permitted	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (perm)	3433	2787	3433	3539	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	452	123	263	1072	73	88
RTOR Reduction (vph)	0	102	0	0	0	56
Lane Group Flow (vph)	452	21	263	1072	73	32
Turn Type	Prot	Perm	Prot	NA	NA	Perm
Protected Phases	8		1	6	2	
Permitted Phases		8				2
Actuated Green, G (s)	6.5	6.5	3.0	18.0	11.0	11.0
Effective Green, g (s)	5.9	5.9	3.0	19.7	12.7	12.7
Actuated g/C Ratio	0.17	0.17	0.09	0.57	0.36	0.36
Clearance Time (s)	4.6	4.6	4.0	5.7	5.7	5.7
Vehicle Extension (s)	5.0	5.0	6.0	2.5	2.5	2.5
Lane Grp Cap (vph)	582	472	295	2003	1291	577
v/s Ratio Prot	c0.13		c0.08	c0.30	0.02	
v/s Ratio Perm		0.01				0.02
v/c Ratio	0.78	0.04	0.89	0.54	0.06	0.06
Uniform Delay, d1	13.8	12.1	15.7	4.7	7.2	7.2
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	7.5	0.1	29.1	0.2	0.0	0.0
Delay (s)	21.3	12.2	44.9	4.9	7.2	7.2
Level of Service	C	B	D	A	A	A
Approach Delay (s)	19.4			12.8	7.2	
Approach LOS	B			B	A	

Intersection Summary

HCM 2000 Control Delay	14.2	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.71		
Actuated Cycle Length (s)	34.8	Sum of lost time (s)	13.2
Intersection Capacity Utilization	46.8%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
50: Greenville Rd & Patterson Pass Rd

BART to Livermore Extension Project
2025 No Project PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	35	520	59	5	13	7	72	407	320	420	206	46
Future Volume (vph)	35	520	59	5	13	7	72	407	320	420	206	46
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.98		1.00	0.95		1.00	0.93		1.00	0.97	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1834		1770	1761		1770	1740		1770	1812	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	1834		1770	1761		1770	1740		1770	1812	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	38	565	64	5	14	8	78	442	348	457	224	50
RTOR Reduction (vph)	0	4	0	0	6	0	0	23	0	0	6	0
Lane Group Flow (vph)	38	625	0	5	16	0	78	767	0	457	268	0
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												
Actuated Green, G (s)	8.8	32.0		0.8	24.0		8.1	43.8		25.0	60.7	
Effective Green, g (s)	8.8	32.0		0.8	24.0		8.1	43.8		25.0	60.7	
Actuated g/C Ratio	0.07	0.27		0.01	0.20		0.07	0.37		0.21	0.52	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	132	499		12	359		121	648		376	935	
v/s Ratio Prot	c0.02	c0.34		0.00	0.01		0.04	c0.44		c0.26	0.15	
v/s Ratio Perm												
v/c Ratio	0.29	1.25		0.42	0.04		0.64	1.18		1.22	0.29	
Uniform Delay, d1	51.4	42.8		58.2	37.6		53.3	36.9		46.3	16.2	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	1.2	129.6		21.8	0.1		11.2	97.6		119.0	0.8	
Delay (s)	52.6	172.4		79.9	37.6		64.5	134.5		165.3	16.9	
Level of Service	D	F		E	D		E	F		F	B	
Approach Delay (s)		165.6			45.5			128.2			109.7	
Approach LOS		F			D			F			F	

Intersection Summary

HCM 2000 Control Delay	132.2	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.21		
Actuated Cycle Length (s)	117.6	Sum of lost time (s)	16.0
Intersection Capacity Utilization	105.2%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
1: Dougherty Rd & Amador Valley Rd



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	85	515	388	719	1803	137
Future Volume (vph)	85	515	388	719	1803	137
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5	5.7	5.7	
Lane Util. Factor	1.00	1.00	0.97	0.91	0.91	
Frt	1.00	0.85	1.00	1.00	0.99	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1770	1583	3433	5085	5031	
Flt Permitted	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	1770	1583	3433	5085	5031	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	92	560	422	782	1960	149
RTOR Reduction (vph)	0	193	0	0	8	0
Lane Group Flow (vph)	92	367	422	782	2101	0
Turn Type	Perm	Perm	Prot	NA	NA	
Protected Phases			5	2	6	
Permitted Phases	4	4				
Actuated Green, G (s)	23.0	23.0	12.3	56.1	39.3	
Effective Green, g (s)	23.0	23.0	12.3	56.1	39.3	
Actuated g/C Ratio	0.26	0.26	0.14	0.63	0.44	
Clearance Time (s)	4.5	4.5	4.5	5.7	5.7	
Vehicle Extension (s)	1.8	1.8	2.0	4.0	4.0	
Lane Grp Cap (vph)	455	407	472	3194	2214	
v/s Ratio Prot			c0.12	0.15	c0.42	
v/s Ratio Perm	0.05	c0.23				
v/c Ratio	0.20	0.90	0.89	0.24	0.95	
Uniform Delay, d1	26.0	32.1	37.9	7.3	24.0	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.1	22.2	18.6	0.1	9.7	
Delay (s)	26.0	54.2	56.4	7.3	33.7	
Level of Service	C	D	E	A	C	
Approach Delay (s)	50.2			24.6	33.7	
Approach LOS	D			C	C	

Intersection Summary

HCM 2000 Control Delay	33.7	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.92		
Actuated Cycle Length (s)	89.3	Sum of lost time (s)	14.7
Intersection Capacity Utilization	78.3%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
2: Dougherty Rd & Dublin Blvd

BART to Livermore Extension Project
2025 BART AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↑↑↑	↖↗	↖↗↘	↑↑↑	↖	↖↗↘	↑↑↑	↖↗	↖↗	↑↑↑	↖↗
Traffic Volume (vph)	41	372	415	269	608	369	613	1000	120	705	1757	75
Future Volume (vph)	41	372	415	269	608	369	613	1000	120	705	1757	75
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	6.0	5.0	5.0	5.5	5.0	5.0	5.5	5.0	5.0	5.5	
Lane Util. Factor	0.97	0.91	0.88	0.94	0.91	1.00	0.94	0.91	0.88	0.97	0.86	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	3433	5085	2787	4990	5085	1583	4990	5085	2787	3433	6368	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	3433	5085	2787	4990	5085	1583	4990	5085	2787	3433	6368	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	45	404	451	292	661	401	666	1087	130	766	1910	82
RTOR Reduction (vph)	0	0	41	0	0	100	0	0	77	0	4	0
Lane Group Flow (vph)	45	404	410	292	661	301	666	1087	53	766	1988	0
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	
Protected Phases	5	2	3	1	6	7	3	8	1	7	4	
Permitted Phases			2			6			8			
Actuated Green, G (s)	11.8	22.5	39.5	15.0	26.2	52.2	17.0	33.1	48.1	26.0	42.1	
Effective Green, g (s)	11.8	22.5	39.5	15.0	26.2	52.2	17.0	33.1	48.1	26.0	42.1	
Actuated g/C Ratio	0.10	0.19	0.33	0.13	0.22	0.44	0.14	0.28	0.41	0.22	0.36	
Clearance Time (s)	5.0	6.0	5.0	5.0	5.5	5.0	5.0	5.5	5.0	5.0	5.5	
Vehicle Extension (s)	2.0	4.5	2.0	2.0	4.5	2.0	2.0	4.5	2.0	2.0	4.5	
Lane Grp Cap (vph)	343	968	932	633	1128	699	718	1425	1135	755	2270	
v/s Ratio Prot	0.01	0.08	0.06	c0.06	c0.13	0.09	0.13	0.21	0.01	c0.22	c0.31	
v/s Ratio Perm			0.08			0.10			0.01			
v/c Ratio	0.13	0.42	0.44	0.46	0.59	0.43	0.93	0.76	0.05	1.01	0.88	
Uniform Delay, d1	48.5	42.0	30.7	47.8	41.1	22.7	49.9	38.9	21.1	46.0	35.6	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.1	0.5	0.1	0.2	1.1	0.2	17.8	2.8	0.0	36.4	4.4	
Delay (s)	48.5	42.5	30.8	48.0	42.2	22.9	67.7	41.7	21.2	82.5	39.9	
Level of Service	D	D	C	D	D	C	E	D	C	F	D	
Approach Delay (s)		37.0			37.7			49.5			51.8	
Approach LOS		D			D			D			D	

Intersection Summary

HCM 2000 Control Delay	46.4	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.83		
Actuated Cycle Length (s)	118.1	Sum of lost time (s)	21.5
Intersection Capacity Utilization	81.8%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
3: Dougherty Rd & I-580 WB Ramps



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations				↔↔		↔↔		↑↑↑			↑↑↑	↔	
Traffic Volume (vph)	0	0	0	395	0	637	0	1270	0	0	1658	0	
Future Volume (vph)	0	0	0	395	0	637	0	1270	0	0	1658	0	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)				4.0		4.0		4.0			4.0		
Lane Util. Factor				0.97		0.88		0.91			0.86		
Frt				1.00		0.85		1.00			1.00		
Flt Protected				0.95		1.00		1.00			1.00		
Satd. Flow (prot)				3433		2787		5085			4806		
Flt Permitted				0.95		1.00		1.00			1.00		
Satd. Flow (perm)				3433		2787		5085			4806		
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	
Adj. Flow (vph)	0	0	0	429	0	692	0	1380	0	0	1802	0	
RTOR Reduction (vph)	0	0	0	0	0	37	0	0	0	0	0	0	
Lane Group Flow (vph)	0	0	0	429	0	655	0	1380	0	0	1802	0	
Turn Type				Prot		Prot		NA			NA	Perm	
Protected Phases				4		4		2			6		
Permitted Phases												6	
Actuated Green, G (s)				14.0		14.0		25.2			25.2		
Effective Green, g (s)				15.4		15.4		26.6			26.6		
Actuated g/C Ratio				0.31		0.31		0.53			0.53		
Clearance Time (s)				5.4		5.4		5.4			5.4		
Vehicle Extension (s)				3.0		3.0		3.0			3.0		
Lane Grp Cap (vph)				1057		858		2705			2556		
v/s Ratio Prot				0.12		c0.24		0.27			c0.37		
v/s Ratio Perm													
v/c Ratio				0.41		0.76		0.51			0.71		
Uniform Delay, d1				13.7		15.7		7.5			8.8		
Progression Factor				1.00		1.00		0.58			1.00		
Incremental Delay, d2				0.3		4.1		0.6			1.7		
Delay (s)				13.9		19.7		5.0			10.4		
Level of Service				B		B		A			B		
Approach Delay (s)		0.0			17.5			5.0			10.4		
Approach LOS		A			B			A			B		
Intersection Summary													
HCM 2000 Control Delay			10.5		HCM 2000 Level of Service						B		
HCM 2000 Volume to Capacity ratio			0.73										
Actuated Cycle Length (s)			50.0		Sum of lost time (s)						8.0		
Intersection Capacity Utilization			53.5%		ICU Level of Service						A		
Analysis Period (min)			15										
c Critical Lane Group													

HCM Signalized Intersection Capacity Analysis
4: Hopyard Rd/Dougherty Rd & I-580 EB Ramps

BART to Livermore Extension Project
2025 BART AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗		↖↗					↑↑↑	↖		↑↑↑	↖
Traffic Volume (vph)	756	0	1509	0	0	0	0	753	0	0	1519	0
Future Volume (vph)	756	0	1509	0	0	0	0	753	0	0	1519	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0					4.0			4.0	
Lane Util. Factor	0.97		0.88					0.91			0.86	
Frt	1.00		0.85					1.00			1.00	
Flt Protected	0.95		1.00					1.00			1.00	
Satd. Flow (prot)	3433		2787					5085			4806	
Flt Permitted	0.95		1.00					1.00			1.00	
Satd. Flow (perm)	3433		2787					5085			4806	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	822	0	1640	0	0	0	0	818	0	0	1651	0
RTOR Reduction (vph)	0	0	11	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	822	0	1629	0	0	0	0	818	0	0	1651	0
Turn Type	Prot		Prot					NA	Free		NA	Perm
Protected Phases	4		4					2			6	
Permitted Phases									Free			6
Actuated Green, G (s)	54.6		54.6					34.6			34.6	
Effective Green, g (s)	56.0		56.0					36.0			36.0	
Actuated g/C Ratio	0.56		0.56					0.36			0.36	
Clearance Time (s)	5.4		5.4					5.4			5.4	
Vehicle Extension (s)	3.0		3.0					3.0			3.0	
Lane Grp Cap (vph)	1922		1560					1830			1730	
v/s Ratio Prot	0.24		c0.58					0.16			c0.34	
v/s Ratio Perm												
v/c Ratio	0.43		1.04					0.45			0.95	
Uniform Delay, d1	12.7		22.0					24.4			31.2	
Progression Factor	1.00		1.00					1.00			0.93	
Incremental Delay, d2	0.2		35.2					0.8			10.8	
Delay (s)	12.9		57.2					25.2			39.8	
Level of Service	B		E					C			D	
Approach Delay (s)		42.4			0.0			25.2			39.8	
Approach LOS		D			A			C			D	

Intersection Summary

HCM 2000 Control Delay	38.7	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	1.01		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	88.8%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
5: Hopyard Rd & Owens Rd

BART to Livermore Extension Project
2025 BART AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↔↗		↖	↗	↗	↖	↑↑↑	↗	↖↗	↑↑↗	
Traffic Volume (vph)	194	104	52	119	134	199	142	688	159	904	1626	548
Future Volume (vph)	194	104	52	119	134	199	142	688	159	904	1626	548
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	2.7	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	0.91	0.91		1.00	0.95	0.95	1.00	0.91	1.00	0.97	0.91	
Frt	1.00	0.97		1.00	0.95	0.85	1.00	1.00	0.85	1.00	0.96	
Flt Protected	0.95	0.98		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1610	3223		1770	1686	1504	1770	5085	1583	3433	4893	
Flt Permitted	0.95	0.98		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1610	3223		1770	1686	1504	1770	5085	1583	3433	4893	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	211	113	57	129	146	216	154	748	173	983	1767	596
RTOR Reduction (vph)	0	26	0	0	18	74	0	0	128	0	67	0
Lane Group Flow (vph)	116	239	0	129	195	75	154	748	45	983	2296	0
Turn Type	Split	NA		Split	NA	pm+ov	Prot	NA	Perm	Prot	NA	
Protected Phases	8	8		4	4	1	5	2		1	6	
Permitted Phases						4			2			
Actuated Green, G (s)	6.5	6.5		9.9	9.9	41.6	8.0	21.6	21.6	31.7	45.3	
Effective Green, g (s)	7.8	7.8		11.2	11.2	44.2	8.0	23.3	23.3	31.7	47.0	
Actuated g/C Ratio	0.09	0.09		0.12	0.12	0.49	0.09	0.26	0.26	0.35	0.52	
Clearance Time (s)	5.3	5.3		5.3	5.3	4.0	4.0	5.7	5.7	4.0	5.7	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	139	279		220	209	783	157	1316	409	1209	2555	
v/s Ratio Prot	0.07	c0.07		0.07	c0.12	0.04	c0.09	0.15		0.29	c0.47	
v/s Ratio Perm						0.01			0.03			
v/c Ratio	0.83	0.86		0.59	0.93	0.10	0.98	0.57	0.11	0.81	0.90	
Uniform Delay, d1	40.5	40.6		37.2	39.0	12.2	40.9	29.0	25.4	26.5	19.4	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	33.0	22.0		4.0	43.2	0.1	65.8	1.8	0.5	4.3	5.6	
Delay (s)	73.4	62.6		41.2	82.2	12.3	106.7	30.8	26.0	30.7	24.9	
Level of Service	E	E		D	F	B	F	C	C	C	C	
Approach Delay (s)		65.9			50.2			40.9			26.6	
Approach LOS		E			D			D			C	

Intersection Summary

HCM 2000 Control Delay	34.5	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.91		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	82.7%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
6: Hopyard Rd & Stoneridge Dr

BART to Livermore Extension Project
2025 BART AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↑↑↑	↖	↖↗	↑↑↑	↖	↖↗	↑↑	↖	↖↗	↑↑↑	↖
Traffic Volume (vph)	150	730	438	84	1008	120	651	750	88	280	976	233
Future Volume (vph)	150	730	438	84	1008	120	651	750	88	280	976	233
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.91	1.00	0.97	0.91	1.00	0.94	0.95	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5085	1583	3433	5085	1583	4990	3539	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5085	1583	3433	5085	1583	4990	3539	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	163	793	476	91	1096	130	708	815	96	304	1061	253
RTOR Reduction (vph)	0	0	235	0	0	95	0	0	64	0	0	129
Lane Group Flow (vph)	163	793	241	91	1096	35	708	815	32	304	1061	124
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8			2			6
Actuated Green, G (s)	6.0	24.4	24.4	3.2	21.6	21.6	14.4	26.3	26.3	9.8	21.7	21.7
Effective Green, g (s)	6.0	24.4	24.4	3.2	21.6	21.6	14.4	26.3	26.3	9.8	21.7	21.7
Actuated g/C Ratio	0.08	0.31	0.31	0.04	0.27	0.27	0.18	0.33	0.33	0.12	0.27	0.27
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	258	1556	484	137	1378	429	901	1167	522	422	1384	431
v/s Ratio Prot	c0.05	c0.16		0.03	c0.22		c0.14	c0.23		0.09	0.21	
v/s Ratio Perm			0.15			0.02			0.02			0.08
v/c Ratio	0.63	0.51	0.50	0.66	0.80	0.08	0.79	0.70	0.06	0.72	0.77	0.29
Uniform Delay, d1	35.8	22.7	22.6	37.7	27.0	21.7	31.2	23.2	18.3	33.6	26.7	22.9
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	5.0	0.3	0.8	11.5	3.3	0.1	4.6	1.8	0.0	6.0	2.6	0.4
Delay (s)	40.8	23.0	23.5	49.2	30.3	21.7	35.7	25.1	18.3	39.6	29.3	23.3
Level of Service	D	C	C	D	C	C	D	C	B	D	C	C
Approach Delay (s)		25.2			30.7			29.3			30.3	
Approach LOS		C			C			C			C	


































Intersection Summary

HCM 2000 Control Delay	28.9	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.76		
Actuated Cycle Length (s)	79.7	Sum of lost time (s)	16.0
Intersection Capacity Utilization	68.3%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
7: Hopyard Rd & Las Positas Blvd

BART to Livermore Extension Project
2025 BART AM

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations	 	 		 	 		 	  		 	  		
Traffic Volume (vph)	152	462	373	350	447	57	411	1147	363	111	1014	90	
Future Volume (vph)	152	462	373	350	447	57	411	1147	363	111	1014	90	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	0.97	0.95	1.00	0.97	0.95	1.00	0.97	0.91	1.00	0.97	0.91	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	3433	3539	1583	3433	3539	1583	3433	5085	1583	3433	5085	1583	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	3433	3539	1583	3433	3539	1583	3433	5085	1583	3433	5085	1583	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	
Adj. Flow (vph)	165	502	405	380	486	62	447	1247	395	121	1102	98	
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	72	
Lane Group Flow (vph)	165	502	405	380	486	62	447	1247	395	121	1102	26	
Turn Type	Prot	NA	Free	Prot	NA	Free	Prot	NA	Free	Prot	NA	Perm	
Protected Phases	7	4		3	8		5	2		1	6		
Permitted Phases			Free			Free			Free			6	
Actuated Green, G (s)	5.5	14.6	64.5	8.0	17.1	64.5	9.0	22.7	64.5	3.2	16.9	16.9	
Effective Green, g (s)	5.5	14.6	64.5	8.0	17.1	64.5	9.0	22.7	64.5	3.2	16.9	16.9	
Actuated g/C Ratio	0.09	0.23	1.00	0.12	0.27	1.00	0.14	0.35	1.00	0.05	0.26	0.26	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0	
Lane Grp Cap (vph)	292	801	1583	425	938	1583	479	1789	1583	170	1332	414	
v/s Ratio Prot	0.05	c0.14		c0.11	0.14		c0.13	0.25		0.04	c0.22		
v/s Ratio Perm			c0.26			0.04			0.25			0.02	
v/c Ratio	0.57	0.63	0.26	0.89	0.52	0.04	0.93	0.70	0.25	0.71	0.83	0.06	
Uniform Delay, d1	28.4	22.5	0.0	27.8	20.2	0.0	27.5	17.9	0.0	30.2	22.4	17.9	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	2.5	1.5	0.4	20.6	0.5	0.0	25.3	1.2	0.4	13.2	4.4	0.1	
Delay (s)	30.8	24.0	0.4	48.4	20.7	0.0	52.8	19.1	0.4	43.3	26.8	17.9	
Level of Service	C	C	A	D	C	A	D	B	A	D	C	B	
Approach Delay (s)		16.2			30.7			22.8			27.6		
Approach LOS		B			C			C			C		
Intersection Summary													
HCM 2000 Control Delay			24.0									HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio			0.79										
Actuated Cycle Length (s)			64.5									Sum of lost time (s)	16.0
Intersection Capacity Utilization			67.4%									ICU Level of Service	C
Analysis Period (min)			15										

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
8: Willow Rd & Owens Rd

BART to Livermore Extension Project
2025 BART AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↖↗↘		↖↗	↖↗↘	↖	↖	↖↗	↖	↖	↖	↖
Traffic Volume (vph)	195	361	235	92	330	109	86	103	0	89	87	101
Future Volume (vph)	195	361	235	92	330	109	86	103	0	89	87	101
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	5.3	4.0		5.3	4.0	4.0
Lane Util. Factor	0.97	0.91		0.97	0.91	1.00	1.00	0.95		1.00	1.00	1.00
Frt	1.00	0.94		1.00	1.00	0.85	1.00	1.00		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	4785		3433	5085	1583	1770	3539		1770	1863	1583
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.66	1.00		0.68	1.00	1.00
Satd. Flow (perm)	3433	4785		3433	5085	1583	1221	3539		1269	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	212	392	255	100	359	118	93	112	0	97	95	110
RTOR Reduction (vph)	0	68	0	0	0	47	0	0	0	0	0	94
Lane Group Flow (vph)	212	579	0	100	359	71	93	112	0	97	95	16
Turn Type	Prot	NA		Prot	NA	Perm	Perm	NA	Perm	Perm	NA	Perm
Protected Phases	1	6		5	2			4				8
Permitted Phases						2	4		4	8		8
Actuated Green, G (s)	13.6	64.7		7.1	58.2	58.2	13.2	13.2		13.2	13.2	13.2
Effective Green, g (s)	13.6	66.4		7.1	59.9	59.9	13.2	14.5		13.2	14.5	14.5
Actuated g/C Ratio	0.14	0.66		0.07	0.60	0.60	0.13	0.14		0.13	0.14	0.14
Clearance Time (s)	4.0	5.7		4.0	5.7	5.7	5.3	5.3		5.3	5.3	5.3
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	466	3177		243	3045	948	161	513		167	270	229
v/s Ratio Prot	c0.06	c0.12		c0.03	0.07			0.03			0.05	
v/s Ratio Perm						0.04	0.08			c0.08		0.01
v/c Ratio	0.45	0.18		0.41	0.12	0.07	0.58	0.22		0.58	0.35	0.07
Uniform Delay, d1	39.8	6.4		44.5	8.7	8.4	40.8	37.7		40.8	38.5	36.9
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	0.7	0.1		1.1	0.1	0.2	4.9	0.2		5.1	0.8	0.1
Delay (s)	40.5	6.5		45.6	8.7	8.6	45.7	38.0		45.9	39.3	37.1
Level of Service	D	A		D	A	A	D	D		D	D	D
Approach Delay (s)		14.9			15.1			41.5			40.6	
Approach LOS		B			B			D			D	

Intersection Summary

HCM 2000 Control Delay	21.8	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.29		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	37.2%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
9: Hacienda Dr & Dublin Blvd

BART to Livermore Extension Project
2025 BART AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	72	335	94	271	744	80	157	633	115	12	390	132
Future Volume (vph)	72	335	94	271	744	80	157	633	115	12	390	132
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	6.0	5.0	4.5	6.0		5.0	6.0	6.0	4.5	5.5	5.5
Lane Util. Factor	0.97	0.91	0.88	0.97	0.91		0.94	0.95	0.88	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5085	2787	3433	5011		4990	3539	2787	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5085	2787	3433	5011		4990	3539	2787	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	78	364	102	295	809	87	171	688	125	13	424	143
RTOR Reduction (vph)	0	0	71	0	12	0	0	0	86	0	0	117
Lane Group Flow (vph)	78	364	31	295	884	0	171	688	39	13	424	26
Turn Type	Prot	NA	pm+ov	Prot	NA		Prot	NA	Perm	Prot	NA	Perm
Protected Phases	5	2	3	1	6		3	8		7	NA	4
Permitted Phases			2						8			4
Actuated Green, G (s)	4.8	12.1	22.4	17.3	24.6		10.3	23.5	23.5	0.6	13.8	13.8
Effective Green, g (s)	4.8	12.1	22.4	17.3	24.6		10.3	23.5	23.5	0.6	13.8	13.8
Actuated g/C Ratio	0.06	0.16	0.30	0.23	0.33		0.14	0.32	0.32	0.01	0.19	0.19
Clearance Time (s)	4.5	6.0	5.0	4.5	6.0		5.0	6.0	6.0	4.5	5.5	5.5
Vehicle Extension (s)	2.0	3.5	2.0	2.0	3.5		2.0	3.5	3.5	2.0	3.5	3.5
Lane Grp Cap (vph)	221	825	1025	797	1654		689	1116	879	27	941	293
v/s Ratio Prot	0.02	c0.07	0.00	0.09	c0.18		0.03	c0.19		0.00	c0.08	
v/s Ratio Perm			0.01						0.01			0.02
v/c Ratio	0.35	0.44	0.03	0.37	0.53		0.25	0.62	0.04	0.48	0.45	0.09
Uniform Delay, d1	33.4	28.1	18.4	24.0	20.3		28.6	21.7	17.7	36.8	27.0	25.1
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.4	0.4	0.0	0.1	0.4		0.1	1.1	0.0	4.9	0.4	0.2
Delay (s)	33.7	28.6	18.4	24.1	20.7		28.7	22.7	17.7	41.6	27.4	25.3
Level of Service	C	C	B	C	C		C	C	B	D	C	C
Approach Delay (s)		27.4			21.5			23.1			27.2	
Approach LOS		C			C			C			C	

Intersection Summary

HCM 2000 Control Delay	24.0	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.59		
Actuated Cycle Length (s)	74.5	Sum of lost time (s)	21.0
Intersection Capacity Utilization	57.8%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 10: Hacienda Dr & Martinelli Blvd/Hacienda Crossings



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↶	↷	↶↷	↶↷	↷		↶↷↶	↶↶↶	↷	↶↷	↶↶↶	
Traffic Volume (vph)	10	8	174	110	12	8	243	870	113	17	727	48
Future Volume (vph)	10	8	174	110	12	8	243	870	113	17	727	48
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	3.0	3.0	5.5	3.0		3.5	3.0	3.0	5.0	3.5	
Lane Util. Factor	1.00	0.91	0.91	0.97	1.00		0.94	0.91	1.00	0.97	0.86	
Frt	1.00	0.90	0.85	1.00	0.94		1.00	1.00	0.85	1.00	0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1770	1523	2882	3433	1748		4990	5085	1583	3433	6348	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1770	1523	2882	3433	1748		4990	5085	1583	3433	6348	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	11	9	189	120	13	9	264	946	123	18	790	52
RTOR Reduction (vph)	0	14	129	0	6	0	0	0	55	0	8	0
Lane Group Flow (vph)	11	14	41	120	16	0	264	946	68	18	834	0
Turn Type	Prot	NA	Perm	Prot	NA		Prot	NA	pm+ov	Prot	NA	
Protected Phases	5	2		1	6		3	8	1	7	4	
Permitted Phases			2						8			
Actuated Green, G (s)	1.7	15.8	15.8	6.9	21.5		8.2	29.7	36.6	1.1	22.6	
Effective Green, g (s)	1.2	17.8	17.8	6.4	23.5		9.2	31.7	40.6	0.6	24.1	
Actuated g/C Ratio	0.02	0.24	0.24	0.09	0.32		0.13	0.43	0.56	0.01	0.33	
Clearance Time (s)	4.5	5.0	5.0	5.0	5.0		4.5	5.0	5.0	4.5	5.0	
Vehicle Extension (s)	3.0	4.0	4.0	2.0	4.0		3.0	4.0	2.0	3.0	4.0	
Lane Grp Cap (vph)	29	371	702	300	562		628	2208	945	28	2095	
v/s Ratio Prot	c0.01	0.01		c0.03	0.01		c0.05	c0.19	0.01	0.01	0.13	
v/s Ratio Perm			c0.01						0.03			
v/c Ratio	0.38	0.04	0.06	0.40	0.03		0.42	0.43	0.07	0.64	0.40	
Uniform Delay, d1	35.5	21.1	21.2	31.5	16.9		29.4	14.4	7.5	36.1	18.9	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	8.1	0.1	0.0	0.3	0.0		0.5	0.2	0.0	40.9	0.2	
Delay (s)	43.6	21.1	21.2	31.8	17.0		29.9	14.5	7.5	77.0	19.0	
Level of Service	D	C	C	C	B		C	B	A	E	B	
Approach Delay (s)		22.4			29.5			16.9			20.2	
Approach LOS		C			C			B			C	

Intersection Summary

HCM 2000 Control Delay	19.2	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.34		
Actuated Cycle Length (s)	73.0	Sum of lost time (s)	16.5
Intersection Capacity Utilization	42.6%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 11: Hacienda Dr & I-580 WB Ramps

BART to Livermore Extension Project
 2025 BART AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↔↔		↔↔		↑↑↑			↑↑↑	↔
Traffic Volume (vph)	0	0	0	310	0	453	0	1063	183	0	604	416
Future Volume (vph)	0	0	0	310	0	453	0	1063	183	0	604	416
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0		4.0		4.0			4.0	4.0
Lane Util. Factor				0.97		0.88		0.91			0.86	0.86
Frt				1.00		0.85		0.98			0.96	0.85
Flt Protected				0.95		1.00		1.00			1.00	1.00
Satd. Flow (prot)				3433		2787		4973			4621	1362
Flt Permitted				0.95		1.00		1.00			1.00	1.00
Satd. Flow (perm)				3433		2787		4973			4621	1362
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	337	0	492	0	1155	199	0	657	452
RTOR Reduction (vph)	0	0	0	0	0	96	0	46	0	0	92	92
Lane Group Flow (vph)	0	0	0	337	0	396	0	1308	0	0	791	134
Turn Type				Prot		Prot		NA			NA	Perm
Protected Phases				4		4		2			6	
Permitted Phases												6
Actuated Green, G (s)				11.0		11.0		27.7			27.7	27.7
Effective Green, g (s)				12.4		12.4		29.6			29.6	29.6
Actuated g/C Ratio				0.25		0.25		0.59			0.59	0.59
Clearance Time (s)				5.4		5.4		5.9			5.9	5.9
Vehicle Extension (s)				3.0		3.0		3.0			3.0	3.0
Lane Grp Cap (vph)				851		691		2944			2735	806
v/s Ratio Prot				0.10		c0.14		c0.26			0.17	
v/s Ratio Perm												0.10
v/c Ratio				0.40		0.57		0.44			0.29	0.17
Uniform Delay, d1				15.7		16.5		5.6			5.0	4.6
Progression Factor				1.00		1.00		0.41			1.00	1.00
Incremental Delay, d2				0.3		1.2		0.5			0.3	0.4
Delay (s)				16.0		17.6		2.8			5.3	5.1
Level of Service				B		B		A			A	A
Approach Delay (s)		0.0			17.0			2.8			5.2	
Approach LOS		A			B			A			A	

Intersection Summary		
HCM 2000 Control Delay	7.2	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.48	A
Actuated Cycle Length (s)	50.0	Sum of lost time (s)
Intersection Capacity Utilization	47.1%	8.0
Analysis Period (min)	15	ICU Level of Service
		A

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 12: Hacienda Dr & I-580 EB Ramps



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗		↖↗					↖↗↘	↖		↖↗↘	
Traffic Volume (vph)	751	0	1094	0	0	0	0	461	166	0	1019	148
Future Volume (vph)	751	0	1094	0	0	0	0	461	166	0	1019	148
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0					4.0	4.0		4.0	
Lane Util. Factor	0.97		0.88					0.86	0.86		0.91	
Frt	1.00		0.85					0.98	0.85		0.98	
Flt Protected	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (prot)	3433		2787					4733	1362		4989	
Flt Permitted	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (perm)	3433		2787					4733	1362		4989	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	816	0	1189	0	0	0	0	501	180	0	1108	161
RTOR Reduction (vph)	0	0	16	0	0	0	0	12	73	0	18	0
Lane Group Flow (vph)	816	0	1173	0	0	0	0	545	51	0	1251	0
Turn Type	Prot		Prot					NA	Perm		NA	
Protected Phases	4		4					2			6	
Permitted Phases									2			
Actuated Green, G (s)	49.8		49.8					38.9	38.9		38.9	
Effective Green, g (s)	51.2		51.2					40.8	40.8		40.8	
Actuated g/C Ratio	0.51		0.51					0.41	0.41		0.41	
Clearance Time (s)	5.4		5.4					5.9	5.9		5.9	
Vehicle Extension (s)	2.0		2.0					2.0	2.0		2.0	
Lane Grp Cap (vph)	1757		1426					1931	555		2035	
v/s Ratio Prot	0.24		c0.42					0.12			c0.25	
v/s Ratio Perm									0.04			
v/c Ratio	0.46		0.82					0.28	0.09		0.61	
Uniform Delay, d1	15.6		20.6					19.8	18.2		23.4	
Progression Factor	1.00		1.00					1.00	1.00		0.89	
Incremental Delay, d2	0.1		3.8					0.4	0.3		1.4	
Delay (s)	15.7		24.4					20.2	18.5		22.2	
Level of Service	B		C					C	B		C	
Approach Delay (s)		20.8			0.0			19.9			22.2	
Approach LOS		C			A			B			C	

Intersection Summary		
HCM 2000 Control Delay	21.1	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.73	C
Actuated Cycle Length (s)	100.0	Sum of lost time (s)
Intersection Capacity Utilization	67.9%	8.0
Analysis Period (min)	15	ICU Level of Service
		C

c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	47	124	14	124	316	204	31	226	153	582	967	537
Future Volume (vph)	47	124	14	124	316	204	31	226	153	582	967	537
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	2.3	4.0	4.0	2.3	4.0	4.0	2.7	4.0	4.0	2.7
Lane Util. Factor	0.97	0.91	1.00	0.97	0.91	1.00	0.97	0.91	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5085	1583	3433	5085	1583	3433	5085	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5085	1583	3433	5085	1583	3433	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	51	135	15	135	343	222	34	246	166	633	1051	584
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	51	135	15	135	343	222	34	246	166	633	1051	584
Turn Type	Prot	NA	Free	Prot	NA	Free	Prot	NA	Free	Prot	NA	Free
Protected Phases	1	6		5	2		7	4		3	8	
Permitted Phases			Free			Free			Free			Free
Actuated Green, G (s)	5.9	30.6	105.0	10.9	35.6	105.0	4.3	12.6	105.0	31.9	40.2	105.0
Effective Green, g (s)	5.9	32.3	105.0	10.9	37.3	105.0	4.3	13.9	105.0	31.9	41.5	105.0
Actuated g/C Ratio	0.06	0.31	1.00	0.10	0.36	1.00	0.04	0.13	1.00	0.30	0.40	1.00
Clearance Time (s)	4.0	5.7		4.0	5.7		4.0	5.3		4.0	5.3	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	192	1564	1583	356	1806	1583	140	673	1583	1042	2009	1583
v/s Ratio Prot	0.01	0.03		0.04	0.07		0.01	0.05		c0.18	c0.21	
v/s Ratio Perm			0.01			0.14			0.10			c0.37
v/c Ratio	0.27	0.09	0.01	0.38	0.19	0.14	0.24	0.37	0.10	0.61	0.52	0.37
Uniform Delay, d1	47.5	25.9	0.0	43.9	23.4	0.0	48.8	41.5	0.0	31.2	24.2	0.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.7	0.1	0.0	0.7	0.2	0.2	0.9	0.3	0.1	1.0	0.2	0.7
Delay (s)	48.2	26.0	0.0	44.6	23.6	0.2	49.7	41.9	0.1	32.2	24.5	0.7
Level of Service	D	C	A	D	C	A	D	D	A	C	C	A
Approach Delay (s)		29.7			20.2			26.9			20.5	
Approach LOS		C			C			C			C	
























Intersection Summary

HCM 2000 Control Delay	21.7	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.53		
Actuated Cycle Length (s)	105.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	44.8%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

14: Tassajara Rd & Dublin Blvd

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	93	148	159	474	595	40	223	512	144	25	1242	229
Future Volume (vph)	93	148	159	474	595	40	223	512	144	25	1242	229
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	6.0	6.0	5.0	6.0		5.0	6.0	6.0	5.0	6.0	6.0
Lane Util. Factor	0.97	0.95	0.88	0.94	0.95		0.94	0.91	1.00	0.97	0.86	0.88
Frt	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	2787	4990	3506		4990	5085	1583	3433	6408	2787
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	2787	4990	3506		4990	5085	1583	3433	6408	2787
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	101	161	173	515	647	43	242	557	157	27	1350	249
RTOR Reduction (vph)	0	0	133	0	4	0	0	0	95	0	0	165
Lane Group Flow (vph)	101	161	40	515	686	0	242	557	62	27	1350	84
Turn Type	Prot	NA	Perm	Prot	NA		Prot	NA	Perm	Prot	NA	Perm
Protected Phases	5	2		1	6		3	8		7	NA	4
Permitted Phases			2						8			4
Actuated Green, G (s)	16.2	29.9	29.9	18.1	31.8		16.2	51.4	51.4	8.4	43.6	43.6
Effective Green, g (s)	16.2	29.9	29.9	18.1	31.8		16.2	51.4	51.4	8.4	43.6	43.6
Actuated g/C Ratio	0.12	0.23	0.23	0.14	0.24		0.12	0.40	0.40	0.06	0.34	0.34
Clearance Time (s)	5.0	6.0	6.0	5.0	6.0		5.0	6.0	6.0	5.0	6.0	6.0
Vehicle Extension (s)	2.0	3.0	3.0	2.0	3.0		2.0	4.0	4.0	2.0	4.0	4.0
Lane Grp Cap (vph)	428	815	641	695	858		622	2013	626	222	2152	936
v/s Ratio Prot	0.03	0.05		c0.10	c0.20		c0.05	0.11		0.01	c0.21	
v/s Ratio Perm			0.01						0.04			0.03
v/c Ratio	0.24	0.20	0.06	0.74	0.80		0.39	0.28	0.10	0.12	0.63	0.09
Uniform Delay, d1	51.2	40.3	39.0	53.6	46.0		52.2	26.6	24.6	57.2	36.3	29.5
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.1	0.1	0.0	3.7	5.3		0.1	0.1	0.1	0.1	0.7	0.1
Delay (s)	51.3	40.4	39.0	57.3	51.3		52.4	26.7	24.7	57.3	36.9	29.6
Level of Service	D	D	D	E	D		D	C	C	E	D	C
Approach Delay (s)		42.4			53.9			32.9			36.1	
Approach LOS		D			D			C			D	
Intersection Summary												
HCM 2000 Control Delay			41.1			HCM 2000 Level of Service				D		
HCM 2000 Volume to Capacity ratio			0.67									
Actuated Cycle Length (s)			129.8			Sum of lost time (s)			22.0			
Intersection Capacity Utilization			80.7%			ICU Level of Service				D		
Analysis Period (min)			15									

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 15: Tassajara Rd & I-580 WB Ramps

BART to Livermore Extension Project
 2025 BART AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↔↔		↔↔		↑↑	↔		↑↑↔	↔
Traffic Volume (vph)	0	0	0	570	0	294	0	1038	467	0	932	935
Future Volume (vph)	0	0	0	570	0	294	0	1038	467	0	932	935
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0		4.0		4.0	4.0		4.0	4.0
Lane Util. Factor				0.97		0.88		0.95	1.00		0.86	0.86
Frt				1.00		0.85		1.00	0.85		0.95	0.85
Flt Protected				0.95		1.00		1.00	1.00		1.00	1.00
Satd. Flow (prot)				3433		2787		3539	1583		4565	1362
Flt Permitted				0.95		1.00		1.00	1.00		1.00	1.00
Satd. Flow (perm)				3433		2787		3539	1583		4565	1362
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	620	0	320	0	1128	508	0	1013	1016
RTOR Reduction (vph)	0	0	0	0	0	75	0	0	225	0	167	225
Lane Group Flow (vph)	0	0	0	620	0	245	0	1128	283	0	1354	283
Turn Type				Perm		Perm		NA	Perm		NA	Perm
Protected Phases								2			6	
Permitted Phases				8		8			2			6
Actuated Green, G (s)				14.1		14.1		27.9	27.9		27.9	27.9
Effective Green, g (s)				14.1		14.1		27.9	27.9		27.9	27.9
Actuated g/C Ratio				0.28		0.28		0.56	0.56		0.56	0.56
Clearance Time (s)				4.0		4.0		4.0	4.0		4.0	4.0
Vehicle Extension (s)				3.0		3.0		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)				968		785		1974	883		2547	759
v/s Ratio Prot								c0.32			0.30	
v/s Ratio Perm				c0.18		0.09			0.18			0.21
v/c Ratio				0.64		0.31		0.57	0.32		0.53	0.37
Uniform Delay, d1				15.7		14.1		7.2	5.9		6.9	6.2
Progression Factor				1.00		1.00		1.00	1.00		1.00	1.00
Incremental Delay, d2				1.5		0.2		1.2	1.0		0.8	1.4
Delay (s)				17.2		14.4		8.4	6.9		7.7	7.6
Level of Service				B		B		A	A		A	A
Approach Delay (s)		0.0			16.2			7.9			7.7	
Approach LOS		A			B			A			A	

Intersection Summary			
HCM 2000 Control Delay	9.5	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.59		
Actuated Cycle Length (s)	50.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	51.6%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 16: Santa Rita Rd & I-580 EB Ramps/Pimilco Dr

BART to Livermore Extension Project
 2025 BART AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	540	118	675	182	0	192	0	733	104	191	1252	0
Future Volume (vph)	540	118	675	182	0	192	0	733	104	191	1252	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0		4.0		4.0		4.0	4.0	
Lane Util. Factor	0.97	1.00	1.00	0.97		0.88		0.86		1.00	0.95	
Frt	1.00	1.00	0.85	1.00		0.85		0.98		1.00	1.00	
Flt Protected	0.95	1.00	1.00	0.95		1.00		1.00		0.95	1.00	
Satd. Flow (prot)	3433	1863	1583	3433		2787		6288		1770	3539	
Flt Permitted	0.95	1.00	1.00	0.95		1.00		1.00		0.95	1.00	
Satd. Flow (perm)	3433	1863	1583	3433		2787		6288		1770	3539	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	587	128	734	198	0	209	0	797	113	208	1361	0
RTOR Reduction (vph)	0	0	0	0	0	71	0	43	0	0	0	0
Lane Group Flow (vph)	587	128	734	198	0	138	0	867	0	208	1361	0
Turn Type	Perm	NA	Free	Prot		pm+ov		NA		Prot	NA	Perm
Protected Phases		4		3		1		2		1	6	
Permitted Phases	4		Free			3						6
Actuated Green, G (s)	14.8	14.8	60.0	4.7		13.3		15.9		8.6	28.5	
Effective Green, g (s)	14.8	14.8	60.0	4.7		13.3		15.9		8.6	28.5	
Actuated g/C Ratio	0.25	0.25	1.00	0.08		0.22		0.27		0.14	0.48	
Clearance Time (s)	4.0	4.0		4.0		4.0		4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0		3.0		3.0		3.0	3.0	
Lane Grp Cap (vph)	846	459	1583	268		617		1666		253	1681	
v/s Ratio Prot		0.07		0.06		0.03		0.14		0.12	c0.38	
v/s Ratio Perm	c0.17		c0.46			0.02						
v/c Ratio	0.69	0.28	0.46	0.74		0.22		0.52		0.82	0.81	
Uniform Delay, d1	20.5	18.3	0.0	27.0		19.1		18.8		25.0	13.4	
Progression Factor	1.00	1.00	1.00	1.00		1.00		1.00		1.00	1.00	
Incremental Delay, d2	2.5	0.3	1.0	10.2		0.2		1.2		18.9	4.3	
Delay (s)	23.0	18.6	1.0	37.2		19.3		20.0		43.9	17.8	
Level of Service	C	B	A	D		B		B		D	B	
Approach Delay (s)		11.5			28.0			20.0			21.2	
Approach LOS		B			C			B			C	

Intersection Summary	
HCM 2000 Control Delay	18.3 HCM 2000 Level of Service B
HCM 2000 Volume to Capacity ratio	0.85
Actuated Cycle Length (s)	60.0 Sum of lost time (s) 16.0
Intersection Capacity Utilization	56.7% ICU Level of Service B
Analysis Period (min)	15
c Critical Lane Group	

HCM Signalized Intersection Capacity Analysis
17: Santa Rita Rd & Valley Ave

BART to Livermore Extension Project
2025 BART AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔↔	↑↑	↗	↖	↑↑	↗	↔↔	↑↑		↔↔	↑↑	↗
Traffic Volume (vph)	187	223	79	180	329	829	93	483	73	571	920	154
Future Volume (vph)	187	223	79	180	329	829	93	483	73	571	920	154
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.97	0.95		0.97	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.98		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	3433	3470		3433	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	3433	3470		3433	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	203	242	86	196	358	901	101	525	79	621	1000	167
RTOR Reduction (vph)	0	0	71	0	0	0	0	17	0	0	0	100
Lane Group Flow (vph)	203	242	15	196	358	901	101	587	0	621	1000	67
Turn Type	Prot	NA	Perm	Prot	NA	Free	Prot	NA		Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1		6
Permitted Phases			4			Free						6
Actuated Green, G (s)	7.7	11.5	11.5	8.1	11.9	64.9	3.1	16.2		13.1	26.2	26.2
Effective Green, g (s)	7.7	11.5	11.5	8.1	11.9	64.9	3.1	16.2		13.1	26.2	26.2
Actuated g/C Ratio	0.12	0.18	0.18	0.12	0.18	1.00	0.05	0.25		0.20	0.40	0.40
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	407	627	280	220	648	1583	163	866		692	1428	639
v/s Ratio Prot	0.06	0.07		c0.11	0.10		0.03	0.17		c0.18	c0.28	
v/s Ratio Perm			0.01			c0.57						0.04
v/c Ratio	0.50	0.39	0.05	0.89	0.55	0.57	0.62	0.68		0.90	0.70	0.11
Uniform Delay, d1	26.8	23.6	22.2	28.0	24.1	0.0	30.3	22.0		25.2	16.1	12.1
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	1.0	0.4	0.1	32.9	1.0	1.5	6.8	2.1		14.3	1.6	0.1
Delay (s)	27.8	24.0	22.3	60.9	25.1	1.5	37.2	24.1		39.6	17.7	12.1
Level of Service	C	C	C	E	C	A	D	C		D	B	B
Approach Delay (s)		25.1			15.3			26.0			24.7	
Approach LOS		C			B			C			C	

Intersection Summary

HCM 2000 Control Delay	21.9	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.84		
Actuated Cycle Length (s)	64.9	Sum of lost time (s)	16.0
Intersection Capacity Utilization	61.4%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

18: Bernal Ave/Valley Ave & Stanley Blvd















































Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	204	202	52	251	894	954	172	476	106	139	343	115
Future Volume (vph)	204	202	52	251	894	954	172	476	106	139	343	115
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.95	1.00	0.97	0.91	0.91	1.00	0.95	1.00	0.97	0.95	
Frt	1.00	1.00	0.85	1.00	0.96	0.85	1.00	1.00	0.85	1.00	0.96	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	3433	3539	1583	3433	3238	1441	1770	3539	1583	3433	3406	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	3433	3539	1583	3433	3238	1441	1770	3539	1583	3433	3406	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	222	220	57	273	972	1037	187	517	115	151	373	125
RTOR Reduction (vph)	0	0	30	0	53	33	0	0	91	0	42	0
Lane Group Flow (vph)	222	220	27	273	1334	589	187	517	24	151	456	0
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	
Protected Phases	7	4	5	3	8	1	5	2		1	6	
Permitted Phases			4			8			2			
Actuated Green, G (s)	5.0	26.4	36.3	9.6	31.0	40.2	9.9	16.0	16.0	9.2	15.3	
Effective Green, g (s)	5.0	26.4	36.3	9.6	31.0	40.2	9.9	16.0	16.0	9.2	15.3	
Actuated g/C Ratio	0.06	0.34	0.47	0.12	0.40	0.52	0.13	0.21	0.21	0.12	0.20	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	222	1210	826	426	1300	825	226	733	328	409	675	
v/s Ratio Prot	c0.06	0.06	0.00	0.08	c0.41	c0.09	0.11	c0.15		0.04	0.13	
v/s Ratio Perm			0.01			0.32			0.02			
v/c Ratio	1.00	0.18	0.03	0.64	1.03	0.71	0.83	0.71	0.07	0.37	0.67	
Uniform Delay, d1	36.1	17.8	11.0	32.2	23.1	14.1	32.8	28.4	24.6	31.3	28.6	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	60.4	0.1	0.0	3.3	31.9	3.0	21.3	3.1	0.1	0.6	2.7	
Delay (s)	96.5	17.9	11.0	35.4	55.0	17.1	54.1	31.5	24.7	31.9	31.3	
Level of Service	F	B	B	D	E	B	D	C	C	C	C	
Approach Delay (s)		52.1			42.3			35.7			31.5	
Approach LOS		D			D			D			C	

Intersection Summary

HCM 2000 Control Delay	40.5	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.92		
Actuated Cycle Length (s)	77.2	Sum of lost time (s)	16.0
Intersection Capacity Utilization	76.7%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
19: Fallon Rd & Dublin Blvd

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	  	 	  	  	 	  	  	  	 	  	 	  
Traffic Volume (vph)	47	48	83	220	672	282	684	295	29	55	717	272
Future Volume (vph)	47	48	83	220	672	282	684	295	29	55	717	272
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.3	5.3	5.3	4.0	4.0	4.0	5.3	4.9	4.9	5.3	4.9	4.9
Lane Util. Factor	0.97	0.91	0.88	0.94	0.91	1.00	0.97	0.91	0.88	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3090	4577	2508	4491	4577	1425	3090	4577	2508	3090	4577	1425
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3090	4577	2508	4491	4577	1425	3090	4577	2508	3090	4577	1425
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	51	52	90	239	730	307	743	321	32	60	779	296
RTOR Reduction (vph)	0	0	50	0	0	233	0	0	17	0	0	172
Lane Group Flow (vph)	51	52	40	239	730	74	743	321	15	60	779	124
Turn Type	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	5	2	3	1	6		3	8		7	4	
Permitted Phases			2			6			8			4
Actuated Green, G (s)	5.0	21.9	44.6	7.1	24.0	24.0	22.7	47.0	47.0	4.5	28.8	28.8
Effective Green, g (s)	5.0	21.9	44.6	7.1	24.0	24.0	22.7	47.0	47.0	4.5	28.8	28.8
Actuated g/C Ratio	0.05	0.22	0.45	0.07	0.24	0.24	0.23	0.47	0.47	0.04	0.29	0.29
Clearance Time (s)	5.3	5.3	5.3	4.0	4.0	4.0	5.3	4.9	4.9	5.3	4.9	4.9
Vehicle Extension (s)	2.0	4.0	2.0	2.0	2.0	2.0	2.0	4.0	4.0	2.0	4.0	4.0
Lane Grp Cap (vph)	154	1002	1118	318	1098	342	701	2151	1178	139	1318	410
v/s Ratio Prot	c0.02	0.01	0.01	0.05	c0.16		c0.24	0.07		0.02	c0.17	
v/s Ratio Perm			0.01			0.05			0.01			0.09
v/c Ratio	0.33	0.05	0.04	0.75	0.66	0.22	1.06	0.15	0.01	0.43	0.59	0.30
Uniform Delay, d1	45.9	30.8	15.6	45.6	34.4	30.5	38.6	15.1	14.1	46.5	30.5	27.8
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.03	0.94	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.5	0.1	0.0	8.6	3.2	1.4	47.7	0.0	0.0	0.8	0.8	0.6
Delay (s)	46.3	30.9	15.6	54.2	37.5	31.9	87.4	14.3	14.1	47.3	31.4	28.3
Level of Service	D	C	B	D	D	C	F	B	B	D	C	C
Approach Delay (s)		27.9			39.3			63.8			31.4	
Approach LOS		C			D			E			C	

Intersection Summary

HCM 2000 Control Delay	43.6	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.73		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	19.5
Intersection Capacity Utilization	70.8%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 20: El Charro Rd/Fallon Rd & I-580 WB Ramps

BART to Livermore Extension Project
 2025 BART AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				←	←	←		←	←		←	←
Traffic Volume (vph)	0	0	0	190	0	610	0	553	478	0	521	399
Future Volume (vph)	0	0	0	190	0	610	0	553	478	0	521	399
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0	4.0	4.0		4.0	4.0		4.0	4.0
Lane Util. Factor				0.95	0.95	0.88		0.95	0.95		0.95	1.00
Frt				1.00	1.00	0.85		0.99	0.85		1.00	0.85
Flt Protected				0.95	0.95	1.00		1.00	1.00		1.00	1.00
Satd. Flow (prot)				1681	1681	2787		1748	1504		3539	1583
Flt Permitted				0.95	0.95	1.00		1.00	1.00		1.00	1.00
Satd. Flow (perm)				1681	1681	2787		1748	1504		3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	207	0	663	0	601	520	0	566	434
RTOR Reduction (vph)	0	0	0	0	0	371	0	5	177	0	0	164
Lane Group Flow (vph)	0	0	0	106	101	292	0	648	291	0	566	270
Turn Type				Perm	NA	Perm		NA	Perm		NA	Perm
Protected Phases					8			2			6	
Permitted Phases				8		8			2			6
Actuated Green, G (s)				11.4	11.4	11.4		31.1	31.1		31.1	31.1
Effective Green, g (s)				10.9	10.9	10.9		31.1	31.1		31.1	31.1
Actuated g/C Ratio				0.22	0.22	0.22		0.62	0.62		0.62	0.62
Clearance Time (s)				3.5	3.5	3.5		4.0	4.0		4.0	4.0
Vehicle Extension (s)				2.0	2.0	2.0		2.0	2.0		2.0	2.0
Lane Grp Cap (vph)				366	366	607		1087	935		2201	984
v/s Ratio Prot								c0.37			0.16	
v/s Ratio Perm				0.06	0.06	c0.10			0.19			0.17
v/c Ratio				0.29	0.28	0.48		0.60	0.31		0.26	0.27
Uniform Delay, d1				16.3	16.3	17.1		5.7	4.4		4.3	4.3
Progression Factor				1.00	1.00	1.00		0.68	0.23		0.47	2.32
Incremental Delay, d2				0.2	0.1	0.2		2.3	0.8		0.2	0.6
Delay (s)				16.5	16.4	17.3		6.2	1.8		2.2	10.6
Level of Service				B	B	B		A	A		A	B
Approach Delay (s)		0.0			17.1			4.4			5.9	
Approach LOS		A			B			A			A	

Intersection Summary

HCM 2000 Control Delay	8.6	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.57		
Actuated Cycle Length (s)	50.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	66.8%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 21: El Charro Rd & I-580 EB Ramps

BART to Livermore Extension Project
 2025 BART AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	245	0	404	0	0	0	0	770	146	0	393	0
Future Volume (vph)	245	0	404	0	0	0	0	770	146	0	393	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0					4.0	4.0		4.0	
Lane Util. Factor	0.97		0.88					0.91	0.91		0.91	
Frt	1.00		0.85					1.00	0.85		1.00	
Flt Protected	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (prot)	3433		2787					3379	1441		3390	
Flt Permitted	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (perm)	3433		2787					3379	1441		3390	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	266	0	439	0	0	0	0	837	159	0	427	0
RTOR Reduction (vph)	0	0	367	0	0	0	0	2	45	0	0	0
Lane Group Flow (vph)	266	0	72	0	0	0	0	854	95	0	427	0
Turn Type	Prot		Perm					NA	Perm		NA	Perm
Protected Phases	4							2			6	
Permitted Phases			4						2			6
Actuated Green, G (s)	8.2		8.2					33.8	33.8		33.8	
Effective Green, g (s)	8.2		8.2					33.8	33.8		33.8	
Actuated g/C Ratio	0.16		0.16					0.68	0.68		0.68	
Clearance Time (s)	4.0		4.0					4.0	4.0		4.0	
Vehicle Extension (s)	2.0		2.0					3.0	3.0		3.0	
Lane Grp Cap (vph)	563		457					2284	974		2291	
v/s Ratio Prot	c0.08							c0.25			0.13	
v/s Ratio Perm			0.03						0.07			
v/c Ratio	0.47		0.16					0.37	0.10		0.19	
Uniform Delay, d1	18.9		17.9					3.5	2.8		3.0	
Progression Factor	1.00		1.00					1.00	1.00		0.55	
Incremental Delay, d2	0.2		0.1					0.5	0.2		0.2	
Delay (s)	19.2		18.0					4.0	3.0		1.8	
Level of Service	B		B					A	A		A	
Approach Delay (s)		18.4			0.0			3.8			1.8	
Approach LOS		B			A			A			A	

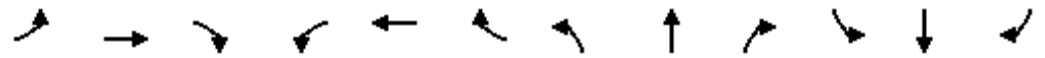
Intersection Summary

HCM 2000 Control Delay	8.3	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.39		
Actuated Cycle Length (s)	50.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	36.5%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 22: El Charro Rd & Stoneridge Dr/Jack London Blvd

BART to Livermore Extension Project
 2025 BART AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔↔↔	↑↑	↗	↖	↑↑	↗↗	↖	↑↑		↖↖↖	↑	↗↗
Traffic Volume (vph)	147	102	8	16	595	632	7	97	2	218	90	177
Future Volume (vph)	147	102	8	16	595	632	7	97	2	218	90	177
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	0.94	0.95	1.00	1.00	0.95	0.88	1.00	0.95		0.94	1.00	0.88
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	4491	3185	1425	1593	3185	2508	1593	3176		4491	1676	2508
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	4491	3185	1425	1593	3185	2508	1593	3176		4491	1676	2508
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	160	111	9	17	647	687	8	105	2	237	98	192
RTOR Reduction (vph)	0	0	6	0	0	367	0	2	0	0	0	133
Lane Group Flow (vph)	160	111	3	17	647	320	8	105	0	237	98	59
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Prot	NA		Prot	NA	Perm
Protected Phases	7	4		3	8	1	5	2		1	6	
Permitted Phases			4			8						6
Actuated Green, G (s)	5.3	19.5	19.5	0.7	14.9	24.8	0.7	7.1		9.9	16.3	16.3
Effective Green, g (s)	5.3	19.5	19.5	0.7	14.9	24.8	0.7	7.1		9.9	16.3	16.3
Actuated g/C Ratio	0.10	0.37	0.37	0.01	0.28	0.47	0.01	0.13		0.19	0.31	0.31
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	447	1167	522	20	892	1357	20	423		835	513	768
v/s Ratio Prot	c0.04	0.03		0.01	c0.20	0.04	0.01	c0.03		c0.05	0.06	
v/s Ratio Perm			0.00			0.08						0.02
v/c Ratio	0.36	0.10	0.01	0.85	0.73	0.24	0.40	0.25		0.28	0.19	0.08
Uniform Delay, d1	22.4	11.1	10.7	26.2	17.3	8.5	26.0	20.7		18.6	13.6	13.1
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	0.5	0.0	0.0	129.8	3.0	0.1	12.6	0.3		0.2	0.2	0.0
Delay (s)	22.9	11.1	10.7	156.0	20.3	8.6	38.7	21.0		18.8	13.8	13.1
Level of Service	C	B	B	F	C	A	D	C		B	B	B
Approach Delay (s)		17.8			16.0			22.2			15.8	
Approach LOS		B			B			C			B	

Intersection Summary		
HCM 2000 Control Delay	16.5	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.46	B
Actuated Cycle Length (s)	53.2	Sum of lost time (s)
Intersection Capacity Utilization	42.9%	16.0
Analysis Period (min)	15	ICU Level of Service
		A

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
24: Airway Blvd/Driveway & N Canyons Pkwy

BART to Livermore Extension Project
2025 BART AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑	↑	↑↑	↑	↑		↑	↑↑		↑	
Traffic Volume (vph)	0	64	75	697	372	0	712	0	899	0	0	0
Future Volume (vph)	0	64	75	697	372	0	712	0	899	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0	4.0	4.0			4.4	4.0			
Lane Util. Factor		0.95	1.00	0.97	1.00			1.00	0.88			
Frt		1.00	0.85	1.00	1.00			1.00	0.85			
Flt Protected		1.00	1.00	0.95	1.00			0.95	1.00			
Satd. Flow (prot)		3539	1583	3433	1863			1770	2787			
Flt Permitted		1.00	1.00	0.95	1.00			0.95	1.00			
Satd. Flow (perm)		3539	1583	3433	1863			1770	2787			
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	70	82	758	404	0	774	0	977	0	0	0
RTOR Reduction (vph)	0	0	73	0	0	0	0	0	115	0	0	0
Lane Group Flow (vph)	0	70	9	758	404	0	0	774	862	0	0	0
Turn Type		NA	Perm	Prot	NA	Perm	Split	NA	pm+ov			
Protected Phases		2		1	6		8	8	1	4	4	
Permitted Phases			2			6			8			
Actuated Green, G (s)		14.2	14.2	27.8	48.0			81.8	109.6			
Effective Green, g (s)		16.2	16.2	29.8	50.0			81.6	113.6			
Actuated g/C Ratio		0.12	0.12	0.21	0.36			0.58	0.81			
Clearance Time (s)		6.0	6.0	6.0	6.0			4.2	6.0			
Vehicle Extension (s)		3.0	3.0	3.0	3.0			3.0	3.0			
Lane Grp Cap (vph)		409	183	730	665			1031	2261			
v/s Ratio Prot		0.02		c0.22	c0.22			c0.44	0.08			
v/s Ratio Perm			0.01						0.23			
v/c Ratio		0.17	0.05	1.04	0.61			0.75	0.38			
Uniform Delay, d1		55.8	55.1	55.1	36.9			21.7	3.6			
Progression Factor		1.00	1.00	1.00	1.00			0.81	0.49			
Incremental Delay, d2		0.9	0.5	43.7	4.1			2.7	0.1			
Delay (s)		56.7	55.6	98.8	41.0			20.2	1.9			
Level of Service		E	E	F	D			C	A			
Approach Delay (s)		56.1			78.7			10.0			0.0	
Approach LOS		E			E			A			A	

Intersection Summary

HCM 2000 Control Delay	38.3	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.84		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	16.4
Intersection Capacity Utilization	73.0%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
25: Airway Blvd & I-580 WB Ramps

BART to Livermore Extension Project
2025 BART AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↰	↩	↱		↕	↱		↕	↱
Traffic Volume (vph)	0	0	0	77	47	469	0	1225	343	0	308	549
Future Volume (vph)	0	0	0	77	47	469	0	1225	343	0	308	549
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0	4.0	4.0		4.0	4.0		4.0	
Lane Util. Factor				0.95	0.95	0.88		0.95	1.00		0.91	
Frt				1.00	1.00	0.85		1.00	0.85		0.90	
Flt Protected				0.95	0.98	1.00		1.00	1.00		1.00	
Satd. Flow (prot)				1681	1732	2787		3539	1583		4597	
Flt Permitted				0.95	0.98	1.00		1.00	1.00		1.00	
Satd. Flow (perm)				1681	1732	2787		3539	1583		4597	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	84	51	510	0	1332	373	0	335	597
RTOR Reduction (vph)	0	0	0	0	0	99	0	0	89	0	142	0
Lane Group Flow (vph)	0	0	0	45	90	411	0	1332	284	0	790	0
Turn Type				Split	NA	Perm		NA	Perm		NA	
Protected Phases				8	8			2			6	
Permitted Phases						8			2			
Actuated Green, G (s)				25.4	25.4	25.4		105.3	105.3		105.3	
Effective Green, g (s)				25.4	25.4	25.4		106.6	106.6		106.6	
Actuated g/C Ratio				0.18	0.18	0.18		0.76	0.76		0.76	
Clearance Time (s)				4.0	4.0	4.0		5.3	5.3		5.3	
Vehicle Extension (s)				2.0	2.0	2.0		4.0	4.0		4.0	
Lane Grp Cap (vph)				304	314	505		2694	1205		3500	
v/s Ratio Prot				0.03	0.05			c0.38			0.17	
v/s Ratio Perm						c0.15			0.18			
v/c Ratio				0.15	0.29	0.81		0.49	0.24		0.23	
Uniform Delay, d1				48.2	49.5	55.0		6.4	4.9		4.8	
Progression Factor				1.00	1.00	1.00		0.46	0.00		0.13	
Incremental Delay, d2				0.1	0.2	9.2		0.6	0.4		0.1	
Delay (s)				48.3	49.7	64.3		3.6	0.4		0.7	
Level of Service				D	D	E		A	A		A	
Approach Delay (s)		0.0			61.1			2.9			0.7	
Approach LOS		A			E			A			A	

Intersection Summary

HCM 2000 Control Delay	13.7	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.56		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	56.9%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 26: Airway Blvd & I-580 EB Ramps/Kitty Hawk Rd

BART to Livermore Extension Project
 2025 BART AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	657	199	293	34	35	89	30	506	161	72	177	152
Future Volume (vph)	657	199	293	34	35	89	30	506	161	72	177	152
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.4	4.4	4.4	4.0	4.0		4.0	4.0	
Lane Util. Factor	0.97	1.00	1.00	1.00	1.00	1.00	1.00	0.95		1.00	0.95	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.96		1.00	0.93	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	3433	1863	1583	1770	1863	1583	1770	3411		1770	3294	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	3433	1863	1583	1770	1863	1583	1770	3411		1770	3294	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	714	216	318	37	38	97	33	550	175	78	192	165
RTOR Reduction (vph)	0	0	236	0	0	82	0	18	0	0	80	0
Lane Group Flow (vph)	714	216	82	37	38	15	33	707	0	78	277	0
Turn Type	Split	NA	Perm	Split	NA	pm+ov	Prot	NA		Prot	NA	
Protected Phases	7	7		8	8	1	5	2		1	6	
Permitted Phases			7			8						
Actuated Green, G (s)	36.0	36.0	36.0	11.2	11.2	23.1	5.0	63.6		11.9	71.0	
Effective Green, g (s)	36.0	36.0	36.0	10.8	10.8	22.3	4.5	64.9		11.9	72.3	
Actuated g/C Ratio	0.26	0.26	0.26	0.08	0.08	0.16	0.03	0.46		0.09	0.52	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	3.5	5.3		4.0	5.3	
Vehicle Extension (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	3.5		2.0	4.0	
Lane Grp Cap (vph)	882	479	407	136	143	252	56	1581		150	1701	
v/s Ratio Prot	c0.21	0.12		c0.02	0.02	0.01	0.02	c0.21		c0.04	0.08	
v/s Ratio Perm			0.05			0.00						
v/c Ratio	0.81	0.45	0.20	0.27	0.27	0.06	0.59	0.45		0.52	0.16	
Uniform Delay, d1	48.8	43.7	40.7	60.9	60.9	50.0	66.8	25.4		61.3	17.9	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		0.75	0.66	
Incremental Delay, d2	5.2	0.2	0.1	0.4	0.4	0.0	9.8	0.9		1.5	0.2	
Delay (s)	54.0	43.9	40.8	61.3	61.2	50.0	76.6	26.3		47.2	12.1	
Level of Service	D	D	D	E	E	D	E	C		D	B	
Approach Delay (s)		48.9			54.9			28.5			18.4	
Approach LOS		D			D			C			B	

Intersection Summary

HCM 2000 Control Delay	38.3	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.55		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	16.8
Intersection Capacity Utilization	61.7%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 27: Collier Canyon Rd & N Canyons Pkwy/Portola Ave

BART to Livermore Extension Project
 2025 BART AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	194	220	104	226	826	60	48	5	112	64	14	129
Future Volume (vph)	194	220	104	226	826	60	48	5	112	64	14	129
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	5.2	5.2
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.86		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	1770	1594		1770	1863	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	1770	1594		1770	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	211	239	113	246	898	65	52	5	122	70	15	140
RTOR Reduction (vph)	0	0	81	0	0	40	0	98	0	0	0	106
Lane Group Flow (vph)	211	239	32	246	898	25	52	29	0	70	15	34
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA		Prot	NA	Perm
Protected Phases	1	6		5	2		3	8		7		4
Permitted Phases			6			2						4
Actuated Green, G (s)	5.2	17.3	17.3	11.4	23.5	23.5	2.2	11.8		6.6	16.6	16.6
Effective Green, g (s)	5.2	18.6	18.6	11.4	24.8	24.8	2.2	12.8		6.6	16.0	16.0
Actuated g/C Ratio	0.08	0.28	0.28	0.17	0.38	0.38	0.03	0.20		0.10	0.24	0.24
Clearance Time (s)	4.0	5.3	5.3	4.0	5.3	5.3	4.0	5.0		4.0	4.6	4.6
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	272	1006	450	308	1342	600	59	311		178	455	387
v/s Ratio Prot	0.06	0.07		c0.14	c0.25		c0.03	0.02		c0.04	0.01	
v/s Ratio Perm			0.02			0.02						c0.02
v/c Ratio	0.78	0.24	0.07	0.80	0.67	0.04	0.88	0.09		0.39	0.03	0.09
Uniform Delay, d1	29.5	18.0	17.1	25.9	16.9	12.8	31.5	21.5		27.5	18.8	19.1
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	12.9	0.1	0.1	13.4	1.3	0.0	75.7	0.1		1.4	0.0	0.1
Delay (s)	42.5	18.1	17.2	39.3	18.2	12.8	107.2	21.7		29.0	18.8	19.2
Level of Service	D	B	B	D	B	B	F	C		C	B	B
Approach Delay (s)		27.0			22.2			46.5			22.2	
Approach LOS		C			C			D			C	

Intersection Summary

HCM 2000 Control Delay	25.4	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.57		
Actuated Cycle Length (s)	65.4	Sum of lost time (s)	17.2
Intersection Capacity Utilization	49.6%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
28: Isabel Ave/Campus Hill Dr & Portola Ave

BART to Livermore Extension Project
2025 BART AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↘	↑↑	↗↗	↘↘↘	↑↑		↘↘	↑↑	↗	↘	↑↑	↗
Traffic Volume (vph)	1	198	272	557	591	141	497	300	75	42	154	2
Future Volume (vph)	1	198	272	557	591	141	497	300	75	42	154	2
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	5.8	5.8
Lane Util. Factor	1.00	0.95	0.88	0.94	0.95		0.97	0.95	1.00	1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	0.97		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3539	2787	4990	3437		3433	3539	1583	1770	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	3539	2787	4990	3437		3433	3539	1583	1770	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	1	215	296	605	642	153	540	326	82	46	167	2
RTOR Reduction (vph)	0	0	230	0	14	0	0	0	54	0	0	2
Lane Group Flow (vph)	1	215	66	605	781	0	540	326	28	46	167	0
Turn Type	Prot	NA	Perm	Prot	NA		Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	NA	6
Permitted Phases			4						2			6
Actuated Green, G (s)	1.5	18.3	18.3	16.4	33.2		21.0	29.2	29.2	5.3	13.9	13.9
Effective Green, g (s)	1.5	19.6	19.6	16.4	34.5		21.0	30.5	30.5	5.3	13.0	13.0
Actuated g/C Ratio	0.02	0.22	0.22	0.19	0.39		0.24	0.35	0.35	0.06	0.15	0.15
Clearance Time (s)	4.0	5.3	5.3	4.0	5.3		4.0	5.3	5.3	4.0	4.9	4.9
Vehicle Extension (s)	2.0	3.0	3.0	2.0	3.0		2.0	3.0	3.0	2.0	3.0	3.0
Lane Grp Cap (vph)	30	790	622	932	1350		821	1229	549	106	523	234
v/s Ratio Prot	0.00	0.06		c0.12	c0.23		c0.16	c0.09		0.03	0.05	
v/s Ratio Perm			0.02						0.02			0.00
v/c Ratio	0.03	0.27	0.11	0.65	0.58		0.66	0.27	0.05	0.43	0.32	0.00
Uniform Delay, d1	42.4	28.2	27.1	33.0	20.9		30.2	20.6	19.0	39.8	33.4	31.9
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.2	0.2	0.1	1.2	0.6		1.5	0.1	0.0	1.0	0.4	0.0
Delay (s)	42.6	28.4	27.2	34.2	21.5		31.6	20.7	19.1	40.8	33.8	31.9
Level of Service	D	C	C	C	C		C	C	B	D	C	C
Approach Delay (s)		27.7			27.0			26.8			35.3	
Approach LOS		C			C			C			D	

Intersection Summary

HCM 2000 Control Delay	27.6	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.60		
Actuated Cycle Length (s)	87.8	Sum of lost time (s)	17.8
Intersection Capacity Utilization	67.3%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 29: Isabel Ave & I-580 WB Ramps

BART to Livermore Extension Project
 2025 BART AM

























Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↖↗		↖		↕↕	↖↗		↕↕	↖
Traffic Volume (vph)	0	0	0	1413	0	416	0	493	0	0	487	566
Future Volume (vph)	0	0	0	1413	0	416	0	493	0	0	487	566
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0		4.0		5.6			5.6	5.6
Lane Util. Factor				0.97		1.00		0.95			0.95	1.00
Frt				1.00		0.85		1.00			1.00	0.85
Flt Protected				0.95		1.00		1.00			1.00	1.00
Satd. Flow (prot)				3433		1583		3539			3539	1583
Flt Permitted				0.95		1.00		1.00			1.00	1.00
Satd. Flow (perm)				3433		1583		3539			3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	1536	0	452	0	536	0	0	529	615
RTOR Reduction (vph)	0	0	0	0	0	66	0	0	0	0	0	394
Lane Group Flow (vph)	0	0	0	1536	0	386	0	536	0	0	529	221
Turn Type				Prot		Prot		NA	Free		NA	Prot
Protected Phases				8		8		2			6	6
Permitted Phases									Free			
Actuated Green, G (s)				35.2		35.2		26.0			26.0	26.0
Effective Green, g (s)				35.2		35.2		25.2			25.2	25.2
Actuated g/C Ratio				0.50		0.50		0.36			0.36	0.36
Clearance Time (s)				4.0		4.0		4.8			4.8	4.8
Vehicle Extension (s)				2.0		2.0		4.0			4.0	4.0
Lane Grp Cap (vph)				1726		796		1274			1274	569
v/s Ratio Prot				c0.45		0.24		c0.15			0.15	0.14
v/s Ratio Perm												
v/c Ratio				0.89		0.49		0.42			0.42	0.39
Uniform Delay, d1				15.7		11.4		16.9			16.9	16.7
Progression Factor				1.00		1.00		0.77			1.00	1.00
Incremental Delay, d2				5.9		0.2		1.0			0.3	0.6
Delay (s)				21.6		11.6		14.0			17.2	17.3
Level of Service				C		B		B			B	B
Approach Delay (s)		0.0			19.3			14.0			17.2	
Approach LOS		A			B			B			B	

Intersection Summary			
HCM 2000 Control Delay	17.9	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.69		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	9.6
Intersection Capacity Utilization	61.9%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
30: Isabel Ave & I-580 EB Ramps

BART to Livermore Extension Project
2025 BART AM

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations	 		 					 			 		
Traffic Volume (vph)	198	0	387	0	0	0	0	728	546	0	1730	265	
Future Volume (vph)	198	0	387	0	0	0	0	728	546	0	1730	265	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)	4.0		4.0					4.0	4.0		4.0	4.0	
Lane Util. Factor	0.97		0.88					0.95	1.00		0.95	1.00	
Frt	1.00		0.85					1.00	0.85		1.00	0.85	
Flt Protected	0.95		1.00					1.00	1.00		1.00	1.00	
Satd. Flow (prot)	3433		2787					3539	1583		3539	1583	
Flt Permitted	0.95		1.00					1.00	1.00		1.00	1.00	
Satd. Flow (perm)	3433		2787					3539	1583		3539	1583	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	
Adj. Flow (vph)	215	0	421	0	0	0	0	791	593	0	1880	288	
RTOR Reduction (vph)	0	0	39	0	0	0	0	0	0	0	0	0	
Lane Group Flow (vph)	215	0	382	0	0	0	0	791	593	0	1880	288	
Turn Type	Prot		Perm					NA	Free		NA	Free	
Protected Phases	4							2			6		
Permitted Phases			4						Free			Free	
Actuated Green, G (s)	12.6		12.6					48.4	70.0		48.4	70.0	
Effective Green, g (s)	12.6		12.6					49.4	70.0		49.4	70.0	
Actuated g/C Ratio	0.18		0.18					0.71	1.00		0.71	1.00	
Clearance Time (s)	4.0		4.0					5.0			5.0		
Vehicle Extension (s)	2.0		2.0					4.0			4.0		
Lane Grp Cap (vph)	617		501					2497	1583		2497	1583	
v/s Ratio Prot	0.06							0.22			c0.53		
v/s Ratio Perm			c0.14						0.37			0.18	
v/c Ratio	0.35		0.76					0.32	0.37		0.75	0.18	
Uniform Delay, d1	25.1		27.3					3.9	0.0		6.5	0.0	
Progression Factor	1.00		1.00					1.00	1.00		0.64	1.00	
Incremental Delay, d2	0.1		6.1					0.1	0.7		1.5	0.2	
Delay (s)	25.2		33.4					4.0	0.7		5.6	0.2	
Level of Service	C		C					A	A		A	A	
Approach Delay (s)		30.7			0.0			2.6			4.9		
Approach LOS		C			A			A			A		
Intersection Summary													
HCM 2000 Control Delay			8.0									HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio			0.75										
Actuated Cycle Length (s)			70.0									Sum of lost time (s)	8.0
Intersection Capacity Utilization			68.0%									ICU Level of Service	C
Analysis Period (min)			15										
c Critical Lane Group													

HCM Signalized Intersection Capacity Analysis
31: Isabel Ave & Airway Blvd

BART to Livermore Extension Project
2025 BART AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↑	↗	↖	↑	↗	↖	↑↑↑	↗	↖↗	↑↑↑	↗
Traffic Volume (vph)	0	0	319	191	258	206	318	1075	251	1032	1258	15
Future Volume (vph)	0	0	319	191	258	206	318	1075	251	1032	1258	15
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)			5.6	5.2	5.2	5.6	4.0	4.0	4.0	4.0	4.0	5.0
Lane Util. Factor			1.00	1.00	1.00	1.00	1.00	0.91	1.00	0.97	0.91	1.00
Frt			0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected			1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)			1583	1770	1863	1583	1770	5085	1583	3433	5085	1583
Flt Permitted			1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)			1583	1770	1863	1583	1770	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	347	208	280	224	346	1168	273	1122	1367	16
RTOR Reduction (vph)	0	0	118	0	0	110	0	0	192	0	0	10
Lane Group Flow (vph)	0	0	229	208	280	114	346	1168	81	1122	1367	6
Turn Type	Prot		pm+ov	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4	5	3	8	1	5	2		1	6	
Permitted Phases			4			8			2			6
Actuated Green, G (s)			16.0	16.6	16.6	40.7	16.0	22.1	22.1	24.1	30.2	30.2
Effective Green, g (s)			15.4	16.0	16.0	39.5	17.0	23.1	23.1	25.1	31.2	30.2
Actuated g/C Ratio			0.20	0.21	0.21	0.51	0.22	0.30	0.30	0.32	0.40	0.39
Clearance Time (s)			5.0	4.6	4.6	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Extension (s)			3.0	3.0	3.0	3.0	3.0	5.0	5.0	3.0	5.0	5.0
Lane Grp Cap (vph)			314	365	385	807	388	1517	472	1113	2049	617
v/s Ratio Prot			0.14	0.12	c0.15	0.04	0.20	c0.23		c0.33	0.27	
v/s Ratio Perm						0.03			0.05			0.00
v/c Ratio			0.73	0.57	0.73	0.14	0.89	0.77	0.17	1.01	0.67	0.01
Uniform Delay, d1			29.1	27.6	28.7	10.0	29.3	24.7	20.1	26.2	18.9	14.4
Progression Factor			1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2			8.4	2.0	6.7	0.1	21.8	2.9	0.4	29.0	1.1	0.0
Delay (s)			37.5	29.6	35.4	10.1	51.1	27.6	20.4	55.1	20.0	14.5
Level of Service			D	C	D	B	D	C	C	E	B	B
Approach Delay (s)		37.5			25.7			31.0			35.7	
Approach LOS		D			C			C			D	

Intersection Summary

HCM 2000 Control Delay	32.9	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.95		
Actuated Cycle Length (s)	77.4	Sum of lost time (s)	20.0
Intersection Capacity Utilization	74.8%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
32: Isabel Ave & Jack London Blvd

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	27	54	55	217	752	312	339	849	96	159	1194	281
Future Volume (vph)	27	54	55	217	752	312	339	849	96	159	1194	281
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.97	0.91	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	3433	5085	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	3433	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	29	59	60	236	817	339	368	923	104	173	1298	305
RTOR Reduction (vph)	0	0	49	0	0	73	0	0	68	0	0	121
Lane Group Flow (vph)	29	59	11	236	817	266	368	923	36	173	1298	184
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8	1	5	2		1	NA	6
Permitted Phases			4			8			2			6
Actuated Green, G (s)	3.7	17.6	17.6	13.8	27.7	37.2	10.0	33.0	33.0	9.5	32.5	32.5
Effective Green, g (s)	3.7	17.6	17.6	13.8	27.7	37.2	10.0	33.0	33.0	9.5	32.5	32.5
Actuated g/C Ratio	0.04	0.19	0.19	0.15	0.29	0.39	0.11	0.35	0.35	0.10	0.34	0.34
Clearance Time (s)	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	133	654	292	256	1030	707	360	1764	549	342	1737	540
v/s Ratio Prot	0.01	0.02		c0.13	c0.23	0.04	c0.11	0.18		0.05	c0.26	
v/s Ratio Perm			0.01			0.13			0.02			0.12
v/c Ratio	0.22	0.09	0.04	0.92	0.79	0.38	1.02	0.52	0.07	0.51	0.75	0.34
Uniform Delay, d1	44.3	32.1	31.8	40.1	31.1	20.7	42.5	24.8	20.7	40.6	27.7	23.3
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.8	0.1	0.1	35.8	4.3	0.3	53.2	0.3	0.1	1.2	1.8	0.4
Delay (s)	45.1	32.2	31.9	75.9	35.3	21.0	95.8	25.1	20.8	41.8	29.5	23.7
Level of Service	D	C	C	E	D	C	F	C	C	D	C	C
Approach Delay (s)		34.6			38.7			43.4			29.7	
Approach LOS		C			D			D			C	

Intersection Summary		
HCM 2000 Control Delay	36.6	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.85	D
Actuated Cycle Length (s)	95.1	Sum of lost time (s)
Intersection Capacity Utilization	66.8%	21.2
Analysis Period (min)	15	ICU Level of Service
		C

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 33: Isabel Ave Connector & Stanley Blvd



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑	↑	↑↓	↑↑	↑↓	↑↓
Traffic Volume (vph)	338	163	319	1948	386	207
Future Volume (vph)	338	163	319	1948	386	207
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	3.8	4.0	4.0	4.0	2.5
Lane Util. Factor	0.95	1.00	0.97	0.95	0.97	0.88
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	3539	1583	3433	3539	3433	2787
Flt Permitted	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (perm)	3539	1583	3433	3539	3433	2787
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	367	177	347	2117	420	225
RTOR Reduction (vph)	0	18	0	0	0	143
Lane Group Flow (vph)	367	159	347	2117	420	82
Turn Type	NA	pm+ov	Prot	NA	Prot	pm+ov
Protected Phases	2	8	1	6	8	1
Permitted Phases		2				8
Actuated Green, G (s)	42.2	57.4	13.2	59.4	15.2	28.4
Effective Green, g (s)	43.9	60.8	13.2	61.1	16.7	31.4
Actuated g/C Ratio	0.51	0.71	0.15	0.71	0.19	0.37
Clearance Time (s)	5.7	5.5	4.0	5.7	5.5	4.0
Vehicle Extension (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Grp Cap (vph)	1810	1121	528	2520	668	1019
v/s Ratio Prot	0.10	0.03	0.10	c0.60	c0.12	0.01
v/s Ratio Perm		0.07				0.02
v/c Ratio	0.20	0.14	0.66	0.84	0.63	0.08
Uniform Delay, d1	11.4	4.0	34.2	8.8	31.7	17.8
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.0	0.0	2.3	2.6	1.3	0.0
Delay (s)	11.4	4.1	36.4	11.4	33.0	17.8
Level of Service	B	A	D	B	C	B
Approach Delay (s)	9.0			14.9	27.7	
Approach LOS	A			B	C	

Intersection Summary

HCM 2000 Control Delay	16.3	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.84		
Actuated Cycle Length (s)	85.8	Sum of lost time (s)	12.0
Intersection Capacity Utilization	71.5%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
34: Murrieta Blvd/Driveway & Portola Ave



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗		↖	↗		↖	↗	↗		↗	
Traffic Volume (vph)	0	545	96	270	1727	1	191	6	146	1	3	0
Future Volume (vph)	0	545	96	270	1727	1	191	6	146	1	3	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.8		4.0	5.8		5.2	5.2	5.2		4.0	
Lane Util. Factor		0.95		1.00	0.95		0.95	0.95	1.00		1.00	
Frt		0.98		1.00	1.00		1.00	1.00	0.85		1.00	
Flt Protected		1.00		0.95	1.00		0.95	0.96	1.00		0.99	
Satd. Flow (prot)		3460		1770	3539		1681	1691	1583		1840	
Flt Permitted		1.00		0.95	1.00		0.95	0.96	1.00		0.99	
Satd. Flow (perm)		3460		1770	3539		1681	1691	1583		1840	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	592	104	293	1877	1	208	7	159	1	3	0
RTOR Reduction (vph)	0	12	0	0	0	0	0	0	138	0	0	0
Lane Group Flow (vph)	0	684	0	293	1878	0	108	107	21	0	4	0
Turn Type	Prot	NA		Prot	NA		Split	NA	Perm		Split	NA
Protected Phases	5	2		1	6		8	8		4	4	
Permitted Phases									8			
Actuated Green, G (s)		24.9		18.7	47.6		10.3	10.3	10.3		0.5	
Effective Green, g (s)		24.0		18.7	46.7		9.7	9.7	9.7		0.5	
Actuated g/C Ratio		0.33		0.26	0.65		0.13	0.13	0.13		0.01	
Clearance Time (s)		4.9		4.0	4.9		4.6	4.6	4.6		4.0	
Vehicle Extension (s)		2.0		2.0	2.0		2.0	2.0	2.0		2.0	
Lane Grp Cap (vph)		1154		460	2298		226	228	213		12	
v/s Ratio Prot		0.20		0.17	c0.53		c0.06	0.06			c0.00	
v/s Ratio Perm									0.01			
v/c Ratio		0.59		0.64	0.82		0.48	0.47	0.10		0.33	
Uniform Delay, d1		19.9		23.6	9.4		28.8	28.7	27.3		35.5	
Progression Factor		1.00		1.00	1.00		1.00	1.00	1.00		1.00	
Incremental Delay, d2		0.5		2.1	2.2		0.6	0.6	0.1		5.9	
Delay (s)		20.4		25.7	11.7		29.3	29.3	27.4		41.4	
Level of Service		C		C	B		C	C	C		D	
Approach Delay (s)		20.4			13.6			28.5			41.4	
Approach LOS		C			B			C			D	

Intersection Summary

HCM 2000 Control Delay	16.8	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.81		
Actuated Cycle Length (s)	71.9	Sum of lost time (s)	19.0
Intersection Capacity Utilization	75.7%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
35: Murrieta Blvd & Jack London Blvd



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	76	263	623	206	250	167
Future Volume (vph)	76	263	623	206	250	167
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00	1.00	0.95	0.91	
Frt	1.00	0.85	1.00	1.00	0.94	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1770	1583	1770	3539	4780	
Flt Permitted	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	1770	1583	1770	3539	4780	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	83	286	677	224	272	182
RTOR Reduction (vph)	0	244	0	0	152	0
Lane Group Flow (vph)	83	42	677	224	302	0
Turn Type	Prot	Perm	Prot	NA	NA	
Protected Phases	4		5	2	6	
Permitted Phases		4				
Actuated Green, G (s)	8.5	8.5	27.3	40.9	9.6	
Effective Green, g (s)	8.5	8.5	27.3	40.9	9.6	
Actuated g/C Ratio	0.15	0.15	0.48	0.71	0.17	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	262	234	841	2521	799	
v/s Ratio Prot	c0.05		c0.38	0.06	c0.06	
v/s Ratio Perm		0.03				
v/c Ratio	0.32	0.18	0.80	0.09	0.38	
Uniform Delay, d1	21.9	21.4	12.8	2.5	21.2	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.7	0.4	5.6	0.0	0.3	
Delay (s)	22.6	21.8	18.4	2.5	21.5	
Level of Service	C	C	B	A	C	
Approach Delay (s)	22.0			14.5	21.5	
Approach LOS	C			B	C	

Intersection Summary

HCM 2000 Control Delay	17.9	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.62		
Actuated Cycle Length (s)	57.4	Sum of lost time (s)	12.0
Intersection Capacity Utilization	57.3%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 36: Murrieta Blvd & Stanley Blvd

BART to Livermore Extension Project
 2025 BART AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	212	436	222	18	823	115	429	336	8	154	224	448
Future Volume (vph)	212	436	222	18	823	115	429	336	8	154	224	448
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.9	4.9	4.0	4.9	4.9	4.9	4.9		4.9	4.9	4.0
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.97	0.95		1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	3433	3526		1770	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	3433	3526		1770	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	230	474	241	20	895	125	466	365	9	167	243	487
RTOR Reduction (vph)	0	0	157	0	0	72	0	2	0	0	0	98
Lane Group Flow (vph)	230	474	84	20	895	53	466	372	0	167	243	389
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Prot	NA		Prot	NA	Perm
Protected Phases	7	4		3	8	1	5	2		1	6	
Permitted Phases			4			8						6
Actuated Green, G (s)	6.0	27.8	27.8	1.6	23.4	34.6	12.0	20.4		11.2	19.6	19.6
Effective Green, g (s)	6.0	26.9	26.9	1.6	22.5	32.8	11.1	19.5		10.3	18.7	19.6
Actuated g/C Ratio	0.08	0.35	0.35	0.02	0.29	0.43	0.14	0.25		0.13	0.24	0.25
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	267	1236	553	36	1034	775	494	892		236	859	402
v/s Ratio Prot	c0.07	0.13		0.01	c0.25	0.01	c0.14	0.11		0.09	0.07	
v/s Ratio Perm			0.05			0.02						c0.25
v/c Ratio	0.86	0.38	0.15	0.56	0.87	0.07	0.94	0.42		0.71	0.28	0.97
Uniform Delay, d1	35.1	18.8	17.2	37.3	25.8	13.1	32.6	24.0		31.9	23.7	28.4
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	23.6	0.2	0.1	17.3	7.7	0.0	26.8	0.3		9.3	0.2	36.2
Delay (s)	58.7	19.0	17.3	54.6	33.5	13.1	59.4	24.3		41.2	23.9	64.6
Level of Service	E	B	B	D	C	B	E	C		D	C	E
Approach Delay (s)		28.2			31.5			43.8			49.2	
Approach LOS		C			C			D			D	

Intersection Summary

HCM 2000 Control Delay	37.7	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.93		
Actuated Cycle Length (s)	77.0	Sum of lost time (s)	18.7
Intersection Capacity Utilization	74.2%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
37: Livermore Ave & I-580 WB Ramps



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↖	↔		↗	↑			↕	
Traffic Volume (vph)	0	0	0	405	89	28	448	79	0	0	151	0
Future Volume (vph)	0	0	0	405	89	28	448	79	0	0	151	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)					4.0		4.0	4.0			4.0	
Lane Util. Factor					0.95		0.97	1.00			0.95	
Frt					0.99		1.00	1.00			1.00	
Flt Protected					0.96		0.95	1.00			1.00	
Satd. Flow (prot)					1690		3433	1863			3539	
Flt Permitted					0.96		0.95	1.00			1.00	
Satd. Flow (perm)					1690		3433	1863			3539	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	440	97	30	487	86	0	0	164	0
RTOR Reduction (vph)	0	0	0	0	4	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	0	563	0	487	86	0	0	164	0
Turn Type				Split	NA		Prot	NA			NA	
Protected Phases				8	8		5	2			6	
Permitted Phases												
Actuated Green, G (s)					22.7		12.0	27.6			12.1	
Effective Green, g (s)					22.7		11.5	29.3			13.8	
Actuated g/C Ratio					0.38		0.19	0.49			0.23	
Clearance Time (s)					4.0		3.5	5.7			5.7	
Vehicle Extension (s)					2.0		2.0	2.5			2.5	
Lane Grp Cap (vph)					639		657	909			813	
v/s Ratio Prot					c0.33		c0.14	0.05			c0.05	
v/s Ratio Perm												
v/c Ratio					0.88		0.74	0.09			0.20	
Uniform Delay, d1					17.4		22.8	8.2			18.7	
Progression Factor					1.00		0.74	0.36			1.00	
Incremental Delay, d2					13.2		3.6	0.2			0.6	
Delay (s)					30.6		20.6	3.2			19.2	
Level of Service					C		C	A			B	
Approach Delay (s)		0.0			30.6			18.0			19.2	
Approach LOS		A			C			B			B	

Intersection Summary

HCM 2000 Control Delay	23.6	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.65		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	49.8%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
38: Livermore Ave & I-580 EB Ramps



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕	↗					↕		↘	↕	
Traffic Volume (vph)	12	1	580	0	0	0	0	509	303	23	539	0
Future Volume (vph)	12	1	580	0	0	0	0	509	303	23	539	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0					4.0		4.0	4.0	
Lane Util. Factor		0.95	0.95					0.95		1.00	0.95	
Frt		0.86	0.85					0.94		1.00	1.00	
Flt Protected		1.00	1.00					1.00		0.95	1.00	
Satd. Flow (prot)		1513	1504					3341		1770	3539	
Flt Permitted		1.00	1.00					1.00		0.95	1.00	
Satd. Flow (perm)		1513	1504					3341		1770	3539	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	13	1	630	0	0	0	0	553	329	25	586	0
RTOR Reduction (vph)	0	192	192	0	0	0	0	109	0	0	0	0
Lane Group Flow (vph)	0	131	129	0	0	0	0	773	0	25	586	0
Turn Type	Prot	NA	Perm					NA		Prot	NA	
Protected Phases	7	4						2		1	6	
Permitted Phases			4									
Actuated Green, G (s)		15.8	15.8					30.8		1.4	35.2	
Effective Green, g (s)		15.8	15.8					31.8		0.4	36.2	
Actuated g/C Ratio		0.26	0.26					0.53		0.01	0.60	
Clearance Time (s)		4.0	4.0					5.0		3.0	5.0	
Vehicle Extension (s)		2.0	2.0					2.5		2.0	2.5	
Lane Grp Cap (vph)		398	396					1770		11	2135	
v/s Ratio Prot								c0.23		c0.01	0.17	
v/s Ratio Perm		0.09	0.09									
v/c Ratio		0.33	0.33					0.44		2.27	0.27	
Uniform Delay, d1		17.8	17.8					8.6		29.8	5.7	
Progression Factor		1.00	1.00					1.00		1.10	0.21	
Incremental Delay, d2		0.2	0.2					0.8		746.3	0.2	
Delay (s)		18.0	18.0					9.4		779.1	1.5	
Level of Service		B	B					A		F	A	
Approach Delay (s)		18.0			0.0			9.4			33.3	
Approach LOS		B			A			A			C	





























Intersection Summary

HCM 2000 Control Delay	18.8	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.42		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	49.8%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
39: Livermore Ave & Portola Ave

BART to Livermore Extension Project
2025 BART AM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 	 			 			 			 	
Traffic Volume (vph)	319	293	107	26	799	74	302	429	63	106	570	453
Future Volume (vph)	319	293	107	26	799	74	302	429	63	106	570	453
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	5.3	4.0	4.0	5.3	4.0	5.8		4.0	5.8	4.9
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	1.00	0.95		1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.98		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	1770	3472		1770	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	1770	3472		1770	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	347	318	116	28	868	80	328	466	68	115	620	492
RTOR Reduction (vph)	0	0	72	0	0	58	0	10	0	0	0	85
Lane Group Flow (vph)	347	318	44	28	868	23	328	524	0	115	620	407
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA		Prot	NA	pm+ov
Protected Phases	3	8		7	4		1	6		5	2	3
Permitted Phases			8			4						2
Actuated Green, G (s)	14.8	42.9	42.9	3.4	31.5	31.5	22.1	35.5		12.0	25.4	40.2
Effective Green, g (s)	14.8	44.2	42.9	3.4	32.8	31.5	22.1	34.6		12.0	24.5	38.4
Actuated g/C Ratio	0.13	0.39	0.38	0.03	0.29	0.28	0.20	0.31		0.11	0.22	0.34
Clearance Time (s)	4.0	5.3	5.3	4.0	5.3	5.3	4.0	4.9		4.0	4.9	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	453	1396	606	53	1036	445	349	1072		189	774	542
v/s Ratio Prot	c0.10	0.09		0.02	c0.25		c0.19	0.15		0.06	c0.18	0.09
v/s Ratio Perm			0.03			0.01						0.16
v/c Ratio	0.77	0.23	0.07	0.53	0.84	0.05	0.94	0.49		0.61	0.80	0.75
Uniform Delay, d1	46.9	22.5	21.9	53.5	37.1	29.3	44.3	31.5		47.8	41.4	32.6
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	7.6	0.1	0.1	9.2	6.0	0.0	32.5	0.4		5.5	6.0	5.8
Delay (s)	54.5	22.6	22.0	62.7	43.1	29.4	76.8	31.9		53.2	47.4	38.3
Level of Service	D	C	C	E	D	C	E	C		D	D	D
Approach Delay (s)		36.7			42.6			49.0			44.3	
Approach LOS		D			D			D			D	

Intersection Summary

HCM 2000 Control Delay	43.4	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.85		
Actuated Cycle Length (s)	112.0	Sum of lost time (s)	18.7
Intersection Capacity Utilization	78.5%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
40: First St/Springtown Blvd & I-580 WB Ramps





















Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations			↗↘			↗	↗↘	↑			↗↘	↗
Traffic Volume (vph)	0	0	207	0	0	0	341	375	0	0	823	632
Future Volume (vph)	0	0	207	0	0	0	341	375	0	0	823	632
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)			4.0				4.0	4.0			5.0	5.0
Lane Util. Factor			0.88				0.97	1.00			0.95	1.00
Frt			0.85				1.00	1.00			1.00	0.85
Flt Protected			1.00				0.95	1.00			1.00	1.00
Satd. Flow (prot)			2787				3433	1863			3539	1583
Flt Permitted			1.00				0.95	1.00			1.00	1.00
Satd. Flow (perm)			2787				3433	1863			3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	225	0	0	0	371	408	0	0	895	687
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	24
Lane Group Flow (vph)	0	0	225	0	0	0	371	408	0	0	895	663
Turn Type			Over			Free	Prot	NA			NA	Perm
Protected Phases			5				5	2			6	
Permitted Phases						Free						6
Actuated Green, G (s)			11.5				11.5	70.0			50.5	50.5
Effective Green, g (s)			11.0				11.0	70.0			50.0	50.0
Actuated g/C Ratio			0.16				0.16	1.00			0.71	0.71
Clearance Time (s)			3.5				3.5	4.0			4.5	4.5
Vehicle Extension (s)			2.0				2.0	0.2			4.0	4.0
Lane Grp Cap (vph)			437				539	1863			2527	1130
v/s Ratio Prot			0.08				c0.11	0.22			0.25	
v/s Ratio Perm												c0.42
v/c Ratio			0.51				0.69	0.22			0.35	0.59
Uniform Delay, d1			27.1				27.9	0.0			3.8	4.9
Progression Factor			1.00				0.87	1.00			1.00	1.00
Incremental Delay, d2			0.4				2.9	0.3			0.1	0.9
Delay (s)			27.5				27.1	0.3			3.9	5.8
Level of Service			C				C	A			A	A
Approach Delay (s)		27.5			0.0			13.0			4.8	
Approach LOS		C			A			B			A	

Intersection Summary		
HCM 2000 Control Delay	9.2	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.60	A
Actuated Cycle Length (s)	70.0	Sum of lost time (s)
Intersection Capacity Utilization	56.4%	9.0
Analysis Period (min)	15	ICU Level of Service
		B

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
41: First St & I-580 EB Ramps

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations													
Traffic Volume (vph)	96	1	344	0	0	0	0	627	381	63	936	0	
Future Volume (vph)	96	1	344	0	0	0	0	627	381	63	936	0	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)		4.0	4.0					5.0	5.0	4.0	5.0		
Lane Util. Factor		1.00	0.88					0.95	1.00	1.00	0.95		
Frt		1.00	0.85					1.00	0.85	1.00	1.00		
Flt Protected		0.95	1.00					1.00	1.00	0.95	1.00		
Satd. Flow (prot)		1775	2787					3539	1583	1770	3539		
Flt Permitted		0.95	1.00					1.00	1.00	0.95	1.00		
Satd. Flow (perm)		1775	2787					3539	1583	1770	3539		
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	
Adj. Flow (vph)	104	1	374	0	0	0	0	682	414	68	1017	0	
RTOR Reduction (vph)	0	0	248	0	0	0	0	0	99	0	0	0	
Lane Group Flow (vph)	0	105	126	0	0	0	0	682	315	68	1017	0	
Turn Type	Perm	NA	Perm					NA	Perm	Prot	NA		
Protected Phases		4						2		1	6		
Permitted Phases	4		4						2				
Actuated Green, G (s)		13.4	13.4					106.9	106.9	8.7	118.6		
Effective Green, g (s)		12.9	12.9					106.4	106.4	7.7	118.1		
Actuated g/C Ratio		0.09	0.09					0.76	0.76	0.06	0.84		
Clearance Time (s)		3.5	3.5					4.5	4.5	3.0	4.5		
Vehicle Extension (s)		2.5	2.5					4.0	4.0	2.0	4.0		
Lane Grp Cap (vph)		163	256					2689	1203	97	2985		
v/s Ratio Prot								0.19		c0.04	c0.29		
v/s Ratio Perm		0.06	0.05						0.20				
v/c Ratio		0.64	0.49					0.25	0.26	0.70	0.34		
Uniform Delay, d1		61.3	60.4					5.0	5.0	65.0	2.4		
Progression Factor		1.00	1.00					1.00	1.00	0.99	0.92		
Incremental Delay, d2		7.5	1.1					0.2	0.5	16.2	0.3		
Delay (s)		68.8	61.5					5.2	5.6	80.3	2.5		
Level of Service		E	E					A	A	F	A		
Approach Delay (s)		63.1			0.0			5.4			7.4		
Approach LOS		E			A			A			A		
Intersection Summary													
HCM 2000 Control Delay			16.6									HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio			0.40										
Actuated Cycle Length (s)			140.0									Sum of lost time (s)	13.0
Intersection Capacity Utilization			45.4%									ICU Level of Service	A
Analysis Period (min)			15										

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
42: 1st St & Mines Rd

BART to Livermore Extension Project
2025 BART AM





















Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	34	68	43	540	106	333	19	912	312	208	1288	21
Future Volume (vph)	34	68	43	540	106	333	19	912	312	208	1288	21
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		0.97	1.00	1.00	1.00	0.91		0.97	0.91	
Frt	1.00	0.94		1.00	1.00	0.85	1.00	0.96		1.00	1.00	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1754		3433	1863	1583	1770	4891		3433	5073	
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	1754		3433	1863	1583	1770	4891		3433	5073	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	37	74	47	587	115	362	21	991	339	226	1400	23
RTOR Reduction (vph)	0	37	0	0	0	74	0	80	0	0	2	0
Lane Group Flow (vph)	37	84	0	587	115	288	21	1250	0	226	1421	0
Turn Type	Prot	NA		Prot	NA	pm+ov	Prot	NA		Prot	NA	
Protected Phases	7	4		3	8	1	5	2		1	6	
Permitted Phases						8						
Actuated Green, G (s)	1.8	8.5		12.9	19.6	24.7	0.7	23.0		5.1	27.4	
Effective Green, g (s)	1.8	8.5		12.9	19.6	24.7	0.7	23.0		5.1	27.4	
Actuated g/C Ratio	0.03	0.13		0.20	0.30	0.38	0.01	0.35		0.08	0.42	
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	48	227		676	557	693	18	1717		267	2122	
v/s Ratio Prot	0.02	0.05		c0.17	0.06	c0.03	0.01	0.26		c0.07	c0.28	
v/s Ratio Perm						0.15						
v/c Ratio	0.77	0.37		0.87	0.21	0.42	1.17	0.73		0.85	0.67	
Uniform Delay, d1	31.6	26.1		25.5	17.1	15.1	32.4	18.5		29.8	15.4	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	53.1	1.0		11.4	0.2	0.4	269.7	1.6		21.2	0.8	
Delay (s)	84.8	27.1		36.9	17.3	15.5	302.1	20.1		51.0	16.2	
Level of Service	F	C		D	B	B	F	C		D	B	
Approach Delay (s)		40.6			27.5			24.5			21.0	
Approach LOS		D			C			C			C	

Intersection Summary

HCM 2000 Control Delay	24.5	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.77		
Actuated Cycle Length (s)	65.5	Sum of lost time (s)	16.0
Intersection Capacity Utilization	62.6%	ICU Level of Service	B
Analysis Period (min)	15		



















c Critical Lane Group

HCM Unsignalized Intersection Capacity Analysis
43: Vasco Rd & I-580 WB Ramps

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	0	0	170	0	833	0	0	1543	0
Future Volume (Veh/h)	0	0	0	0	0	170	0	833	0	0	1543	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	0	0	0	185	0	905	0	0	1677	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage (veh)												
Upstream signal (ft)											487	
pX, platoon unblocked												
vC, conflicting volume	2314	2582	1677	2582	2582	452	1677			905		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	2314	2582	1677	2582	2582	452	1677			905		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	100	100	67	100			100		
cM capacity (veh/h)	14	25	84	13	25	554	378			747		
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	SB 1	SB 2					
Volume Total	0	185	452	452	0	1677	0					
Volume Left	0	0	0	0	0	0	0					
Volume Right	0	185	0	0	0	0	0					
cSH	1700	554	1700	1700	1700	1700	1700					
Volume to Capacity	0.00	0.33	0.27	0.27	0.00	0.99	0.00					
Queue Length 95th (ft)	0	36	0	0	0	0	0					
Control Delay (s)	0.0	14.7	0.0	0.0	0.0	0.0	0.0					
Lane LOS	A	B										
Approach Delay (s)	0.0	14.7	0.0			0.0						
Approach LOS	A	B										
Intersection Summary												
Average Delay			1.0									
Intersection Capacity Utilization			84.5%	ICU Level of Service	E							
Analysis Period (min)			15									

HCM Unsignalized Intersection Capacity Analysis
 44: Vasco Rd & I-580 EB Ramps

BART to Livermore Extension Project
 2025 BART AM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	0	0	0	0	1191	0	73	1767	0
Future Volume (Veh/h)	0	0	0	0	0	0	0	1191	0	73	1767	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	0	0	0	0	0	1295	0	79	1921	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	2726	3374	1921	3374	3374	648	1921			1295		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	2726	3374	1921	3374	3374	648	1921			1295		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	100	100	100	100			85		
cM capacity (veh/h)	9	6	57	3	6	413	304			531		
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2						
Volume Total	0	0	863	432	79	1921						
Volume Left	0	0	0	0	79	0						
Volume Right	0	0	0	0	0	0						
cSH	1700	1700	1700	1700	531	1700						
Volume to Capacity	0.00	0.00	0.51	0.25	0.15	1.13						
Queue Length 95th (ft)	0	0	0	0	13	0						
Control Delay (s)	0.0	0.0	0.0	0.0	13.0	0.0						
Lane LOS	A	A			B							
Approach Delay (s)	0.0	0.0	0.0		0.5							
Approach LOS	A	A										
Intersection Summary												
Average Delay			0.3									
Intersection Capacity Utilization			96.3%	ICU Level of Service	F							
Analysis Period (min)			15									

HCM Signalized Intersection Capacity Analysis
45: Vasco Rd & East Ave

BART to Livermore Extension Project
2025 BART AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	270	325	52	9	15	15	51	255	190	223	283	207
Future Volume (vph)	270	325	52	9	15	15	51	255	190	223	283	207
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	0.95		0.97	1.00	1.00
Frt	1.00	0.98		1.00	0.93		1.00	0.94		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	3465		1770	3274		1770	3312		3433	1863	1583
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1770	3465		1770	3274		1770	3312		3433	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	293	353	57	10	16	16	55	277	207	242	308	225
RTOR Reduction (vph)	0	22	0	0	15	0	0	152	0	0	0	151
Lane Group Flow (vph)	293	388	0	10	17	0	55	332	0	242	308	74
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												6
Actuated Green, G (s)	12.1	14.2		0.6	2.7		2.1	13.1		5.2	16.2	16.2
Effective Green, g (s)	12.1	14.2		0.6	2.7		2.1	13.1		5.2	16.2	16.2
Actuated g/C Ratio	0.25	0.29		0.01	0.05		0.04	0.27		0.11	0.33	0.33
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	436	1002		21	180		75	883		363	614	522
v/s Ratio Prot	c0.17	c0.11		0.01	0.01		0.03	0.10		c0.07	c0.17	
v/s Ratio Perm												0.05
v/c Ratio	0.67	0.39		0.48	0.09		0.73	0.38		0.67	0.50	0.14
Uniform Delay, d1	16.7	14.0		24.1	22.0		23.2	14.7		21.1	13.2	11.6
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	4.1	0.2		16.0	0.2		30.6	0.3		4.6	0.6	0.1
Delay (s)	20.8	14.2		40.1	22.3		53.8	14.9		25.7	13.9	11.7
Level of Service	C	B		D	C		D	B		C	B	B
Approach Delay (s)		16.9			26.5			18.9			16.9	
Approach LOS		B			C			B			B	

Intersection Summary

HCM 2000 Control Delay	17.6	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.62		
Actuated Cycle Length (s)	49.1	Sum of lost time (s)	16.0
Intersection Capacity Utilization	51.1%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Unsignalized Intersection Capacity Analysis
 46: I-580 WB Ramps & Northfront Rd/Northfront Road



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	123	225	1332	119	69	619
Future Volume (Veh/h)	123	225	1332	119	69	619
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	134	245	1448	129	75	673
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None		None			
Median storage (veh)						
Upstream signal (ft)	1007					
pX, platoon unblocked					0.51	
vC, conflicting volume			134		3282	256
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			134		5015	256
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			0		0	14
cM capacity (veh/h)			1451		0	782
Direction, Lane #	EB 1	WB 1	NB 1	NB 2		
Volume Total	379	1577	75	673		
Volume Left	0	1448	75	0		
Volume Right	245	0	0	673		
cSH	1700	1451	0	782		
Volume to Capacity	0.22	1.00	Err	0.86		
Queue Length 95th (ft)	0	579	Err	262		
Control Delay (s)	0.0	40.5	Err	30.8		
Lane LOS	E		F	D		
Approach Delay (s)	0.0	40.5	1030.3			
Approach LOS			F			
Intersection Summary						
Average Delay			308.6			
Intersection Capacity Utilization			114.1%	ICU Level of Service		H
Analysis Period (min)			15			

Intersection	
Intersection Delay, s/veh	9.8
Intersection LOS	A

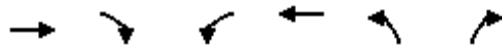
Movement	EBU	EBL	EBT	WBU	WBT	WBR	SBU	SBL	SBR
Lane Configurations		↘	↕↕		↕	↘		↘↘	↘
Traffic Vol, veh/h	0	51	18	0	137	135	0	294	92
Future Vol, veh/h	0	51	18	0	137	135	0	294	92
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	55	20	0	149	147	0	320	100
Number of Lanes	0	1	2	0	1	1	0	2	1

Approach	EB	WB	SB
Opposing Approach	WB	EB	
Opposing Lanes	2	3	0
Conflicting Approach Left	SB		WB
Conflicting Lanes Left	3	0	2
Conflicting Approach Right		SB	EB
Conflicting Lanes Right	0	3	3
HCM Control Delay	9.8	9.8	9.8
HCM LOS	A	A	A

Lane	EBLn1	EBLn2	EBLn3	WBLn1	WBLn2	SBLn1	SBLn2	SBLn3
Vol Left, %	100%	0%	0%	0%	0%	100%	100%	0%
Vol Thru, %	0%	100%	100%	100%	0%	0%	0%	0%
Vol Right, %	0%	0%	0%	0%	100%	0%	0%	100%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	51	9	9	137	135	147	147	92
LT Vol	51	0	0	0	0	147	147	0
Through Vol	0	9	9	137	0	0	0	0
RT Vol	0	0	0	0	135	0	0	92
Lane Flow Rate	55	10	10	149	147	160	160	100
Geometry Grp	8	8	8	8	8	7	7	7
Degree of Util (X)	0.105	0.017	0.012	0.24	0.208	0.264	0.264	0.084
Departure Headway (Hd)	6.84	6.334	4.581	5.807	5.101	5.946	5.946	3.01
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cap	527	568	786	614	697	601	601	1168
Service Time	4.54	4.034	2.281	3.592	2.886	3.723	3.723	0.787
HCM Lane V/C Ratio	0.104	0.018	0.013	0.243	0.211	0.266	0.266	0.086
HCM Control Delay	10.3	9.1	7.3	10.4	9.2	10.9	10.9	6.1
HCM Lane LOS	B	A	A	B	A	B	B	A
HCM 95th-tile Q	0.3	0.1	0	0.9	0.8	1.1	1.1	0.3

HCM Signalized Intersection Capacity Analysis
48: Greenville Rd & Northfront Road/Altamont Pass Road

BART to Livermore Extension Project
2025 BART AM



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↑	↑	↑	↑	↑
Traffic Volume (vph)	4	652	270	865	600	63
Future Volume (vph)	4	652	270	865	600	63
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	1863	1583	1770	1863	1770	1583
Flt Permitted	1.00	1.00	0.76	1.00	0.95	1.00
Satd. Flow (perm)	1863	1583	1407	1863	1770	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	4	709	293	940	652	68
RTOR Reduction (vph)	0	338	0	0	0	29
Lane Group Flow (vph)	4	371	293	940	652	39
Turn Type	NA	Perm	Perm	NA	Prot	Perm
Protected Phases	4			8	2	
Permitted Phases		4	8			2
Actuated Green, G (s)	46.1	46.1	46.1	46.1	34.1	34.1
Effective Green, g (s)	46.1	46.1	46.1	46.1	34.1	34.1
Actuated g/C Ratio	0.52	0.52	0.52	0.52	0.39	0.39
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	973	827	735	973	684	612
v/s Ratio Prot	0.00			c0.50	c0.37	
v/s Ratio Perm		0.23	0.21			0.02
v/c Ratio	0.00	0.45	0.40	0.97	0.95	0.06
Uniform Delay, d1	10.1	13.1	12.7	20.3	26.3	17.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.0	0.4	0.4	20.8	23.4	0.0
Delay (s)	10.1	13.5	13.0	41.1	49.7	17.0
Level of Service	B	B	B	D	D	B
Approach Delay (s)	13.5			34.5	46.6	
Approach LOS	B			C	D	

Intersection Summary

HCM 2000 Control Delay	32.1	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.96		
Actuated Cycle Length (s)	88.2	Sum of lost time (s)	8.0
Intersection Capacity Utilization	85.4%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	119	222	140	622	747	120
Future Volume (vph)	119	222	140	622	747	120
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.2	5.2	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.88	0.97	0.95	0.95	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	3433	2787	3433	3539	3539	1583
Flt Permitted	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (perm)	3433	2787	3433	3539	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	129	241	152	676	812	130
RTOR Reduction (vph)	0	200	0	0	0	73
Lane Group Flow (vph)	129	41	152	676	812	57
Turn Type	Prot	Perm	Prot	NA	NA	Perm
Protected Phases	8		1	6	2	
Permitted Phases		8				2
Actuated Green, G (s)	8.6	8.6	5.2	27.8	18.6	18.6
Effective Green, g (s)	8.0	8.0	5.2	29.5	20.3	20.3
Actuated g/C Ratio	0.17	0.17	0.11	0.63	0.43	0.43
Clearance Time (s)	4.6	4.6	4.0	5.7	5.7	5.7
Vehicle Extension (s)	5.0	5.0	6.0	2.5	2.5	2.5
Lane Grp Cap (vph)	588	477	382	2235	1538	688
v/s Ratio Prot	c0.04		c0.04	0.19	c0.23	
v/s Ratio Perm		0.01				0.04
v/c Ratio	0.22	0.09	0.40	0.30	0.53	0.08
Uniform Delay, d1	16.7	16.3	19.3	3.9	9.7	7.7
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.4	0.2	1.9	0.1	0.3	0.0
Delay (s)	17.1	16.4	21.2	4.0	9.9	7.8
Level of Service	B	B	C	A	A	A
Approach Delay (s)	16.7			7.1	9.6	
Approach LOS	B			A	A	

Intersection Summary

HCM 2000 Control Delay	9.9	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.43		
Actuated Cycle Length (s)	46.7	Sum of lost time (s)	13.2
Intersection Capacity Utilization	39.0%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
50: Greenville Rd & Patterson Pass Rd

BART to Livermore Extension Project
2025 BART AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	31	3	25	223	356	649	8	148	1	9	344	48
Future Volume (vph)	31	3	25	223	356	649	8	148	1	9	344	48
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.86		1.00	0.90		1.00	1.00		1.00	0.98	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1611		1770	1682		1770	1861		1770	1829	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	1611		1770	1682		1770	1861		1770	1829	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	34	3	27	242	387	705	9	161	1	10	374	52
RTOR Reduction (vph)	0	20	0	0	52	0	0	0	0	0	4	0
Lane Group Flow (vph)	34	10	0	242	1040	0	9	162	0	10	422	0
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												
Actuated Green, G (s)	2.3	30.7		40.8	69.2		0.7	27.1		0.7	27.1	
Effective Green, g (s)	2.3	30.7		40.8	69.2		0.7	27.1		0.7	27.1	
Actuated g/C Ratio	0.02	0.27		0.35	0.60		0.01	0.24		0.01	0.24	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	35	428		626	1009		10	437		10	429	
v/s Ratio Prot	c0.02	0.01		0.14	c0.62		0.01	0.09		c0.01	c0.23	
v/s Ratio Perm												
v/c Ratio	0.97	0.02		0.39	1.03		0.90	0.37		1.00	0.98	
Uniform Delay, d1	56.5	31.2		27.9	23.0		57.3	37.0		57.3	43.9	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	140.0	0.0		0.4	36.6		226.0	2.4		284.6	39.7	
Delay (s)	196.5	31.3		28.3	59.7		283.2	39.4		341.9	83.6	
Level of Service	F	C		C	E		F	D		F	F	
Approach Delay (s)		119.0			54.0			52.2			89.5	
Approach LOS		F			D			D			F	

Intersection Summary

HCM 2000 Control Delay	63.6	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.02		
Actuated Cycle Length (s)	115.3	Sum of lost time (s)	16.0
Intersection Capacity Utilization	86.3%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
1: Dougherty Rd & Amador Valley Rd



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	330	459	620	1990	1088	208
Future Volume (vph)	330	459	620	1990	1088	208
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5	5.7	5.7	
Lane Util. Factor	1.00	1.00	0.97	0.91	0.91	
Frt	1.00	0.85	1.00	1.00	0.98	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1770	1583	3433	5085	4963	
Flt Permitted	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	1770	1583	3433	5085	4963	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	359	499	674	2163	1183	226
RTOR Reduction (vph)	0	228	0	0	28	0
Lane Group Flow (vph)	359	271	674	2163	1381	0
Turn Type	Perm	Perm	Prot	NA	NA	
Protected Phases			5	2	6	
Permitted Phases	4	4				
Actuated Green, G (s)	21.1	21.1	13.6	55.6	37.5	
Effective Green, g (s)	21.1	21.1	13.6	55.6	37.5	
Actuated g/C Ratio	0.24	0.24	0.16	0.64	0.43	
Clearance Time (s)	4.5	4.5	4.5	5.7	5.7	
Vehicle Extension (s)	1.8	1.8	2.0	4.0	4.0	
Lane Grp Cap (vph)	429	384	537	3253	2141	
v/s Ratio Prot			c0.20	c0.43	0.28	
v/s Ratio Perm	c0.20	0.17				
v/c Ratio	0.84	0.71	1.26	0.66	0.65	
Uniform Delay, d1	31.3	30.1	36.7	9.8	19.5	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	12.7	4.8	129.4	0.6	0.8	
Delay (s)	44.0	34.8	166.1	10.4	20.2	
Level of Service	D	C	F	B	C	
Approach Delay (s)	38.7			47.4	20.2	
Approach LOS	D			D	C	

Intersection Summary

HCM 2000 Control Delay	38.4	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.85		
Actuated Cycle Length (s)	86.9	Sum of lost time (s)	14.7
Intersection Capacity Utilization	73.9%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
2: Dougherty Rd & Dublin Blvd

BART to Livermore Extension Project
2025 BART PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↑↑↑	↖↗	↖↗↘	↑↑↑	↖	↖↗↘	↑↑↑	↖↗	↖↗	↑↑↑	↖↗
Traffic Volume (vph)	86	1012	912	552	845	721	814	1868	291	622	1251	36
Future Volume (vph)	86	1012	912	552	845	721	814	1868	291	622	1251	36
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	6.0	5.0	5.0	5.5	5.0	5.0	5.5	5.0	5.0	5.5	
Lane Util. Factor	0.97	0.91	0.88	0.94	0.91	1.00	0.94	0.91	0.88	0.97	0.86	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	3433	5085	2787	4990	5085	1583	4990	5085	2787	3433	6381	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	3433	5085	2787	4990	5085	1583	4990	5085	2787	3433	6381	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	93	1100	991	600	918	784	885	2030	316	676	1360	39
RTOR Reduction (vph)	0	0	36	0	0	58	0	0	34	0	3	0
Lane Group Flow (vph)	93	1100	955	600	918	726	885	2030	282	676	1396	0
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	
Protected Phases	5	2	3	1	6	7	3	8	1	7	4	
Permitted Phases			2			6			8			
Actuated Green, G (s)	15.0	34.3	54.1	18.3	38.1	52.1	19.8	45.0	63.3	14.0	39.2	
Effective Green, g (s)	15.0	34.3	54.1	18.3	38.1	52.1	19.8	45.0	63.3	14.0	39.2	
Actuated g/C Ratio	0.11	0.26	0.41	0.14	0.29	0.39	0.15	0.34	0.48	0.11	0.29	
Clearance Time (s)	5.0	6.0	5.0	5.0	5.5	5.0	5.0	5.5	5.0	5.0	5.5	
Vehicle Extension (s)	2.0	4.5	2.0	2.0	4.5	2.0	2.0	4.5	2.0	2.0	4.5	
Lane Grp Cap (vph)	386	1310	1132	686	1455	619	742	1719	1325	361	1879	
v/s Ratio Prot	0.03	0.22	0.13	c0.12	0.18	c0.12	c0.18	c0.40	0.03	c0.20	0.22	
v/s Ratio Perm			0.22			0.34			0.07			
v/c Ratio	0.24	0.84	0.84	0.87	0.63	1.17	1.19	1.18	0.21	1.87	0.74	
Uniform Delay, d1	53.9	46.8	35.7	56.3	41.4	40.5	56.6	44.0	20.4	59.5	42.4	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.1	5.3	5.6	11.6	1.1	93.8	99.8	87.8	0.0	403.1	1.8	
Delay (s)	54.0	52.1	41.3	67.9	42.5	134.3	156.4	131.8	20.4	462.6	44.2	
Level of Service	D	D	D	E	D	F	F	F	C	F	D	
Approach Delay (s)		47.3			80.4			127.7			180.5	
Approach LOS		D			F			F			F	

Intersection Summary

HCM 2000 Control Delay	109.8	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.25		
Actuated Cycle Length (s)	133.1	Sum of lost time (s)	21.5
Intersection Capacity Utilization	106.2%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

3: Dougherty Rd & I-580 WB Ramps

BART to Livermore Extension Project
2025 BART PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↔↔		↔↔		↑↑↑			↑↑↑	↔
Traffic Volume (vph)	0	0	0	312	0	647	0	2355	0	0	1636	0
Future Volume (vph)	0	0	0	312	0	647	0	2355	0	0	1636	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0		4.0		4.0			4.0	
Lane Util. Factor				0.97		0.88		0.91			0.86	
Frt				1.00		0.85		1.00			1.00	
Flt Protected				0.95		1.00		1.00			1.00	
Satd. Flow (prot)				3433		2787		5085			4806	
Flt Permitted				0.95		1.00		1.00			1.00	
Satd. Flow (perm)				3433		2787		5085			4806	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	339	0	703	0	2560	0	0	1778	0
RTOR Reduction (vph)	0	0	0	0	0	38	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	339	0	665	0	2560	0	0	1778	0
Turn Type				Prot		Prot		NA			NA	Perm
Protected Phases				4		4		2			6	
Permitted Phases												6
Actuated Green, G (s)				11.6		11.6		27.6			27.6	
Effective Green, g (s)				13.0		13.0		29.0			29.0	
Actuated g/C Ratio				0.26		0.26		0.58			0.58	
Clearance Time (s)				5.4		5.4		5.4			5.4	
Vehicle Extension (s)				3.0		3.0		3.0			3.0	
Lane Grp Cap (vph)				892		724		2949			2787	
v/s Ratio Prot				0.10		c0.24		c0.50			0.37	
v/s Ratio Perm												
v/c Ratio				0.38		0.92		0.87			0.64	
Uniform Delay, d1				15.2		18.0		8.9			7.0	
Progression Factor				1.00		1.00		1.00			1.00	
Incremental Delay, d2				0.3		16.5		3.8			1.1	
Delay (s)				15.5		34.4		12.7			8.1	
Level of Service				B		C		B			A	
Approach Delay (s)		0.0			28.3			12.7			8.1	
Approach LOS		A			C			B			A	

Intersection Summary

HCM 2000 Control Delay	14.2	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.88		
Actuated Cycle Length (s)	50.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	74.8%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
4: Hopyard Rd/Dougherty Rd & I-580 EB Ramps

BART to Livermore Extension Project
2025 BART PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↗↘		↗↘					↑↑↑	↗		↑↑↑	↗
Traffic Volume (vph)	1113	0	819	0	0	0	0	2467	0	0	1140	0
Future Volume (vph)	1113	0	819	0	0	0	0	2467	0	0	1140	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0					4.0			4.0	
Lane Util. Factor	0.97		0.88					0.91			0.86	
Frt	1.00		0.85					1.00			1.00	
Flt Protected	0.95		1.00					1.00			1.00	
Satd. Flow (prot)	3433		2787					5085			4806	
Flt Permitted	0.95		1.00					1.00			1.00	
Satd. Flow (perm)	3433		2787					5085			4806	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	1210	0	890	0	0	0	0	2682	0	0	1239	0
RTOR Reduction (vph)	0	0	60	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	1210	0	830	0	0	0	0	2682	0	0	1239	0
Turn Type	Prot		Prot					NA	Free		NA	Perm
Protected Phases	4		4					2			6	
Permitted Phases									Free			6
Actuated Green, G (s)	39.6		39.6					59.6			59.6	
Effective Green, g (s)	41.0		41.0					61.0			61.0	
Actuated g/C Ratio	0.37		0.37					0.55			0.55	
Clearance Time (s)	5.4		5.4					5.4			5.4	
Vehicle Extension (s)	3.0		3.0					3.0			3.0	
Lane Grp Cap (vph)	1279		1038					2819			2665	
v/s Ratio Prot	c0.35		0.30					c0.53			0.26	
v/s Ratio Perm												
v/c Ratio	0.95		0.80					0.95			0.46	
Uniform Delay, d1	33.4		30.8					23.1			14.7	
Progression Factor	1.00		1.00					1.00			1.00	
Incremental Delay, d2	14.1		4.4					8.9			0.6	
Delay (s)	47.5		35.2					32.0			15.3	
Level of Service	D		D					C			B	
Approach Delay (s)		42.3			0.0			32.0			15.3	
Approach LOS		D			A			C			B	

Intersection Summary

HCM 2000 Control Delay	32.2	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.95		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	86.1%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
5: Hopyard Rd & Owens Rd

BART to Livermore Extension Project
2025 BART PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	359	240	310	561	291	290	281	913	263	316	1462	228
Future Volume (vph)	359	240	310	561	291	290	281	913	263	316	1462	228
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	2.7	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	0.91	0.91		1.00	0.95	0.95	1.00	0.91	1.00	0.97	0.91	
Frt	1.00	0.93		1.00	0.96	0.85	1.00	1.00	0.85	1.00	0.98	
Flt Protected	0.95	0.99		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1610	3133		1770	1707	1504	1770	5085	1583	3433	4982	
Flt Permitted	0.95	0.99		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1610	3133		1770	1707	1504	1770	5085	1583	3433	4982	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	390	261	337	610	316	315	305	992	286	343	1589	248
RTOR Reduction (vph)	0	99	0	0	8	34	0	0	205	0	15	0
Lane Group Flow (vph)	214	675	0	610	406	183	305	992	81	343	1822	0
Turn Type	Split	NA		Split	NA	pm+ov	Prot	NA	Perm	Prot	NA	
Protected Phases	8	8		4	4	1	5	2		1	6	
Permitted Phases						4			2			
Actuated Green, G (s)	20.7	20.7		35.7	35.7	61.2	18.0	37.8	37.8	25.5	45.3	
Effective Green, g (s)	22.0	22.0		37.0	37.0	63.8	18.0	39.5	39.5	25.5	47.0	
Actuated g/C Ratio	0.16	0.16		0.26	0.26	0.46	0.13	0.28	0.28	0.18	0.34	
Clearance Time (s)	5.3	5.3		5.3	5.3	4.0	4.0	5.7	5.7	4.0	5.7	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	253	492		467	451	714	227	1434	446	625	1672	
v/s Ratio Prot	0.13	c0.22		c0.34	0.24	0.05	c0.17	0.20		0.10	c0.37	
v/s Ratio Perm						0.07			0.05			
v/c Ratio	0.85	1.37		1.31	0.90	0.26	1.34	0.69	0.18	0.55	1.09	
Uniform Delay, d1	57.4	59.0		51.5	49.7	23.5	61.0	44.8	38.0	52.0	46.5	
Progression Factor	1.00	1.00		0.99	1.00	1.06	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	22.0	180.3		152.4	20.4	0.2	181.1	2.8	0.9	1.0	50.7	
Delay (s)	79.4	239.3		203.6	70.2	25.0	242.1	47.6	38.9	53.0	97.2	
Level of Service	E	F		F	E	C	F	D	D	D	F	
Approach Delay (s)		204.6			127.9			83.5			90.3	
Approach LOS		F			F			F			F	



































Intersection Summary

HCM 2000 Control Delay	115.1	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.24		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	111.3%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
6: Hopyard Rd & Stoneridge Dr

BART to Livermore Extension Project
2025 BART PM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 	  		 	  		  	 		  		
Traffic Volume (vph)	291	1381	716	114	1313	194	588	838	95	292	878	201
Future Volume (vph)	291	1381	716	114	1313	194	588	838	95	292	878	201
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.91	1.00	0.97	0.91	1.00	0.94	0.95	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5085	1583	3433	5085	1583	4990	3539	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5085	1583	3433	5085	1583	4990	3539	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	316	1501	778	124	1427	211	639	911	103	317	954	218
RTOR Reduction (vph)	0	0	181	0	0	145	0	0	75	0	0	135
Lane Group Flow (vph)	316	1501	597	124	1427	66	639	911	28	317	954	83
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8			2			6
Actuated Green, G (s)	9.0	30.0	30.0	4.0	25.0	25.0	11.0	22.0	22.0	8.0	19.0	19.0
Effective Green, g (s)	9.0	30.0	30.0	4.0	25.0	25.0	11.0	22.0	22.0	8.0	19.0	19.0
Actuated g/C Ratio	0.11	0.38	0.38	0.05	0.31	0.31	0.14	0.28	0.28	0.10	0.24	0.24
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	386	1906	593	171	1589	494	686	973	435	343	1207	375
v/s Ratio Prot	c0.09	0.30		0.04	0.28		c0.13	c0.26		0.09	0.19	
v/s Ratio Perm			c0.38			0.04			0.02			0.05
v/c Ratio	0.82	0.79	1.01	0.73	0.90	0.13	0.93	0.94	0.07	0.92	0.79	0.22
Uniform Delay, d1	34.7	22.2	25.0	37.5	26.3	19.7	34.1	28.3	21.4	35.7	28.6	24.5
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	12.7	2.2	38.8	14.2	7.1	0.1	19.4	15.6	0.1	29.8	3.6	0.3
Delay (s)	47.4	24.4	63.8	51.6	33.4	19.9	53.6	43.9	21.5	65.5	32.2	24.8
Level of Service	D	C	E	D	C	B	D	D	C	E	C	C
Approach Delay (s)		39.0			33.1			46.3			38.2	
Approach LOS		D			C			D			D	

Intersection Summary

HCM 2000 Control Delay	39.1	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	1.01		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	78.5%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
7: Hopyard Rd & Las Positas Blvd

BART to Livermore Extension Project
2025 BART PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	100	252	422	536	409	51	345	941	246	73	1387	74
Future Volume (vph)	100	252	422	536	409	51	345	941	246	73	1387	74
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.95	1.00	0.97	0.95	1.00	0.97	0.91	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	3433	3539	1583	3433	5085	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	3433	3539	1583	3433	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	109	274	459	583	445	55	375	1023	267	79	1508	80
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	53
Lane Group Flow (vph)	109	274	459	583	445	55	375	1023	267	79	1508	27
Turn Type	Prot	NA	Free	Prot	NA	Free	Prot	NA	Free	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			Free			Free			Free			6
Actuated Green, G (s)	4.0	11.9	76.8	14.0	21.9	76.8	9.0	30.9	76.8	4.0	25.9	25.9
Effective Green, g (s)	4.0	11.9	76.8	14.0	21.9	76.8	9.0	30.9	76.8	4.0	25.9	25.9
Actuated g/C Ratio	0.05	0.15	1.00	0.18	0.29	1.00	0.12	0.40	1.00	0.05	0.34	0.34
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	178	548	1583	625	1009	1583	402	2045	1583	178	1714	533
v/s Ratio Prot	0.03	0.08		c0.17	c0.13		c0.11	0.20		0.02	c0.30	
v/s Ratio Perm			0.29			0.03			0.17			0.02
v/c Ratio	0.61	0.50	0.29	0.93	0.44	0.03	0.93	0.50	0.17	0.44	0.88	0.05
Uniform Delay, d1	35.6	29.7	0.0	30.9	22.4	0.0	33.6	17.2	0.0	35.3	24.0	17.2
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	6.1	0.7	0.5	21.0	0.3	0.0	28.4	0.2	0.2	1.8	5.5	0.0
Delay (s)	41.8	30.4	0.5	51.9	22.8	0.0	62.0	17.4	0.2	37.1	29.5	17.2
Level of Service	D	C	A	D	C	A	E	B	A	D	C	B
Approach Delay (s)		15.6			37.3			24.7			29.3	
Approach LOS		B			D			C			C	

Intersection Summary

HCM 2000 Control Delay	27.3	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.83		
Actuated Cycle Length (s)	76.8	Sum of lost time (s)	16.0
Intersection Capacity Utilization	72.2%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
8: Willow Rd & Owens Rd

BART to Livermore Extension Project
2025 BART PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↕↔		↖↗	↕↕	↖	↖	↕↕	↖	↖	↕	↖
Traffic Volume (vph)	91	597	170	105	619	80	167	77	0	189	81	154
Future Volume (vph)	91	597	170	105	619	80	167	77	0	189	81	154
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	5.3	4.0		5.3	4.0	4.0
Lane Util. Factor	0.97	0.91		0.97	0.91	1.00	1.00	0.95		1.00	1.00	1.00
Frt	1.00	0.97		1.00	1.00	0.85	1.00	1.00		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	4916		3433	5085	1583	1770	3539		1770	1863	1583
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.70	1.00		0.70	1.00	1.00
Satd. Flow (perm)	3433	4916		3433	5085	1583	1304	3539		1303	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	99	649	185	114	673	87	182	84	0	205	88	167
RTOR Reduction (vph)	0	62	0	0	0	46	0	0	0	0	0	124
Lane Group Flow (vph)	99	772	0	114	673	41	182	84	0	205	88	43
Turn Type	Prot	NA		Prot	NA	Perm	Perm	NA	Perm	Perm	NA	Perm
Protected Phases	1	6		5	2			4				8
Permitted Phases						2	4		4	8		8
Actuated Green, G (s)	7.3	32.4		5.9	31.0	31.0	16.7	16.7		16.7	16.7	16.7
Effective Green, g (s)	7.3	34.1		5.9	32.7	32.7	16.7	18.0		16.7	18.0	18.0
Actuated g/C Ratio	0.10	0.49		0.08	0.47	0.47	0.24	0.26		0.24	0.26	0.26
Clearance Time (s)	4.0	5.7		4.0	5.7	5.7	5.3	5.3		5.3	5.3	5.3
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	358	2394		289	2375	739	311	910		310	479	407
v/s Ratio Prot	0.03	c0.16		c0.03	0.13			0.02			0.05	
v/s Ratio Perm						0.03	0.14			c0.16		0.03
v/c Ratio	0.28	0.32		0.39	0.28	0.05	0.59	0.09		0.66	0.18	0.11
Uniform Delay, d1	28.9	10.9		30.4	11.5	10.2	23.6	19.8		24.1	20.3	19.9
Progression Factor	0.84	1.99		1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	0.3	0.3		0.9	0.3	0.1	2.8	0.0		5.2	0.2	0.1
Delay (s)	24.6	21.9		31.2	11.8	10.3	26.4	19.8		29.3	20.5	20.0
Level of Service	C	C		C	B	B	C	B		C	C	B
Approach Delay (s)		22.2			14.2			24.3			24.2	
Approach LOS		C			B			C			C	

Intersection Summary

HCM 2000 Control Delay	20.0	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.42		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	45.8%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
9: Hacienda Dr & Dublin Blvd

BART to Livermore Extension Project
2025 BART PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	52	1013	132	228	489	34	221	580	443	42	633	168
Future Volume (vph)	52	1013	132	228	489	34	221	580	443	42	633	168
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	6.0	5.0	4.5	6.0		5.0	6.0	6.0	4.5	5.5	5.5
Lane Util. Factor	0.97	0.91	0.88	0.97	0.91		0.94	0.95	0.88	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5085	2787	3433	5036		4990	3539	2787	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5085	2787	3433	5036		4990	3539	2787	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	57	1101	143	248	532	37	240	630	482	46	688	183
RTOR Reduction (vph)	0	0	65	0	7	0	0	0	234	0	0	141
Lane Group Flow (vph)	57	1101	78	248	562	0	240	630	248	46	688	42
Turn Type	Prot	NA	pm+ov	Prot	NA		Prot	NA	Perm	Prot	NA	Perm
Protected Phases	5	2	3	1	6		3	8		7	NA	4
Permitted Phases			2						8			4
Actuated Green, G (s)	4.2	29.4	40.0	10.9	36.1		10.6	29.4	29.4	2.7	21.5	21.5
Effective Green, g (s)	4.2	29.4	40.0	10.9	36.1		10.6	29.4	29.4	2.7	21.5	21.5
Actuated g/C Ratio	0.04	0.31	0.43	0.12	0.39		0.11	0.31	0.31	0.03	0.23	0.23
Clearance Time (s)	4.5	6.0	5.0	4.5	6.0		5.0	6.0	6.0	4.5	5.5	5.5
Vehicle Extension (s)	2.0	3.5	2.0	2.0	3.5		2.0	3.5	3.5	2.0	3.5	3.5
Lane Grp Cap (vph)	154	1600	1342	400	1946		566	1113	877	99	1170	364
v/s Ratio Prot	0.02	c0.22	0.01	c0.07	0.11		0.05	c0.18		0.01	c0.14	
v/s Ratio Perm			0.02						0.09			0.03
v/c Ratio	0.37	0.69	0.06	0.62	0.29		0.42	0.57	0.28	0.46	0.59	0.12
Uniform Delay, d1	43.3	28.0	15.7	39.3	19.8		38.6	26.7	24.1	44.6	32.0	28.4
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.5	1.3	0.0	2.0	0.1		0.2	0.7	0.2	1.3	0.8	0.2
Delay (s)	43.9	29.3	15.7	41.3	19.9		38.7	27.4	24.3	45.9	32.8	28.6
Level of Service	D	C	B	D	B		D	C	C	D	C	C
Approach Delay (s)		28.4			26.4			28.3			32.6	
Approach LOS		C			C			C			C	

Intersection Summary

HCM 2000 Control Delay	28.9	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.64		
Actuated Cycle Length (s)	93.4	Sum of lost time (s)	21.0
Intersection Capacity Utilization	63.1%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 10: Hacienda Dr & Martinelli Blvd/Hacienda Crossings



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗	↖↗	↖↗	↗		↖↗↘	↖↗↘	↖	↖↗	↖↗↘	
Traffic Volume (vph)	21	46	338	293	32	22	340	1231	467	64	921	63
Future Volume (vph)	21	46	338	293	32	22	340	1231	467	64	921	63
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	3.0	3.0	5.5	3.0		3.5	3.0	3.0	5.0	3.5	
Lane Util. Factor	1.00	0.91	0.91	0.97	1.00		0.94	0.91	1.00	0.97	0.86	
Frt	1.00	0.94	0.85	1.00	0.94		1.00	1.00	0.85	1.00	0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1770	1587	2882	3433	1749		4990	5085	1583	3433	6347	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1770	1587	2882	3433	1749		4990	5085	1583	3433	6347	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	23	50	367	318	35	24	370	1338	508	70	1001	68
RTOR Reduction (vph)	0	28	206	0	17	0	0	0	211	0	8	0
Lane Group Flow (vph)	23	59	124	318	42	0	370	1338	297	70	1061	0
Turn Type	Prot	NA	Perm	Prot	NA		Prot	NA	pm+ov	Prot	NA	
Protected Phases	5	2		1	6		3	8	1	7	4	
Permitted Phases			2						8			
Actuated Green, G (s)	6.6	15.6	15.6	12.3	21.8		8.6	34.3	46.6	4.8	30.5	
Effective Green, g (s)	6.1	17.6	17.6	11.8	23.8		9.6	36.3	50.6	4.3	32.0	
Actuated g/C Ratio	0.07	0.20	0.20	0.14	0.28		0.11	0.42	0.58	0.05	0.37	
Clearance Time (s)	4.5	5.0	5.0	5.0	5.0		4.5	5.0	5.0	4.5	5.0	
Vehicle Extension (s)	3.0	4.0	4.0	2.0	4.0		3.0	4.0	2.0	3.0	4.0	
Lane Grp Cap (vph)	124	322	586	468	481		553	2133	980	170	2348	
v/s Ratio Prot	0.01	0.04		c0.09	0.02		c0.07	c0.26	0.05	0.02	0.17	
v/s Ratio Perm			c0.04						0.14			
v/c Ratio	0.19	0.18	0.21	0.68	0.09		0.67	0.63	0.30	0.41	0.45	
Uniform Delay, d1	37.9	28.5	28.7	35.6	23.3		36.9	19.8	9.1	39.9	20.6	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.7	0.4	0.2	3.1	0.1		3.1	0.7	0.1	1.6	0.2	
Delay (s)	38.6	28.9	28.9	38.6	23.4		40.0	20.4	9.1	41.5	20.8	
Level of Service	D	C	C	D	C		D	C	A	D	C	
Approach Delay (s)		29.4			36.2			21.1			22.1	
Approach LOS		C			D			C			C	

Intersection Summary

HCM 2000 Control Delay	23.6	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.57		
Actuated Cycle Length (s)	86.5	Sum of lost time (s)	16.5
Intersection Capacity Utilization	54.7%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
11: Hacienda Dr & I-580 WB Ramps

BART to Livermore Extension Project
2025 BART PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↔↔		↔↔		↑↑↑			↑↑↑	↔
Traffic Volume (vph)	0	0	0	345	0	290	0	1491	759	0	771	755
Future Volume (vph)	0	0	0	345	0	290	0	1491	759	0	771	755
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0		4.0		4.0			4.0	4.0
Lane Util. Factor				0.97		0.88		0.91			0.86	0.86
Frt				1.00		0.85		0.95			0.95	0.85
Flt Protected				0.95		1.00		1.00			1.00	1.00
Satd. Flow (prot)				3433		2787		4828			4569	1362
Flt Permitted				0.95		1.00		1.00			1.00	1.00
Satd. Flow (perm)				3433		2787		4828			4569	1362
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	375	0	315	0	1621	825	0	838	821
RTOR Reduction (vph)	0	0	0	0	0	54	0	164	0	0	141	141
Lane Group Flow (vph)	0	0	0	375	0	261	0	2282	0	0	1108	269
Turn Type				Prot		Prot		NA			NA	Perm
Protected Phases				4		4		2			6	
Permitted Phases												6
Actuated Green, G (s)				9.5		9.5		34.2			34.2	34.2
Effective Green, g (s)				10.9		10.9		36.1			36.1	36.1
Actuated g/C Ratio				0.20		0.20		0.66			0.66	0.66
Clearance Time (s)				5.4		5.4		5.9			5.9	5.9
Vehicle Extension (s)				3.0		3.0		3.0			3.0	3.0
Lane Grp Cap (vph)				680		552		3168			2998	893
v/s Ratio Prot				c0.11		0.09		c0.47			0.24	
v/s Ratio Perm												0.20
v/c Ratio				0.55		0.47		0.72			0.37	0.30
Uniform Delay, d1				19.8		19.5		6.2			4.3	4.0
Progression Factor				1.00		1.00		0.69			1.00	1.00
Incremental Delay, d2				1.0		0.6		1.0			0.4	0.9
Delay (s)				20.8		20.2		5.2			4.6	4.9
Level of Service				C		C		A			A	A
Approach Delay (s)		0.0			20.5			5.2			4.7	
Approach LOS		A			C			A			A	

Intersection Summary		
HCM 2000 Control Delay	7.3	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.68	A
Actuated Cycle Length (s)	55.0	Sum of lost time (s)
Intersection Capacity Utilization	62.6%	8.0
Analysis Period (min)	15	ICU Level of Service
		B

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 12: Hacienda Dr & I-580 EB Ramps

BART to Livermore Extension Project
 2025 BART PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔↔		↔↔					↑↑↑	↔		↑↑↑	
Traffic Volume (vph)	886	0	439	0	0	0	0	1546	822	0	741	313
Future Volume (vph)	886	0	439	0	0	0	0	1546	822	0	741	313
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0					4.0	4.0		4.0	
Lane Util. Factor	0.97		0.88					0.86	0.86		0.91	
Frt	1.00		0.85					0.98	0.85		0.96	
Flt Protected	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (prot)	3433		2787					4704	1362		4859	
Flt Permitted	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (perm)	3433		2787					4704	1362		4859	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	963	0	477	0	0	0	0	1680	893	0	805	340
RTOR Reduction (vph)	0	0	175	0	0	0	0	17	255	0	62	0
Lane Group Flow (vph)	963	0	302	0	0	0	0	1940	361	0	1083	0
Turn Type	Prot		Prot					NA	Perm		NA	
Protected Phases	4		4					2			6	
Permitted Phases									2			
Actuated Green, G (s)	36.2		36.2					62.5	62.5		62.5	
Effective Green, g (s)	37.6		37.6					64.4	64.4		64.4	
Actuated g/C Ratio	0.34		0.34					0.59	0.59		0.59	
Clearance Time (s)	5.4		5.4					5.9	5.9		5.9	
Vehicle Extension (s)	2.0		2.0					2.0	2.0		2.0	
Lane Grp Cap (vph)	1173		952					2753	797		2844	
v/s Ratio Prot	c0.28		0.11					c0.41			0.22	
v/s Ratio Perm									0.26			
v/c Ratio	0.82		0.32					0.70	0.45		0.38	
Uniform Delay, d1	33.1		26.7					16.1	12.9		12.2	
Progression Factor	1.00		1.00					1.00	1.00		0.85	
Incremental Delay, d2	4.5		0.1					1.5	1.9		0.4	
Delay (s)	37.6		26.8					17.6	14.7		10.7	
Level of Service	D		C					B	B		B	
Approach Delay (s)		34.0			0.0			16.9			10.7	
Approach LOS		C			A			B			B	

Intersection Summary		
HCM 2000 Control Delay	20.3	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.75	C
Actuated Cycle Length (s)	110.0	Sum of lost time (s)
Intersection Capacity Utilization	67.9%	8.0
Analysis Period (min)	15	ICU Level of Service
		C

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
13: Hacienda Dr & Owens Rd

BART to Livermore Extension Project
2025 BART PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↖	↑↑↑	↗	↖↖	↑↑↑	↗	↖↖	↑↑↑	↗	↖↖	↑↑↑	↗
Traffic Volume (vph)	607	692	49	122	300	739	36	1008	297	450	466	249
Future Volume (vph)	607	692	49	122	300	739	36	1008	297	450	466	249
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	2.3	4.0	4.0	2.3	4.0	4.0	2.7	4.0	4.0	2.7
Lane Util. Factor	0.97	0.91	1.00	0.97	0.91	1.00	0.97	0.91	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5085	1583	3433	5085	1583	3433	5085	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5085	1583	3433	5085	1583	3433	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	660	752	53	133	326	803	39	1096	323	489	507	271
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	660	752	53	133	326	803	39	1096	323	489	507	271
Turn Type	Prot	NA	Free	Prot	NA	Free	Prot	NA	Free	Prot	NA	Free
Protected Phases	1	6		5	2		7	4		3	8	
Permitted Phases			Free			Free			Free			Free
Actuated Green, G (s)	35.2	38.5	115.0	7.8	11.1	115.0	3.9	33.3	115.0	16.4	45.8	115.0
Effective Green, g (s)	35.2	40.2	115.0	7.8	12.8	115.0	3.9	34.6	115.0	16.4	47.1	115.0
Actuated g/C Ratio	0.31	0.35	1.00	0.07	0.11	1.00	0.03	0.30	1.00	0.14	0.41	1.00
Clearance Time (s)	4.0	5.7		4.0	5.7		4.0	5.3		4.0	5.3	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	1050	1777	1583	232	565	1583	116	1529	1583	489	2082	1583
v/s Ratio Prot	c0.19	0.15		0.04	0.06		0.01	c0.22		c0.14	0.10	
v/s Ratio Perm			0.03			c0.51			0.20			0.17
v/c Ratio	0.63	0.42	0.03	0.57	0.58	0.51	0.34	0.72	0.20	1.00	0.24	0.17
Uniform Delay, d1	34.3	28.5	0.0	52.0	48.5	0.0	54.3	35.8	0.0	49.3	22.3	0.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.2	0.7	0.0	3.4	4.3	1.2	1.7	1.6	0.3	40.7	0.1	0.2
Delay (s)	35.5	29.3	0.0	55.4	52.8	1.2	56.0	37.5	0.3	90.0	22.3	0.2
Level of Service	D	C	A	E	D	A	E	D	A	F	C	A
Approach Delay (s)		31.0			20.2			29.7			43.7	
Approach LOS		C			C			C			D	

Intersection Summary

HCM 2000 Control Delay	31.1	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.73		
Actuated Cycle Length (s)	115.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	68.8%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 14: Tassajara Rd & Dublin Blvd

BART to Livermore Extension Project
 2025 BART PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	249	765	451	245	292	19	381	874	474	28	784	137
Future Volume (vph)	249	765	451	245	292	19	381	874	474	28	784	137
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	6.0	6.0	5.0	6.0		5.0	6.0	6.0	5.0	6.0	6.0
Lane Util. Factor	0.97	0.95	0.88	0.94	0.95		0.94	0.91	1.00	0.97	0.86	0.88
Frt	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	2787	4990	3506		4990	5085	1583	3433	6408	2787
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	2787	4990	3506		4990	5085	1583	3433	6408	2787
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	271	832	490	266	317	21	414	950	515	30	852	149
RTOR Reduction (vph)	0	0	288	0	3	0	0	0	257	0	0	108
Lane Group Flow (vph)	271	832	202	266	335	0	414	950	258	30	852	41
Turn Type	Prot	NA	Perm	Prot	NA		Prot	NA	Perm	Prot	NA	Perm
Protected Phases	5	2		1	6		3	8		7		4
Permitted Phases			2						8			4
Actuated Green, G (s)	17.0	40.3	40.3	16.4	39.7		17.1	45.3	45.3	8.1	36.3	36.3
Effective Green, g (s)	17.0	40.3	40.3	16.4	39.7		17.1	45.3	45.3	8.1	36.3	36.3
Actuated g/C Ratio	0.13	0.31	0.31	0.12	0.30		0.13	0.34	0.34	0.06	0.27	0.27
Clearance Time (s)	5.0	6.0	6.0	5.0	6.0		5.0	6.0	6.0	5.0	6.0	6.0
Vehicle Extension (s)	2.0	3.0	3.0	2.0	3.0		2.0	4.0	4.0	2.0	4.0	4.0
Lane Grp Cap (vph)	441	1079	850	619	1053		645	1743	542	210	1760	765
v/s Ratio Prot	c0.08	c0.24		0.05	0.10		c0.08	c0.19		0.01	0.13	
v/s Ratio Perm			0.07						0.16			0.01
v/c Ratio	0.61	0.77	0.24	0.43	0.32		0.64	0.55	0.48	0.14	0.48	0.05
Uniform Delay, d1	54.4	41.7	34.4	53.5	35.7		54.6	35.1	34.1	58.7	40.1	35.3
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.8	3.5	0.1	0.2	0.2		1.6	0.4	0.9	0.1	0.3	0.0
Delay (s)	56.2	45.2	34.5	53.7	35.9		56.2	35.5	35.0	58.8	40.4	35.3
Level of Service	E	D	C	D	D		E	D	C	E	D	D
Approach Delay (s)		43.8			43.7			39.9			40.2	
Approach LOS		D			D			D			D	

Intersection Summary		
HCM 2000 Control Delay	41.6	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.67	D
Actuated Cycle Length (s)	132.1	Sum of lost time (s)
Intersection Capacity Utilization	82.2%	22.0
Analysis Period (min)	15	ICU Level of Service
		E

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 15: Tassajara Rd & I-580 WB Ramps

BART to Livermore Extension Project
 2025 BART PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↔		↔		↕	↔		↕↔	↔
Traffic Volume (vph)	0	0	0	484	0	226	0	1347	644	0	1158	614
Future Volume (vph)	0	0	0	484	0	226	0	1347	644	0	1158	614
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0		4.0		4.0	4.0		4.0	4.0
Lane Util. Factor				0.97		0.88		0.95	1.00		0.86	0.86
Frt				1.00		0.85		1.00	0.85		0.98	0.85
Flt Protected				0.95		1.00		1.00	1.00		1.00	1.00
Satd. Flow (prot)				3433		2787		3539	1583		4693	1362
Flt Permitted				0.95		1.00		1.00	1.00		1.00	1.00
Satd. Flow (perm)				3433		2787		3539	1583		4693	1362
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	526	0	246	0	1464	700	0	1259	667
RTOR Reduction (vph)	0	0	0	0	0	43	0	0	275	0	40	170
Lane Group Flow (vph)	0	0	0	526	0	203	0	1464	425	0	1452	264
Turn Type				Perm		Perm		NA	Perm		NA	Perm
Protected Phases								2			6	
Permitted Phases				8		8			2			6
Actuated Green, G (s)				13.6		13.6		33.4	33.4		33.4	33.4
Effective Green, g (s)				13.6		13.6		33.4	33.4		33.4	33.4
Actuated g/C Ratio				0.25		0.25		0.61	0.61		0.61	0.61
Clearance Time (s)				4.0		4.0		4.0	4.0		4.0	4.0
Vehicle Extension (s)				3.0		3.0		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)				848		689		2149	961		2849	827
v/s Ratio Prot								c0.41			0.31	
v/s Ratio Perm				c0.15		0.07			0.27			0.19
v/c Ratio				0.62		0.29		0.68	0.44		0.51	0.32
Uniform Delay, d1				18.4		16.8		7.2	5.8		6.1	5.3
Progression Factor				1.00		1.00		1.00	1.00		1.00	1.00
Incremental Delay, d2				1.4		0.2		1.8	1.5		0.7	1.0
Delay (s)				19.8		17.0		9.0	7.3		6.8	6.3
Level of Service				B		B		A	A		A	A
Approach Delay (s)		0.0			18.9			8.4			6.7	
Approach LOS		A			B			A			A	

Intersection Summary			
HCM 2000 Control Delay	9.4	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.66		
Actuated Cycle Length (s)	55.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	57.7%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 16: Santa Rita Rd & I-580 EB Ramps/Pimilco Dr



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	391	89	233	142	0	316	0	1185	176	316	950	0
Future Volume (vph)	391	89	233	142	0	316	0	1185	176	316	950	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0		4.0		4.0		4.0	4.0	
Lane Util. Factor	0.97	1.00	1.00	0.97		0.88		0.86		1.00	0.95	
Frt	1.00	1.00	0.85	1.00		0.85		0.98		1.00	1.00	
Flt Protected	0.95	1.00	1.00	0.95		1.00		1.00		0.95	1.00	
Satd. Flow (prot)	3433	1863	1583	3433		2787		6284		1770	3539	
Flt Permitted	0.95	1.00	1.00	0.95		1.00		1.00		0.95	1.00	
Satd. Flow (perm)	3433	1863	1583	3433		2787		6284		1770	3539	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	425	97	253	154	0	343	0	1288	191	343	1033	0
RTOR Reduction (vph)	0	0	94	0	0	35	0	22	0	0	0	0
Lane Group Flow (vph)	425	97	159	154	0	308	0	1457	0	343	1033	0
Turn Type	Perm	NA	Perm	Prot		pm+ov		NA		Prot	NA	Perm
Protected Phases		4		3		1		2		1	6	
Permitted Phases	4		4			3						6
Actuated Green, G (s)	19.6	19.6	19.6	8.0		33.8		40.6		25.8	70.4	
Effective Green, g (s)	19.6	19.6	19.6	8.0		33.8		40.6		25.8	70.4	
Actuated g/C Ratio	0.18	0.18	0.18	0.07		0.31		0.37		0.23	0.64	
Clearance Time (s)	4.0	4.0	4.0	4.0		4.0		4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0		3.0		3.0		3.0	3.0	
Lane Grp Cap (vph)	611	331	282	249		856		2319		415	2264	
v/s Ratio Prot		0.05		c0.04		0.08		c0.23		c0.19	0.29	
v/s Ratio Perm	c0.12		0.10			0.03						
v/c Ratio	0.70	0.29	0.56	0.62		0.36		0.63		0.83	0.46	
Uniform Delay, d1	42.4	39.2	41.3	49.5		29.7		28.5		40.0	10.1	
Progression Factor	1.00	1.00	1.00	1.00		1.00		1.00		1.00	1.00	
Incremental Delay, d2	3.4	0.5	2.6	4.5		0.3		1.3		12.7	0.7	
Delay (s)	45.8	39.7	43.9	54.0		29.9		29.8		52.6	10.7	
Level of Service	D	D	D	D		C		C		D	B	
Approach Delay (s)		44.4			37.4			29.8			21.2	
Approach LOS		D			D			C			C	

Intersection Summary		
HCM 2000 Control Delay	30.6	HCM 2000 Level of Service C
HCM 2000 Volume to Capacity ratio	0.70	
Actuated Cycle Length (s)	110.0	Sum of lost time (s) 16.0
Intersection Capacity Utilization	59.7%	ICU Level of Service B
Analysis Period (min)	15	

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 17: Santa Rita Rd & Valley Ave

BART to Livermore Extension Project
 2025 BART PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	358	479	117	130	311	771	157	796	136	994	1106	243
Future Volume (vph)	358	479	117	130	311	771	157	796	136	994	1106	243
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.97	0.95		0.97	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.98		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	3433	3462		3433	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	3433	3462		3433	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	389	521	127	141	338	838	171	865	148	1080	1202	264
RTOR Reduction (vph)	0	0	106	0	0	0	0	13	0	0	0	121
Lane Group Flow (vph)	389	521	21	141	338	838	171	1000	0	1080	1202	143
Turn Type	Prot	NA	Perm	Prot	NA	Free	Prot	NA		Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1		6
Permitted Phases			4			Free						6
Actuated Green, G (s)	12.0	18.5	18.5	9.0	15.5	109.6	9.5	32.1		34.0	56.6	56.6
Effective Green, g (s)	12.0	18.5	18.5	9.0	15.5	109.6	9.5	32.1		34.0	56.6	56.6
Actuated g/C Ratio	0.11	0.17	0.17	0.08	0.14	1.00	0.09	0.29		0.31	0.52	0.52
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	375	597	267	145	500	1583	297	1013		1064	1827	817
v/s Ratio Prot	c0.11	c0.15		0.08	0.10		0.05	c0.29		c0.31	0.34	
v/s Ratio Perm			0.01			c0.53						0.09
v/c Ratio	1.04	0.87	0.08	0.97	0.68	0.53	0.58	0.99		1.02	0.66	0.18
Uniform Delay, d1	48.8	44.4	38.4	50.2	44.7	0.0	48.1	38.5		37.8	19.4	14.1
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	56.5	13.3	0.1	66.0	3.6	1.3	2.7	25.0		31.4	0.9	0.1
Delay (s)	105.3	57.7	38.5	116.1	48.3	1.3	50.8	63.5		69.2	20.3	14.2
Level of Service	F	E	D	F	D	A	D	E		E	C	B
Approach Delay (s)		73.2			25.6			61.7			40.4	
Approach LOS		E			C			E			D	

Intersection Summary

HCM 2000 Control Delay	46.9	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	1.01		
Actuated Cycle Length (s)	109.6	Sum of lost time (s)	16.0
Intersection Capacity Utilization	88.5%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
18: Bernal Ave/Valley Ave & Stanley Blvd

BART to Livermore Extension Project
2025 BART PM










































Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	204	839	58	101	233	344	86	327	303	820	543	118
Future Volume (vph)	204	839	58	101	233	344	86	327	303	820	543	118
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.95	1.00	0.97	0.91	0.91	1.00	0.95	1.00	0.97	0.95	0.95
Frt	1.00	1.00	0.85	1.00	0.94	0.85	1.00	1.00	0.85	1.00	0.97	0.97
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	3433	3179	1441	1770	3539	1583	3433	3445	3445
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	3433	3179	1441	1770	3539	1583	3433	3445	3445
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	222	912	63	110	253	374	93	355	329	891	590	128
RTOR Reduction (vph)	0	0	39	0	123	52	0	0	168	0	20	0
Lane Group Flow (vph)	222	912	24	110	310	142	93	355	161	891	698	0
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	NA
Protected Phases	7	4	5	3	8	1	5	2		1	6	
Permitted Phases			4			8			2			
Actuated Green, G (s)	9.4	25.2	32.6	4.0	19.8	44.8	7.4	15.8	15.8	25.0	33.4	33.4
Effective Green, g (s)	9.4	25.2	32.6	4.0	19.8	44.8	7.4	15.8	15.8	25.0	33.4	33.4
Actuated g/C Ratio	0.11	0.29	0.38	0.05	0.23	0.52	0.09	0.18	0.18	0.29	0.39	0.39
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	375	1037	673	159	731	817	152	650	290	997	1337	1337
v/s Ratio Prot	c0.06	c0.26	0.00	0.03	0.10	0.05	0.05	0.10		c0.26	c0.20	c0.20
v/s Ratio Perm			0.01			0.05			0.10			
v/c Ratio	0.59	0.88	0.04	0.69	0.42	0.17	0.61	0.55	0.55	0.89	0.52	0.52
Uniform Delay, d1	36.5	29.0	16.8	40.4	28.2	10.8	37.9	31.8	31.9	29.2	20.2	20.2
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	2.5	8.7	0.0	12.2	0.4	0.1	7.1	0.9	2.3	10.3	0.4	0.4
Delay (s)	39.0	37.6	16.8	52.6	28.6	11.0	45.0	32.8	34.2	39.5	20.5	20.5
Level of Service	D	D	B	D	C	B	D	C	C	D	C	C
Approach Delay (s)		36.8			27.6			34.8			31.1	
Approach LOS		D			C			C			C	

Intersection Summary		
HCM 2000 Control Delay	32.7	HCM 2000 Level of Service C
HCM 2000 Volume to Capacity ratio	0.82	
Actuated Cycle Length (s)	86.0	Sum of lost time (s) 16.0
Intersection Capacity Utilization	75.3%	ICU Level of Service D
Analysis Period (min)	15	

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
19: Fallon Rd & Dublin Blvd

BART to Livermore Extension Project
2025 BART PM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 	  	 	  	  		 	  	 	 	  	
Traffic Volume (vph)	201	444	394	47	17	54	193	635	134	89	606	27
Future Volume (vph)	201	444	394	47	17	54	193	635	134	89	606	27
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.3	5.3	5.3	4.0	4.0	4.0	5.3	4.9	4.9	5.3	4.9	4.9
Lane Util. Factor	0.97	0.91	0.88	0.94	0.91	1.00	0.97	0.91	0.88	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3090	4577	2508	4491	4577	1425	3090	4577	2508	3090	4577	1425
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3090	4577	2508	4491	4577	1425	3090	4577	2508	3090	4577	1425
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	218	483	428	51	18	59	210	690	146	97	659	29
RTOR Reduction (vph)	0	0	136	0	0	56	0	0	94	0	0	20
Lane Group Flow (vph)	218	483	292	51	18	3	210	690	52	97	659	9
Turn Type	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	5	2	3	1	6		3	8		7	4	
Permitted Phases			2			6			8			4
Actuated Green, G (s)	15.7	16.4	25.9	3.0	3.7	3.7	9.5	24.5	24.5	5.5	20.5	20.5
Effective Green, g (s)	15.7	16.4	25.9	3.0	3.7	3.7	9.5	24.5	24.5	5.5	20.5	20.5
Actuated g/C Ratio	0.23	0.24	0.38	0.04	0.05	0.05	0.14	0.36	0.36	0.08	0.30	0.30
Clearance Time (s)	5.3	5.3	5.3	4.0	4.0	4.0	5.3	4.9	4.9	5.3	4.9	4.9
Vehicle Extension (s)	2.0	4.0	2.0	2.0	2.0	2.0	2.0	4.0	4.0	2.0	4.0	4.0
Lane Grp Cap (vph)	704	1089	942	195	245	76	426	1627	891	246	1361	423
v/s Ratio Prot	c0.07	c0.11	0.04	0.01	0.00		c0.07	c0.15		0.03	c0.14	
v/s Ratio Perm			0.07			0.00			0.02			0.01
v/c Ratio	0.31	0.44	0.31	0.26	0.07	0.04	0.49	0.42	0.06	0.39	0.48	0.02
Uniform Delay, d1	22.1	22.4	15.2	31.9	31.0	30.9	27.5	16.8	14.6	30.1	19.9	17.1
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.1	0.4	0.1	0.3	0.0	0.1	0.3	0.2	0.0	0.4	0.4	0.0
Delay (s)	22.2	22.8	15.3	32.1	31.0	31.0	27.8	17.1	14.6	30.5	20.2	17.1
Level of Service	C	C	B	C	C	C	C	B	B	C	C	B
Approach Delay (s)		19.8			31.5			18.9			21.4	
Approach LOS		B			C			B			C	
Intersection Summary												
HCM 2000 Control Delay			20.4			HCM 2000 Level of Service			C			
HCM 2000 Volume to Capacity ratio			0.47									
Actuated Cycle Length (s)			68.9	Sum of lost time (s)					19.5			
Intersection Capacity Utilization			45.9%	ICU Level of Service			A					
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis
20: El Charro Rd/Fallon Rd & I-580 WB Ramps

BART to Livermore Extension Project
2025 BART PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↙	↖	↗		↑	↘		↕	↙
Traffic Volume (vph)	0	0	0	270	0	443	0	643	245	0	856	373
Future Volume (vph)	0	0	0	270	0	443	0	643	245	0	856	373
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0	4.0	4.0		4.0	4.0		4.0	4.0
Lane Util. Factor				0.95	0.95	0.88		0.95	0.95		0.95	1.00
Frt				1.00	1.00	0.85		0.99	0.85		1.00	0.85
Flt Protected				0.95	0.95	1.00		1.00	1.00		1.00	1.00
Satd. Flow (prot)				1681	1681	2787		1760	1504		3539	1583
Flt Permitted				0.95	0.95	1.00		1.00	1.00		1.00	1.00
Satd. Flow (perm)				1681	1681	2787		1760	1504		3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	293	0	482	0	699	266	0	930	405
RTOR Reduction (vph)	0	0	0	0	0	369	0	2	80	0	0	135
Lane Group Flow (vph)	0	0	0	149	144	113	0	724	159	0	930	270
Turn Type				Perm	NA	Perm		NA	Perm		NA	Perm
Protected Phases					8			2			6	
Permitted Phases				8		8			2			6
Actuated Green, G (s)				10.9	10.9	10.9		36.6	36.6		36.6	36.6
Effective Green, g (s)				10.4	10.4	10.4		36.6	36.6		36.6	36.6
Actuated g/C Ratio				0.19	0.19	0.19		0.67	0.67		0.67	0.67
Clearance Time (s)				3.5	3.5	3.5		4.0	4.0		4.0	4.0
Vehicle Extension (s)				2.0	2.0	2.0		2.0	2.0		2.0	2.0
Lane Grp Cap (vph)				317	317	526		1171	1000		2355	1053
v/s Ratio Prot								c0.41			0.26	
v/s Ratio Perm				c0.09	0.09	0.04			0.11			0.17
v/c Ratio				0.47	0.45	0.21		0.62	0.16		0.39	0.26
Uniform Delay, d1				19.8	19.8	18.8		5.2	3.4		4.2	3.7
Progression Factor				1.00	1.00	1.00		1.04	2.38		1.00	1.00
Incremental Delay, d2				0.4	0.4	0.1		2.3	0.3		0.5	0.6
Delay (s)				20.2	20.2	18.9		7.7	8.5		4.7	4.3
Level of Service				C	C	B		A	A		A	A
Approach Delay (s)		0.0			19.4			7.9			4.6	
Approach LOS		A			B			A			A	

Intersection Summary

HCM 2000 Control Delay	9.3	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.58		
Actuated Cycle Length (s)	55.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	61.0%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 21: El Charro Rd & I-580 EB Ramps

BART to Livermore Extension Project
 2025 BART PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↗↘		↗↘					↕↔	↗		↕↔	↗
Traffic Volume (vph)	321	0	357	0	0	0	0	897	281	0	847	0
Future Volume (vph)	321	0	357	0	0	0	0	897	281	0	847	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0					4.0	4.0		4.0	
Lane Util. Factor	0.97		0.88					0.91	0.91		0.91	
Frt	1.00		0.85					0.99	0.85		1.00	
Flt Protected	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (prot)	3433		2787					3372	1441		3390	
Flt Permitted	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (perm)	3433		2787					3372	1441		3390	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	349	0	388	0	0	0	0	975	305	0	921	0
RTOR Reduction (vph)	0	0	195	0	0	0	0	4	87	0	0	0
Lane Group Flow (vph)	349	0	193	0	0	0	0	1008	181	0	921	0
Turn Type	Prot		Perm					NA	Perm		NA	Perm
Protected Phases	4							2			6	
Permitted Phases			4						2			6
Actuated Green, G (s)	9.9		9.9					37.1	37.1		37.1	
Effective Green, g (s)	9.9		9.9					37.1	37.1		37.1	
Actuated g/C Ratio	0.18		0.18					0.67	0.67		0.67	
Clearance Time (s)	4.0		4.0					4.0	4.0		4.0	
Vehicle Extension (s)	2.0		2.0					3.0	3.0		3.0	
Lane Grp Cap (vph)	617		501					2274	972		2286	
v/s Ratio Prot	c0.10							c0.30			0.27	
v/s Ratio Perm			0.07						0.13			
v/c Ratio	0.57		0.38					0.44	0.19		0.40	
Uniform Delay, d1	20.6		19.9					4.2	3.3		4.0	
Progression Factor	1.00		1.00					1.00	1.00		0.73	
Incremental Delay, d2	0.7		0.2					0.6	0.4		0.5	
Delay (s)	21.3		20.0					4.8	3.8		3.4	
Level of Service	C		C					A	A		A	
Approach Delay (s)		20.6			0.0			4.6			3.4	
Approach LOS		C			A			A			A	

Intersection Summary

HCM 2000 Control Delay	8.2	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.47		
Actuated Cycle Length (s)	55.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	43.6%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 22: El Charro Rd & Stoneridge Dr/Jack London Blvd

BART to Livermore Extension Project
 2025 BART PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔↔↔	↑↑	↗	↖	↑↑	↗↗	↖	↑↑		↖↖↖	↑	↗↗
Traffic Volume (vph)	258	534	3	3	307	477	2	34	3	745	26	138
Future Volume (vph)	258	534	3	3	307	477	2	34	3	745	26	138
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	0.94	0.95	1.00	1.00	0.95	0.88	1.00	0.95		0.94	1.00	0.88
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	4491	3185	1425	1593	3185	2508	1593	3149		4491	1676	2508
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	4491	3185	1425	1593	3185	2508	1593	3149		4491	1676	2508
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	280	580	3	3	334	518	2	37	3	810	28	150
RTOR Reduction (vph)	0	0	2	0	0	239	0	3	0	0	0	91
Lane Group Flow (vph)	280	580	1	3	334	279	2	37	0	810	28	59
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Prot	NA		Prot	NA	Perm
Protected Phases	7	4		3	8	1	5	2		1	6	
Permitted Phases			4			8						6
Actuated Green, G (s)	8.5	23.1	23.1	0.7	15.3	36.0	0.7	6.3		20.7	26.3	26.3
Effective Green, g (s)	8.5	23.1	23.1	0.7	15.3	36.0	0.7	6.3		20.7	26.3	26.3
Actuated g/C Ratio	0.13	0.35	0.35	0.01	0.23	0.54	0.01	0.09		0.31	0.39	0.39
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	571	1101	492	16	729	1351	16	296		1391	659	987
v/s Ratio Prot	0.06	c0.18		0.00	c0.10	0.06	0.00	c0.01		c0.18	0.02	
v/s Ratio Perm			0.00			0.05						0.02
v/c Ratio	0.49	0.53	0.00	0.19	0.46	0.21	0.12	0.13		0.58	0.04	0.06
Uniform Delay, d1	27.1	17.5	14.3	32.8	22.2	8.0	32.7	27.7		19.4	12.5	12.6
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	0.7	0.5	0.0	5.6	0.5	0.1	3.5	0.2		0.6	0.0	0.0
Delay (s)	27.8	17.9	14.3	38.4	22.6	8.1	36.3	27.9		20.0	12.5	12.6
Level of Service	C	B	B	D	C	A	D	C		C	B	B
Approach Delay (s)		21.1			13.9			28.3			18.7	
Approach LOS		C			B			C			B	

Intersection Summary		
HCM 2000 Control Delay	18.1	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.52	B
Actuated Cycle Length (s)	66.8	Sum of lost time (s)
Intersection Capacity Utilization	52.1%	16.0
Analysis Period (min)	15	ICU Level of Service
		A

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
24: Airway Blvd/Driveway & N Canyons Pkwy



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑	↗	↘↗	↑	↗		↖	↗↖		↕	
Traffic Volume (vph)	0	344	276	837	63	0	58	0	741	0	0	0
Future Volume (vph)	0	344	276	837	63	0	58	0	741	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0	4.0	4.0			4.4	4.0			
Lane Util. Factor		0.95	1.00	0.97	1.00			1.00	0.88			
Frt		1.00	0.85	1.00	1.00			1.00	0.85			
Flt Protected		1.00	1.00	0.95	1.00			0.95	1.00			
Satd. Flow (prot)		3539	1583	3433	1863			1770	2787			
Flt Permitted		1.00	1.00	0.95	1.00			0.95	1.00			
Satd. Flow (perm)		3539	1583	3433	1863			1770	2787			
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	374	300	910	68	0	63	0	805	0	0	0
RTOR Reduction (vph)	0	0	220	0	0	0	0	0	362	0	0	0
Lane Group Flow (vph)	0	374	80	910	68	0	0	63	443	0	0	0
Turn Type		NA	Perm	Prot	NA	Perm	Split	NA	pm+ov			
Protected Phases		2		1	6		8	8	1	4	4	
Permitted Phases			2			6			8			
Actuated Green, G (s)		13.1	13.1	23.0	42.1			4.0	27.0			
Effective Green, g (s)		15.1	15.1	25.0	44.1			3.8	31.0			
Actuated g/C Ratio		0.27	0.27	0.44	0.78			0.07	0.55			
Clearance Time (s)		6.0	6.0	6.0	6.0			4.2	6.0			
Vehicle Extension (s)		3.0	3.0	3.0	3.0			3.0	3.0			
Lane Grp Cap (vph)		949	424	1524	1459			119	1732			
v/s Ratio Prot		c0.11		c0.27	0.04			0.04	c0.11			
v/s Ratio Perm			0.05						0.05			
v/c Ratio		0.39	0.19	0.60	0.05			0.53	0.26			
Uniform Delay, d1		16.9	15.9	11.8	1.4			25.4	6.6			
Progression Factor		1.00	1.00	1.00	1.00			1.00	1.00			
Incremental Delay, d2		0.3	0.2	0.6	0.0			4.2	0.1			
Delay (s)		17.1	16.1	12.5	1.4			29.6	6.7			
Level of Service		B	B	B	A			C	A			
Approach Delay (s)		16.7			11.7			8.4			0.0	
Approach LOS		B			B			A			A	

Intersection Summary

HCM 2000 Control Delay	11.9	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.58		
Actuated Cycle Length (s)	56.3	Sum of lost time (s)	16.4
Intersection Capacity Utilization	47.6%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
25: Airway Blvd & I-580 WB Ramps

BART to Livermore Extension Project
2025 BART PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↙	↖	↗		↑↑	↗		↑↑↑	
Traffic Volume (vph)	0	0	0	72	28	144	0	696	393	0	567	640
Future Volume (vph)	0	0	0	72	28	144	0	696	393	0	567	640
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0	4.0	4.0		4.0	4.0		4.0	
Lane Util. Factor				0.95	0.95	0.88		0.95	1.00		0.91	
Frt				1.00	1.00	0.85		1.00	0.85		0.92	
Flt Protected				0.95	0.97	1.00		1.00	1.00		1.00	
Satd. Flow (prot)				1681	1722	2787		3539	1583		4681	
Flt Permitted				0.95	0.97	1.00		1.00	1.00		1.00	
Satd. Flow (perm)				1681	1722	2787		3539	1583		4681	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	78	30	157	0	757	427	0	616	696
RTOR Reduction (vph)	0	0	0	0	0	142	0	0	83	0	135	0
Lane Group Flow (vph)	0	0	0	41	67	15	0	757	344	0	1177	0
Turn Type				Split	NA	Perm		NA	Perm		NA	
Protected Phases				8	8			2			6	
Permitted Phases						8			2			
Actuated Green, G (s)				7.5	7.5	7.5		63.2	63.2		63.2	
Effective Green, g (s)				7.5	7.5	7.5		64.5	64.5		64.5	
Actuated g/C Ratio				0.09	0.09	0.09		0.81	0.81		0.81	
Clearance Time (s)				4.0	4.0	4.0		5.3	5.3		5.3	
Vehicle Extension (s)				2.0	2.0	2.0		4.0	4.0		4.0	
Lane Grp Cap (vph)				157	161	261		2853	1276		3774	
v/s Ratio Prot				0.02	c0.04			0.21			c0.25	
v/s Ratio Perm						0.01			0.22			
v/c Ratio				0.26	0.42	0.06		0.27	0.27		0.31	
Uniform Delay, d1				33.7	34.2	33.0		1.9	1.9		2.0	
Progression Factor				1.00	1.00	1.00		0.50	1.01		1.00	
Incremental Delay, d2				0.3	0.6	0.0		0.2	0.5		0.2	
Delay (s)				34.0	34.8	33.1		1.2	2.4		2.2	
Level of Service				C	C	C		A	A		A	
Approach Delay (s)		0.0			33.7			1.6			2.2	
Approach LOS		A			C			A			A	

Intersection Summary

HCM 2000 Control Delay	5.0	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.32		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	35.3%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 26: Airway Blvd & I-580 EB Ramps/Kitty Hawk Rd



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↑	↖	↖	↑	↖	↖	↕↔		↖	↕↔	
Traffic Volume (vph)	570	209	324	60	99	124	54	444	171	86	223	308
Future Volume (vph)	570	209	324	60	99	124	54	444	171	86	223	308
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.4	4.4	4.4	4.0	4.0		4.0	4.0	
Lane Util. Factor	0.97	1.00	1.00	1.00	1.00	1.00	1.00	0.95		1.00	0.95	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.96		1.00	0.91	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	3433	1863	1583	1770	1863	1583	1770	3392		1770	3231	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	3433	1863	1583	1770	1863	1583	1770	3392		1770	3231	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	620	227	352	65	108	135	59	483	186	93	242	335
RTOR Reduction (vph)	0	0	249	0	0	108	0	61	0	0	228	0
Lane Group Flow (vph)	620	227	103	65	108	27	59	608	0	93	349	0
Turn Type	Split	NA	Perm	Split	NA	pm+ov	Prot	NA		Prot	NA	
Protected Phases	7	7		8	8	1	5	2		1	6	
Permitted Phases			7			8						
Actuated Green, G (s)	23.3	23.3	23.3	11.2	11.2	16.6	4.4	22.8		5.4	24.3	
Effective Green, g (s)	23.3	23.3	23.3	10.8	10.8	15.8	3.9	24.1		5.4	25.6	
Actuated g/C Ratio	0.29	0.29	0.29	0.14	0.14	0.20	0.05	0.30		0.07	0.32	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	3.5	5.3		4.0	5.3	
Vehicle Extension (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	3.5		2.0	4.0	
Lane Grp Cap (vph)	999	542	461	238	251	312	86	1021		119	1033	
v/s Ratio Prot	c0.18	0.12		0.04	c0.06	0.01	0.03	c0.18		c0.05	0.11	
v/s Ratio Perm			0.06			0.01						
v/c Ratio	0.62	0.42	0.22	0.27	0.43	0.09	0.69	0.60		0.78	0.34	
Uniform Delay, d1	24.5	22.9	21.5	31.1	31.8	26.2	37.4	23.8		36.7	20.7	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.02	0.80	
Incremental Delay, d2	0.9	0.2	0.1	0.2	0.4	0.0	16.5	2.6		25.0	0.9	
Delay (s)	25.4	23.1	21.6	31.3	32.2	26.2	54.0	26.3		62.5	17.4	
Level of Service	C	C	C	C	C	C	D	C		E	B	
Approach Delay (s)		23.8			29.4			28.6			23.6	
Approach LOS		C			C			C			C	

Intersection Summary

HCM 2000 Control Delay	25.6	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.60		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	16.8
Intersection Capacity Utilization	64.1%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 27: Collier Canyon Rd & N Canyons Pkwy/Portola Ave

BART to Livermore Extension Project
 2025 BART PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔↔	↑↑	↔	↔	↑↑	↔	↔	↔		↔	↑	↔
Traffic Volume (vph)	301	530	139	87	243	27	53	9	294	122	15	103
Future Volume (vph)	301	530	139	87	243	27	53	9	294	122	15	103
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	5.2	5.2
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.85		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	1770	1592		1770	1863	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	1770	1592		1770	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	327	576	151	95	264	29	58	10	320	133	16	112
RTOR Reduction (vph)	0	0	104	0	0	22	0	246	0	0	0	79
Lane Group Flow (vph)	327	576	47	95	264	7	58	84	0	133	16	33
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA		Prot	NA	Perm
Protected Phases	1	6		5	2		3	8		7	4	
Permitted Phases			6			2						4
Actuated Green, G (s)	11.3	21.5	21.5	7.4	17.6	17.6	4.3	16.0		10.0	22.1	22.1
Effective Green, g (s)	11.3	22.8	22.8	7.4	18.9	18.9	4.3	17.0		10.0	21.5	21.5
Actuated g/C Ratio	0.15	0.31	0.31	0.10	0.26	0.26	0.06	0.23		0.14	0.29	0.29
Clearance Time (s)	4.0	5.3	5.3	4.0	5.3	5.3	4.0	5.0		4.0	4.6	4.6
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	529	1102	493	178	913	408	103	369		241	547	464
v/s Ratio Prot	c0.10	c0.16		0.05	0.07		0.03	c0.05		c0.08	0.01	
v/s Ratio Perm			0.03			0.00						0.02
v/c Ratio	0.62	0.52	0.10	0.53	0.29	0.02	0.56	0.23		0.55	0.03	0.07
Uniform Delay, d1	28.9	20.7	17.9	31.3	21.8	20.2	33.5	22.8		29.5	18.4	18.6
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	2.2	0.4	0.1	3.1	0.2	0.0	6.9	0.3		2.7	0.0	0.1
Delay (s)	31.1	21.2	18.0	34.3	21.9	20.3	40.4	23.1		32.2	18.4	18.7
Level of Service	C	C	B	C	C	C	D	C		C	B	B
Approach Delay (s)		23.8			24.8			25.7			25.6	
Approach LOS		C			C			C			C	

Intersection Summary

HCM 2000 Control Delay	24.6	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.48		
Actuated Cycle Length (s)	73.2	Sum of lost time (s)	17.2
Intersection Capacity Utilization	58.2%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
28: Isabel Ave/Campus Hill Dr & Portola Ave

BART to Livermore Extension Project
2025 BART PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↘	↑↑	↗↗	↘↘↘	↑↑		↘↘	↑↑	↗	↘	↑↑	↗
Traffic Volume (vph)	3	492	472	291	192	115	216	328	76	115	295	2
Future Volume (vph)	3	492	472	291	192	115	216	328	76	115	295	2
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	5.8	5.8
Lane Util. Factor	1.00	0.95	0.88	0.94	0.95		0.97	0.95	1.00	1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	0.94		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3539	2787	4990	3341		3433	3539	1583	1770	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	3539	2787	4990	3341		3433	3539	1583	1770	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	3	535	513	316	209	125	235	357	83	125	321	2
RTOR Reduction (vph)	0	0	344	0	65	0	0	0	66	0	0	2
Lane Group Flow (vph)	3	535	169	316	269	0	235	357	17	125	321	0
Turn Type	Prot	NA	Perm	Prot	NA		Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4						2			6
Actuated Green, G (s)	1.3	23.8	23.8	9.3	31.8		9.3	14.1	14.1	10.6	15.8	15.8
Effective Green, g (s)	1.3	25.1	25.1	9.3	33.1		9.3	15.4	15.4	10.6	14.9	14.9
Actuated g/C Ratio	0.02	0.33	0.33	0.12	0.43		0.12	0.20	0.20	0.14	0.20	0.20
Clearance Time (s)	4.0	5.3	5.3	4.0	5.3		4.0	5.3	5.3	4.0	4.9	4.9
Vehicle Extension (s)	2.0	3.0	3.0	2.0	3.0		2.0	3.0	3.0	2.0	3.0	3.0
Lane Grp Cap (vph)	30	1162	915	607	1447		417	713	319	245	690	308
v/s Ratio Prot	0.00	c0.15		c0.06	0.08		0.07	c0.10		c0.07	0.09	
v/s Ratio Perm			0.06						0.01			0.00
v/c Ratio	0.10	0.46	0.18	0.52	0.19		0.56	0.50	0.05	0.51	0.47	0.00
Uniform Delay, d1	37.0	20.3	18.3	31.5	13.3		31.6	27.1	24.6	30.5	27.2	24.8
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.5	0.3	0.1	0.4	0.1		1.0	0.6	0.1	0.7	0.5	0.0
Delay (s)	37.5	20.6	18.4	31.8	13.4		32.7	27.6	24.7	31.2	27.7	24.8
Level of Service	D	C	B	C	B		C	C	C	C	C	C
Approach Delay (s)		19.6			22.4			29.0			28.7	
Approach LOS		B			C			C			C	

Intersection Summary		
HCM 2000 Control Delay	23.9	HCM 2000 Level of Service C
HCM 2000 Volume to Capacity ratio	0.50	
Actuated Cycle Length (s)	76.4	Sum of lost time (s) 17.8
Intersection Capacity Utilization	53.4%	ICU Level of Service A
Analysis Period (min)	15	

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 29: Isabel Ave & I-580 WB Ramps

BART to Livermore Extension Project
 2025 BART PM

























Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↖↗		↖		↕↕	↖↗		↕↕	↖
Traffic Volume (vph)	0	0	0	680	0	248	0	364	0	0	599	452
Future Volume (vph)	0	0	0	680	0	248	0	364	0	0	599	452
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0		4.0		5.6			5.6	5.6
Lane Util. Factor				0.97		1.00		0.95			0.95	1.00
Frt				1.00		0.85		1.00			1.00	0.85
Flt Protected				0.95		1.00		1.00			1.00	1.00
Satd. Flow (prot)				3433		1583		3539			3539	1583
Flt Permitted				0.95		1.00		1.00			1.00	1.00
Satd. Flow (perm)				3433		1583		3539			3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	739	0	270	0	396	0	0	651	491
RTOR Reduction (vph)	0	0	0	0	0	193	0	0	0	0	0	258
Lane Group Flow (vph)	0	0	0	739	0	77	0	396	0	0	651	233
Turn Type				Prot		Prot		NA	Free		NA	Prot
Protected Phases				8		8		2			6	6
Permitted Phases									Free			
Actuated Green, G (s)				11.4		11.4		19.8			19.8	19.8
Effective Green, g (s)				11.4		11.4		19.0			19.0	19.0
Actuated g/C Ratio				0.29		0.29		0.48			0.48	0.48
Clearance Time (s)				4.0		4.0		4.8			4.8	4.8
Vehicle Extension (s)				2.0		2.0		4.0			4.0	4.0
Lane Grp Cap (vph)				978		451		1681			1681	751
v/s Ratio Prot				c0.22		0.05		0.11			c0.18	0.15
v/s Ratio Perm												
v/c Ratio				0.76		0.17		0.24			0.39	0.31
Uniform Delay, d1				13.0		10.7		6.2			6.8	6.5
Progression Factor				1.00		1.00		0.99			1.00	1.00
Incremental Delay, d2				3.0		0.1		0.3			0.2	0.3
Delay (s)				16.0		10.8		6.5			7.0	6.8
Level of Service				B		B		A			A	A
Approach Delay (s)		0.0			14.6			6.5			6.9	
Approach LOS		A			B			A			A	

Intersection Summary			
HCM 2000 Control Delay	9.9	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.53		
Actuated Cycle Length (s)	40.0	Sum of lost time (s)	9.6
Intersection Capacity Utilization	44.0%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 30: Isabel Ave & I-580 EB Ramps

BART to Livermore Extension Project
 2025 BART PM

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations	 		 					 			 		
Traffic Volume (vph)	175	0	363	0	0	0	0	704	1302	0	879	621	
Future Volume (vph)	175	0	363	0	0	0	0	704	1302	0	879	621	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)	4.0		4.0					4.0	4.0		4.0	4.0	
Lane Util. Factor	0.97		0.88					0.95	1.00		0.95	1.00	
Frt	1.00		0.85					1.00	0.85		1.00	0.85	
Flt Protected	0.95		1.00					1.00	1.00		1.00	1.00	
Satd. Flow (prot)	3433		2787					3539	1583		3539	1583	
Flt Permitted	0.95		1.00					1.00	1.00		1.00	1.00	
Satd. Flow (perm)	3433		2787					3539	1583		3539	1583	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	
Adj. Flow (vph)	190	0	395	0	0	0	0	765	1415	0	955	675	
RTOR Reduction (vph)	0	0	216	0	0	0	0	0	0	0	0	0	
Lane Group Flow (vph)	190	0	179	0	0	0	0	765	1415	0	955	675	
Turn Type	Prot		Perm					NA	Free		NA	Free	
Protected Phases	4							2			6		
Permitted Phases			4						Free			Free	
Actuated Green, G (s)	9.7		9.7					61.3	80.0		61.3	80.0	
Effective Green, g (s)	9.7		9.7					62.3	80.0		62.3	80.0	
Actuated g/C Ratio	0.12		0.12					0.78	1.00		0.78	1.00	
Clearance Time (s)	4.0		4.0					5.0			5.0		
Vehicle Extension (s)	2.0		2.0					4.0			4.0		
Lane Grp Cap (vph)	416		337					2755	1583		2755	1583	
v/s Ratio Prot	0.06							0.22			0.27		
v/s Ratio Perm			0.06						c0.89			0.43	
v/c Ratio	0.46		0.53					0.28	0.89		0.35	0.43	
Uniform Delay, d1	32.7		33.0					2.5	0.0		2.7	0.0	
Progression Factor	1.00		1.00					1.00	1.00		0.66	1.00	
Incremental Delay, d2	0.3		0.8					0.1	8.2		0.3	0.8	
Delay (s)	33.0		33.8					2.6	8.2		2.1	0.8	
Level of Service	C		C					A	A		A	A	
Approach Delay (s)		33.5			0.0			6.2			1.5		
Approach LOS		C			A			A			A		
Intersection Summary													
HCM 2000 Control Delay			8.1									HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio			0.99										
Actuated Cycle Length (s)			80.0									Sum of lost time (s)	8.0
Intersection Capacity Utilization			43.7%									ICU Level of Service	A
Analysis Period (min)			15										

c Critical Lane Group





































Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	8	110	532	206	158	847	395	1168	163	366	1352	16
Future Volume (vph)	8	110	532	206	158	847	395	1168	163	366	1352	16
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.2	5.2	5.6	5.2	5.2	5.6	4.0	4.0	4.0	4.0	4.0	5.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.91	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	1863	1583	1770	1863	1583	1770	5085	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	1863	1583	1770	1863	1583	1770	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	9	120	578	224	172	921	429	1270	177	398	1470	17
RTOR Reduction (vph)	0	0	68	0	0	47	0	0	115	0	0	11
Lane Group Flow (vph)	9	120	510	224	172	874	429	1270	62	398	1470	6
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4	5	3	8	1	5	2		1	NA	6
Permitted Phases			4			8			2			6
Actuated Green, G (s)	0.8	14.8	31.8	10.4	24.4	41.4	17.0	31.4	31.4	17.0	31.4	31.4
Effective Green, g (s)	0.2	14.2	30.6	9.8	23.8	40.2	18.0	32.4	32.4	18.0	32.4	31.4
Actuated g/C Ratio	0.00	0.15	0.33	0.11	0.26	0.43	0.19	0.35	0.35	0.19	0.35	0.34
Clearance Time (s)	4.6	4.6	5.0	4.6	4.6	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	5.0	5.0	3.0	5.0	5.0
Lane Grp Cap (vph)	3	285	521	186	477	685	343	1775	552	665	1775	535
v/s Ratio Prot	0.01	0.06	0.17	c0.13	0.09	c0.23	c0.24	0.25		0.12	c0.29	
v/s Ratio Perm			0.15			0.33			0.04			0.00
v/c Ratio	3.00	0.42	0.98	1.20	0.36	1.28	1.25	0.72	0.11	0.60	0.83	0.01
Uniform Delay, d1	46.3	35.6	30.8	41.5	28.3	26.3	37.4	26.2	20.5	34.1	27.7	20.4
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1456.2	1.0	33.5	131.7	0.5	135.3	134.7	1.7	0.2	1.5	3.7	0.0
Delay (s)	1502.5	36.6	64.2	173.2	28.7	161.6	172.1	27.9	20.6	35.6	31.4	20.4
Level of Service	F	D	E	F	C	F	F	C	C	D	C	C
Approach Delay (s)		77.8			146.2			60.2			32.2	
Approach LOS		E			F			E			C	

Intersection Summary

HCM 2000 Control Delay	72.8	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.14		
Actuated Cycle Length (s)	92.8	Sum of lost time (s)	20.0
Intersection Capacity Utilization	90.7%	ICU Level of Service	E
Analysis Period (min)	15		

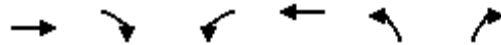
c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
32: Isabel Ave & Jack London Blvd

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 	 			 		 	  		  	  	
Traffic Volume (vph)	122	701	231	196	148	304	89	1109	357	524	1267	65
Future Volume (vph)	122	701	231	196	148	304	89	1109	357	524	1267	65
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.97	0.91	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	3433	5085	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	3433	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	133	762	251	213	161	330	97	1205	388	570	1377	71
RTOR Reduction (vph)	0	0	160	0	0	35	0	0	160	0	0	45
Lane Group Flow (vph)	133	762	91	213	161	295	97	1205	228	570	1377	26
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8	1	5	2		1	NA	6
Permitted Phases			4			8			2			6
Actuated Green, G (s)	8.5	29.4	29.4	15.4	36.3	57.2	7.1	29.5	29.5	20.9	43.3	43.3
Effective Green, g (s)	8.5	29.4	29.4	15.4	36.3	57.2	7.1	29.5	29.5	20.9	43.3	43.3
Actuated g/C Ratio	0.07	0.25	0.25	0.13	0.31	0.49	0.06	0.25	0.25	0.18	0.37	0.37
Clearance Time (s)	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	250	893	399	234	1103	849	209	1288	401	616	1891	588
v/s Ratio Prot	0.04	c0.22		c0.12	0.05	0.06	0.03	c0.24		c0.17	0.27	
v/s Ratio Perm			0.06			0.12			0.14			0.02
v/c Ratio	0.53	0.85	0.23	0.91	0.15	0.35	0.46	0.94	0.57	0.93	0.73	0.04
Uniform Delay, d1	52.0	41.4	34.5	49.8	28.9	18.2	52.8	42.5	37.9	47.0	31.5	23.3
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	2.2	8.0	0.3	35.5	0.1	0.2	1.6	12.6	1.9	19.8	1.4	0.0
Delay (s)	54.2	49.4	34.8	85.3	28.9	18.4	54.4	55.1	39.8	66.8	32.9	23.4
Level of Service	D	D	C	F	C	B	D	E	D	E	C	C
Approach Delay (s)		46.8			41.1			51.5			42.2	
Approach LOS		D			D			D			D	

Intersection Summary		
HCM 2000 Control Delay	45.8	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.90	D
Actuated Cycle Length (s)	116.4	Sum of lost time (s)
Intersection Capacity Utilization	84.3%	21.2
Analysis Period (min)	15	ICU Level of Service
		E

c Critical Lane Group



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑	↑	↑↑	↑↑	↑↑	↑↑
Traffic Volume (vph)	1684	441	217	545	156	376
Future Volume (vph)	1684	441	217	545	156	376
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	3.8	4.0	4.0	4.0	2.5
Lane Util. Factor	0.95	1.00	0.97	0.95	0.97	0.88
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	3539	1583	3433	3539	3433	2787
Flt Permitted	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (perm)	3539	1583	3433	3539	3433	2787
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	1830	479	236	592	170	409
RTOR Reduction (vph)	0	1	0	0	0	8
Lane Group Flow (vph)	1830	478	236	592	170	401
Turn Type	NA	pm+ov	Prot	NA	Prot	pm+ov
Protected Phases	2	8	1	6	8	1
Permitted Phases		2				8
Actuated Green, G (s)	43.8	52.4	6.0	53.8	8.6	14.6
Effective Green, g (s)	45.5	55.8	6.0	55.5	10.1	17.6
Actuated g/C Ratio	0.62	0.76	0.08	0.75	0.14	0.24
Clearance Time (s)	5.7	5.5	4.0	5.7	5.5	4.0
Vehicle Extension (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Grp Cap (vph)	2187	1200	279	2668	471	666
v/s Ratio Prot	c0.52	0.06	c0.07	0.17	0.05	c0.06
v/s Ratio Perm		0.25				0.08
v/c Ratio	0.84	0.40	0.85	0.22	0.36	0.60
Uniform Delay, d1	11.1	3.1	33.3	2.7	28.8	24.9
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	2.8	0.1	19.6	0.0	0.2	1.1
Delay (s)	13.9	3.2	53.0	2.7	29.0	26.0
Level of Service	B	A	D	A	C	C
Approach Delay (s)	11.7			17.0	26.8	
Approach LOS	B			B	C	

Intersection Summary

HCM 2000 Control Delay	15.2	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.80		
Actuated Cycle Length (s)	73.6	Sum of lost time (s)	12.0
Intersection Capacity Utilization	69.4%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 34: Murrieta Blvd/Driveway & Portola Ave



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗		↖	↗		↖	↗	↗		↗	
Traffic Volume (vph)	0	1686	145	211	845	1	136	5	341	6	5	0
Future Volume (vph)	0	1686	145	211	845	1	136	5	341	6	5	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.8		4.0	5.8		5.2	5.2	5.2		4.0	
Lane Util. Factor		0.95		1.00	0.95		0.95	0.95	1.00		1.00	
Frt		0.99		1.00	1.00		1.00	1.00	0.85		1.00	
Flt Protected		1.00		0.95	1.00		0.95	0.96	1.00		0.97	
Satd. Flow (prot)		3497		1770	3539		1681	1691	1583		1810	
Flt Permitted		1.00		0.95	1.00		0.95	0.96	1.00		0.97	
Satd. Flow (perm)		3497		1770	3539		1681	1691	1583		1810	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	1833	158	229	918	1	148	5	371	7	5	0
RTOR Reduction (vph)	0	4	0	0	0	0	0	0	166	0	0	0
Lane Group Flow (vph)	0	1987	0	229	919	0	77	76	205	0	12	0
Turn Type	Prot	NA		Prot	NA		Split	NA	Perm		Split	NA
Protected Phases	5	2		1	6		8	8		4	4	
Permitted Phases									8			
Actuated Green, G (s)		76.6		17.1	97.7		19.6	19.6	19.6		1.5	
Effective Green, g (s)		75.7		17.1	96.8		19.0	19.0	19.0		1.5	
Actuated g/C Ratio		0.57		0.13	0.73		0.14	0.14	0.14		0.01	
Clearance Time (s)		4.9		4.0	4.9		4.6	4.6	4.6		4.0	
Vehicle Extension (s)		2.0		2.0	2.0		2.0	2.0	2.0		2.0	
Lane Grp Cap (vph)		2000		228	2589		241	242	227		20	
v/s Ratio Prot		c0.57		c0.13	0.26		0.05	0.04			c0.01	
v/s Ratio Perm									c0.13			
v/c Ratio		0.99		1.00	0.35		0.32	0.31	0.90		0.60	
Uniform Delay, d1		28.1		57.6	6.4		50.8	50.8	55.7		65.1	
Progression Factor		1.00		1.00	1.00		1.00	1.00	1.00		1.00	
Incremental Delay, d2		18.4		60.7	0.0		0.3	0.3	33.9		28.2	
Delay (s)		46.5		118.3	6.5		51.1	51.1	89.7		93.3	
Level of Service		D		F	A		D	D	F		F	
Approach Delay (s)		46.5			28.8			78.4			93.3	
Approach LOS		D			C			E			F	

Intersection Summary			
HCM 2000 Control Delay	45.7	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.97		
Actuated Cycle Length (s)	132.3	Sum of lost time (s)	19.0
Intersection Capacity Utilization	88.2%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 35: Murrieta Blvd & Jack London Blvd



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	276	859	446	248	289	127
Future Volume (vph)	276	859	446	248	289	127
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00	1.00	0.95	0.91	
Frt	1.00	0.85	1.00	1.00	0.95	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1770	1583	1770	3539	4852	
Flt Permitted	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	1770	1583	1770	3539	4852	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	300	934	485	270	314	138
RTOR Reduction (vph)	0	478	0	0	105	0
Lane Group Flow (vph)	300	456	485	270	347	0
Turn Type	Prot	Perm	Prot	NA	NA	
Protected Phases	4		5	2	6	
Permitted Phases		4				
Actuated Green, G (s)	22.9	22.9	22.3	37.3	11.0	
Effective Green, g (s)	22.9	22.9	22.3	37.3	11.0	
Actuated g/C Ratio	0.34	0.34	0.33	0.55	0.16	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	594	531	578	1935	782	
v/s Ratio Prot	0.17		c0.27	0.08	c0.07	
v/s Ratio Perm		c0.29				
v/c Ratio	0.51	0.86	0.84	0.14	0.44	
Uniform Delay, d1	18.1	21.1	21.3	7.6	25.8	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.7	13.1	10.3	0.0	0.4	
Delay (s)	18.8	34.2	31.6	7.6	26.2	
Level of Service	B	C	C	A	C	
Approach Delay (s)	30.5			23.0	26.2	
Approach LOS	C			C	C	

Intersection Summary

HCM 2000 Control Delay	27.4	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.77		
Actuated Cycle Length (s)	68.2	Sum of lost time (s)	12.0
Intersection Capacity Utilization	68.3%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 36: Murrieta Blvd & Stanley Blvd

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	273	1061	488	41	530	159	226	379	18	255	335	183
Future Volume (vph)	273	1061	488	41	530	159	226	379	18	255	335	183
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.9	4.9	4.0	4.9	4.9	4.9	4.9		4.9	4.9	4.0
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.97	0.95		1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	3433	3515		1770	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	3433	3515		1770	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	297	1153	530	45	576	173	246	412	20	277	364	199
RTOR Reduction (vph)	0	0	312	0	0	69	0	4	0	0	0	151
Lane Group Flow (vph)	297	1153	218	45	576	104	246	428	0	277	364	48
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Prot	NA		Prot	NA	Perm
Protected Phases	7	4		3	8	1	5	2		1	NA	6
Permitted Phases			4			8						6
Actuated Green, G (s)	10.8	29.0	29.0	2.2	20.4	34.9	9.9	13.7		14.5	18.3	18.3
Effective Green, g (s)	10.8	28.1	28.1	2.2	19.5	33.1	9.0	12.8		13.6	17.4	18.3
Actuated g/C Ratio	0.14	0.37	0.37	0.03	0.26	0.44	0.12	0.17		0.18	0.23	0.24
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	491	1318	589	51	915	797	409	596		319	816	384
v/s Ratio Prot	c0.09	c0.33		0.03	0.16	0.02	0.07	c0.12		c0.16	c0.10	
v/s Ratio Perm			0.14			0.04						0.03
v/c Ratio	0.60	0.87	0.37	0.88	0.63	0.13	0.60	0.72		0.87	0.45	0.13
Uniform Delay, d1	30.3	22.0	17.2	36.5	24.8	12.6	31.5	29.6		30.0	24.9	22.3
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	2.1	6.7	0.4	83.2	1.4	0.1	2.5	4.1		21.3	0.4	0.1
Delay (s)	32.4	28.8	17.6	119.7	26.1	12.7	34.0	33.7		51.3	25.3	22.4
Level of Service	C	C	B	F	C	B	C	C		D	C	C
Approach Delay (s)		26.3			28.5			33.8			33.2	
Approach LOS		C			C			C			C	

Intersection Summary		
HCM 2000 Control Delay	29.2	HCM 2000 Level of Service C
HCM 2000 Volume to Capacity ratio	0.83	
Actuated Cycle Length (s)	75.4	Sum of lost time (s) 18.7
Intersection Capacity Utilization	73.4%	ICU Level of Service D
Analysis Period (min)	15	

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
37: Livermore Ave & I-580 WB Ramps



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↖	↔		↗	↑			↕	
Traffic Volume (vph)	0	0	0	365	18	21	684	456	0	0	112	0
Future Volume (vph)	0	0	0	365	18	21	684	456	0	0	112	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)					4.0		4.0	4.0			4.0	
Lane Util. Factor					0.95		0.97	1.00			0.95	
Frt					0.99		1.00	1.00			1.00	
Flt Protected					0.96		0.95	1.00			1.00	
Satd. Flow (prot)					1680		3433	1863			3539	
Flt Permitted					0.96		0.95	1.00			1.00	
Satd. Flow (perm)					1680		3433	1863			3539	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	397	20	23	743	496	0	0	122	0
RTOR Reduction (vph)	0	0	0	0	4	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	0	436	0	743	496	0	0	122	0
Turn Type				Split	NA		Prot	NA			NA	
Protected Phases				8	8		5	2			6	
Permitted Phases												
Actuated Green, G (s)					19.6		14.4	30.7			12.8	
Effective Green, g (s)					19.6		13.9	32.4			14.5	
Actuated g/C Ratio					0.33		0.23	0.54			0.24	
Clearance Time (s)					4.0		3.5	5.7			5.7	
Vehicle Extension (s)					2.0		2.0	2.5			2.5	
Lane Grp Cap (vph)					548		795	1006			855	
v/s Ratio Prot					c0.26		c0.22	c0.27			0.03	
v/s Ratio Perm												
v/c Ratio					0.80		0.93	0.49			0.14	
Uniform Delay, d1					18.4		22.6	8.7			17.9	
Progression Factor					1.00		0.48	0.29			1.00	
Incremental Delay, d2					7.3		2.4	0.2			0.4	
Delay (s)					25.7		13.1	2.7			18.2	
Level of Service					C		B	A			B	
Approach Delay (s)		0.0			25.7			9.0			18.2	
Approach LOS		A			C			A			B	

Intersection Summary

HCM 2000 Control Delay	13.7	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.76		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	98.7%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
38: Livermore Ave & I-580 EB Ramps



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕	↗					↕		↘	↕	
Traffic Volume (vph)	212	19	1313	0	0	0	0	965	509	109	368	0
Future Volume (vph)	212	19	1313	0	0	0	0	965	509	109	368	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0					4.0		4.0	4.0	
Lane Util. Factor		0.95	0.95					0.95		1.00	0.95	
Frt		0.89	0.85					0.95		1.00	1.00	
Flt Protected		0.99	1.00					1.00		0.95	1.00	
Satd. Flow (prot)		1555	1504					3356		1770	3539	
Flt Permitted		0.99	1.00					1.00		0.95	1.00	
Satd. Flow (perm)		1555	1504					3356		1770	3539	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	230	21	1427	0	0	0	0	1049	553	118	400	0
RTOR Reduction (vph)	0	167	277	0	0	0	0	110	0	0	0	0
Lane Group Flow (vph)	0	783	451	0	0	0	0	1492	0	118	400	0
Turn Type	Prot	NA	Perm					NA		Prot	NA	
Protected Phases	7	4						2		1	6	
Permitted Phases			4									
Actuated Green, G (s)		20.0	20.0					22.4		5.6	31.0	
Effective Green, g (s)		20.0	20.0					23.4		4.6	32.0	
Actuated g/C Ratio		0.33	0.33					0.39		0.08	0.53	
Clearance Time (s)		4.0	4.0					5.0		3.0	5.0	
Vehicle Extension (s)		2.0	2.0					2.5		2.0	2.5	
Lane Grp Cap (vph)		518	501					1308		135	1887	
v/s Ratio Prot								c0.44		c0.07	0.11	
v/s Ratio Perm		0.50	0.30									
v/c Ratio		1.51	0.90					1.14		0.87	0.21	
Uniform Delay, d1		20.0	19.1					18.3		27.4	7.4	
Progression Factor		1.00	1.00					1.00		0.85	0.26	
Incremental Delay, d2		239.8	18.8					72.9		37.3	0.2	
Delay (s)		259.8	37.9					91.2		60.6	2.1	
Level of Service		F	D					F		E	A	
Approach Delay (s)		163.5			0.0			91.2			15.4	
Approach LOS		F			A			F			B	





























Intersection Summary

HCM 2000 Control Delay	112.8	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.27		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	98.7%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 39: Livermore Ave & Portola Ave

BART to Livermore Extension Project
 2025 BART PM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 	 			 			 			 	
Traffic Volume (vph)	929	746	180	14	357	70	199	593	77	240	855	559
Future Volume (vph)	929	746	180	14	357	70	199	593	77	240	855	559
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	5.3	4.0	4.0	5.3	4.0	5.8		4.0	5.8	4.9
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	1.00	0.95		1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.98		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	1770	3478		1770	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	1770	3478		1770	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	1010	811	196	15	388	76	216	645	84	261	929	608
RTOR Reduction (vph)	0	0	109	0	0	64	0	7	0	0	0	51
Lane Group Flow (vph)	1010	811	87	15	388	12	216	722	0	261	929	557
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA		Prot	NA	pm+ov
Protected Phases	3	8		7	4		1	6		5	2	3
Permitted Phases			8			4						2
Actuated Green, G (s)	39.5	57.0	57.0	1.9	19.4	19.4	15.0	32.8		18.0	35.8	75.3
Effective Green, g (s)	39.5	58.3	57.0	1.9	20.7	19.4	15.0	31.9		18.0	34.9	73.5
Actuated g/C Ratio	0.31	0.46	0.45	0.01	0.16	0.15	0.12	0.25		0.14	0.27	0.57
Clearance Time (s)	4.0	5.3	5.3	4.0	5.3	5.3	4.0	4.9		4.0	4.9	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	1060	1613	705	26	572	240	207	867		249	965	909
v/s Ratio Prot	c0.29	0.23		0.01	c0.11		0.12	0.21		c0.15	c0.26	0.18
v/s Ratio Perm			0.06			0.01						0.17
v/c Ratio	0.95	0.50	0.12	0.58	0.68	0.05	1.04	0.83		1.05	0.96	0.61
Uniform Delay, d1	43.3	24.6	20.8	62.6	50.5	46.4	56.5	45.5		55.0	45.9	17.9
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	17.4	0.2	0.1	27.4	3.2	0.1	74.4	6.9		70.2	20.4	1.2
Delay (s)	60.6	24.8	20.9	90.0	53.7	46.4	130.9	52.4		125.2	66.2	19.1
Level of Service	E	C	C	F	D	D	F	D		F	E	B
Approach Delay (s)		42.4			53.7			70.3			58.8	
Approach LOS		D			D			E			E	
Intersection Summary												
HCM 2000 Control Delay			54.1				HCM 2000 Level of Service				D	
HCM 2000 Volume to Capacity ratio			0.94									
Actuated Cycle Length (s)			127.9			Sum of lost time (s)				18.7		
Intersection Capacity Utilization			85.9%			ICU Level of Service				E		
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis
40: First St/Springtown Blvd & I-580 WB Ramps





















Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations			↗↗			↗	↗↗	↑			↖↖	↖
Traffic Volume (vph)	0	0	261	0	0	0	387	1517	0	0	422	197
Future Volume (vph)	0	0	261	0	0	0	387	1517	0	0	422	197
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)			4.0				4.0	4.0			5.0	5.0
Lane Util. Factor			0.88				0.97	1.00			0.95	1.00
Frt			0.85				1.00	1.00			1.00	0.85
Flt Protected			1.00				0.95	1.00			1.00	1.00
Satd. Flow (prot)			2787				3433	1863			3539	1583
Flt Permitted			1.00				0.95	1.00			1.00	1.00
Satd. Flow (perm)			2787				3433	1863			3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	284	0	0	0	421	1649	0	0	459	214
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	36
Lane Group Flow (vph)	0	0	284	0	0	0	421	1649	0	0	459	178
Turn Type			Over			Free	Prot	NA			NA	Perm
Protected Phases			5				5	2			6	
Permitted Phases						Free						6
Actuated Green, G (s)			37.0				37.0	80.0			35.0	35.0
Effective Green, g (s)			36.5				36.5	80.0			34.5	34.5
Actuated g/C Ratio			0.46				0.46	1.00			0.43	0.43
Clearance Time (s)			3.5				3.5	4.0			4.5	4.5
Vehicle Extension (s)			2.0				2.0	0.2			4.0	4.0
Lane Grp Cap (vph)			1271				1566	1863			1526	682
v/s Ratio Prot			0.10				0.12	c0.89			0.13	
v/s Ratio Perm												0.11
v/c Ratio			0.22				0.27	0.89			0.30	0.26
Uniform Delay, d1			13.2				13.5	0.0			14.9	14.6
Progression Factor			1.00				0.97	1.00			1.00	1.00
Incremental Delay, d2			0.0				0.0	2.1			0.2	0.3
Delay (s)			13.2				13.2	2.1			15.0	14.9
Level of Service			B				B	A			B	B
Approach Delay (s)		13.2			0.0			4.3			15.0	
Approach LOS		B			A			A			B	

Intersection Summary		
HCM 2000 Control Delay	7.5	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	1.00	A
Actuated Cycle Length (s)	80.0	Sum of lost time (s)
Intersection Capacity Utilization	83.2%	9.0
Analysis Period (min)	15	ICU Level of Service
		E

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
41: First St & I-580 EB Ramps

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations													
Traffic Volume (vph)	553	4	789	0	0	0	0	1392	460	83	901	0	
Future Volume (vph)	553	4	789	0	0	0	0	1392	460	83	901	0	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)		4.0	4.0					5.0	5.0	4.0	5.0		
Lane Util. Factor		1.00	0.88					0.95	1.00	1.00	0.95		
Frt		1.00	0.85					1.00	0.85	1.00	1.00		
Flt Protected		0.95	1.00					1.00	1.00	0.95	1.00		
Satd. Flow (prot)		1775	2787					3539	1583	1770	3539		
Flt Permitted		0.95	1.00					1.00	1.00	0.95	1.00		
Satd. Flow (perm)		1775	2787					3539	1583	1770	3539		
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	
Adj. Flow (vph)	601	4	858	0	0	0	0	1513	500	90	979	0	
RTOR Reduction (vph)	0	0	121	0	0	0	0	0	275	0	0	0	
Lane Group Flow (vph)	0	605	737	0	0	0	0	1513	225	90	979	0	
Turn Type	Perm	NA	Perm					NA	Perm	Prot	NA		
Protected Phases		4						2		1	6		
Permitted Phases	4		4						2				
Actuated Green, G (s)		27.5	27.5					36.5	36.5	5.0	44.5		
Effective Green, g (s)		27.0	27.0					36.0	36.0	4.0	44.0		
Actuated g/C Ratio		0.34	0.34					0.45	0.45	0.05	0.55		
Clearance Time (s)		3.5	3.5					4.5	4.5	3.0	4.5		
Vehicle Extension (s)		2.5	2.5					4.0	4.0	2.0	4.0		
Lane Grp Cap (vph)		599	940					1592	712	88	1946		
v/s Ratio Prot								c0.43		c0.05	0.28		
v/s Ratio Perm		0.34	0.26						0.14				
v/c Ratio		1.01	0.78					0.95	0.32	1.02	0.50		
Uniform Delay, d1		26.5	23.9					21.1	14.1	38.0	11.2		
Progression Factor		1.00	1.00					1.00	1.00	0.89	0.62		
Incremental Delay, d2		39.3	4.2					13.5	1.2	102.1	0.9		
Delay (s)		65.8	28.1					34.6	15.3	136.0	7.9		
Level of Service		E	C					C	B	F	A		
Approach Delay (s)		43.7			0.0			29.8			18.7		
Approach LOS		D			A			C			B		
Intersection Summary													
HCM 2000 Control Delay			31.7		HCM 2000 Level of Service						C		
HCM 2000 Volume to Capacity ratio			0.98										
Actuated Cycle Length (s)			80.0		Sum of lost time (s)					13.0			
Intersection Capacity Utilization			84.8%		ICU Level of Service					E			
Analysis Period (min)			15										
c Critical Lane Group													

HCM Signalized Intersection Capacity Analysis
42: 1st St & Mines Rd

BART to Livermore Extension Project
2025 BART PM





















Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	67	240	58	431	264	388	66	1467	897	404	956	48
Future Volume (vph)	67	240	58	431	264	388	66	1467	897	404	956	48
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	0.97	1.00	1.00	1.00	0.91	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	1863	1583	3433	1863	1583	1770	5085	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	1863	1583	3433	1863	1583	1770	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	73	261	63	468	287	422	72	1595	975	439	1039	52
RTOR Reduction (vph)	0	0	53	0	0	35	0	0	179	0	0	27
Lane Group Flow (vph)	73	261	10	468	287	387	72	1595	796	439	1039	25
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8	1	5	2		1	NA	6
Permitted Phases			4			8			2			6
Actuated Green, G (s)	4.8	16.5	16.5	13.0	24.7	36.7	7.0	43.9	43.9	12.0	48.9	48.9
Effective Green, g (s)	4.8	16.5	16.5	13.0	24.7	36.7	7.0	43.9	43.9	12.0	48.9	48.9
Actuated g/C Ratio	0.05	0.16	0.16	0.13	0.24	0.36	0.07	0.43	0.43	0.12	0.48	0.48
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	83	303	257	440	453	635	122	2201	685	406	2452	763
v/s Ratio Prot	0.04	c0.14		c0.14	0.15	0.07	0.04	0.31		c0.13	0.20	
v/s Ratio Perm			0.01			0.17			c0.50			0.02
v/c Ratio	0.88	0.86	0.04	1.06	0.63	0.61	0.59	0.72	1.16	1.08	0.42	0.03
Uniform Delay, d1	48.0	41.3	35.8	44.2	34.3	26.5	45.8	23.8	28.8	44.7	17.1	13.8
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	59.7	21.3	0.1	60.8	2.9	1.7	7.4	1.2	88.3	68.2	0.1	0.0
Delay (s)	107.7	62.7	35.8	105.0	37.2	28.1	53.2	25.0	117.1	112.9	17.2	13.8
Level of Service	F	E	D	F	D	C	D	C	F	F	B	B
Approach Delay (s)		66.7			60.9			59.7			44.5	
Approach LOS		E			E			E			D	

Intersection Summary

HCM 2000 Control Delay	56.4	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.08		
Actuated Cycle Length (s)	101.4	Sum of lost time (s)	16.0
Intersection Capacity Utilization	89.7%	ICU Level of Service	E
Analysis Period (min)	15		




















c Critical Lane Group

HCM Unsignalized Intersection Capacity Analysis
43: Vasco Rd & I-580 WB Ramps






















												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	0	0	88	0	1851	0	0	438	0
Future Volume (Veh/h)	0	0	0	0	0	88	0	1851	0	0	438	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	0	0	0	96	0	2012	0	0	476	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage (veh)												
Upstream signal (ft)											487	
pX, platoon unblocked												
vC, conflicting volume	1578	2488	476	2488	2488	1006	476			2012		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1578	2488	476	2488	2488	1006	476			2012		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	100	100	60	100			100		
cM capacity (veh/h)	44	29	535	15	29	239	1082			280		
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	SB 1	SB 2					
Volume Total	0	96	1006	1006	0	476	0					
Volume Left	0	0	0	0	0	0	0					
Volume Right	0	96	0	0	0	0	0					
cSH	1700	239	1700	1700	1700	1700	1700					
Volume to Capacity	0.00	0.40	0.59	0.59	0.00	0.28	0.00					
Queue Length 95th (ft)	0	46	0	0	0	0	0					
Control Delay (s)	0.0	29.8	0.0	0.0	0.0	0.0	0.0					
Lane LOS	A	D										
Approach Delay (s)	0.0	29.8	0.0			0.0						
Approach LOS	A	D										
Intersection Summary												
Average Delay			1.1									
Intersection Capacity Utilization			63.3%	ICU Level of Service	B							
Analysis Period (min)			15									

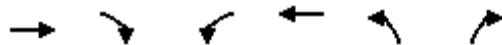
HCM Unsignalized Intersection Capacity Analysis
44: Vasco Rd & I-580 EB Ramps

BART to Livermore Extension Project
2025 BART PM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	0	0	0	0	2104	0	64	571	0
Future Volume (Veh/h)	0	0	0	0	0	0	0	2104	0	64	571	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	0	0	0	0	0	2287	0	70	621	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1904	3048	621	3048	3048	1144	621			2287		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1904	3048	621	3048	3048	1144	621			2287		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	100	100	100	100			68		
cM capacity (veh/h)	31	8	430	4	8	194	956			218		
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2						
Volume Total	0	0	1525	762	70	621						
Volume Left	0	0	0	0	70	0						
Volume Right	0	0	0	0	0	0						
cSH	1700	1700	1700	1700	218	1700						
Volume to Capacity	0.00	0.00	0.90	0.45	0.32	0.37						
Queue Length 95th (ft)	0	0	0	0	33	0						
Control Delay (s)	0.0	0.0	0.0	0.0	29.1	0.0						
Lane LOS	A	A			D							
Approach Delay (s)	0.0	0.0	0.0		3.0							
Approach LOS	A	A										
Intersection Summary												
Average Delay			0.7									
Intersection Capacity Utilization			61.5%	ICU Level of Service	B							
Analysis Period (min)			15									

HCM Signalized Intersection Capacity Analysis
45: Vasco Rd & East Ave

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations													
Traffic Volume (vph)	481	27	96	140	355	237	100	343	12	12	346	355	
Future Volume (vph)	481	27	96	140	355	237	100	343	12	12	346	355	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	0.95		0.97	1.00	1.00	
Frt	1.00	0.88		1.00	0.94		1.00	0.99		1.00	1.00	0.85	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00	
Satd. Flow (prot)	1770	3124		1770	3327		1770	3521		3433	1863	1583	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00	
Satd. Flow (perm)	1770	3124		1770	3327		1770	3521		3433	1863	1583	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	
Adj. Flow (vph)	523	29	104	152	386	258	109	373	13	13	376	386	
RTOR Reduction (vph)	0	65	0	0	127	0	0	3	0	0	0	285	
Lane Group Flow (vph)	523	68	0	152	517	0	109	383	0	13	376	101	
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	Perm	
Protected Phases	7	4		3	8		5	2		1	6		
Permitted Phases												6	
Actuated Green, G (s)	28.0	34.1		10.3	16.4		6.1	29.0		0.8	23.7	23.7	
Effective Green, g (s)	28.0	34.1		10.3	16.4		6.1	29.0		0.8	23.7	23.7	
Actuated g/C Ratio	0.31	0.38		0.11	0.18		0.07	0.32		0.01	0.26	0.26	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0	
Lane Grp Cap (vph)	549	1181		202	604		119	1132		30	489	415	
v/s Ratio Prot	c0.30	0.02		0.09	c0.16		c0.06	0.11		0.00	c0.20		
v/s Ratio Perm												0.06	
v/c Ratio	0.95	0.06		0.75	0.86		0.92	0.34		0.43	0.77	0.24	
Uniform Delay, d1	30.5	17.8		38.7	35.8		41.8	23.3		44.5	30.7	26.2	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00	
Incremental Delay, d2	26.8	0.0		14.6	11.5		56.6	0.2		9.7	7.2	0.3	
Delay (s)	57.3	17.9		53.3	47.2		98.3	23.5		54.2	37.9	26.5	
Level of Service	E	B		D	D		F	C		D	D	C	
Approach Delay (s)		49.3			48.4			40.0			32.5		
Approach LOS		D			D			D			C		
Intersection Summary													
HCM 2000 Control Delay			42.5									HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio			0.87										
Actuated Cycle Length (s)			90.2									Sum of lost time (s)	16.0
Intersection Capacity Utilization			81.1%									ICU Level of Service	D
Analysis Period (min)			15										
c Critical Lane Group													



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	631	36	203	209	5	131
Future Volume (Veh/h)	631	36	203	209	5	131
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	686	39	221	227	5	142
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage (veh)						
Upstream signal (ft)	1007					
pX, platoon unblocked						
vC, conflicting volume			686	1374		706
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			686	1374		706
tC, single (s)			4.1	6.4		6.2
tC, 2 stage (s)						
tF (s)			2.2	3.5		3.3
p0 queue free %			76	96		67
cM capacity (veh/h)			908	121		436
Direction, Lane #	EB 1	WB 1	NB 1	NB 2		
Volume Total	725	448	5	142		
Volume Left	0	221	5	0		
Volume Right	39	0	0	142		
cSH	1700	908	121	436		
Volume to Capacity	0.43	0.24	0.04	0.33		
Queue Length 95th (ft)	0	24	3	35		
Control Delay (s)	0.0	6.5	36.0	17.2		
Lane LOS	A		E	C		
Approach Delay (s)	0.0	6.5	17.8			
Approach LOS	C					
Intersection Summary						
Average Delay	4.2					
Intersection Capacity Utilization	71.0%		ICU Level of Service		C	
Analysis Period (min)	15					

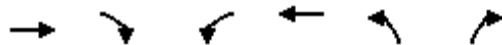
Intersection	
Intersection Delay, s/veh	13.8
Intersection LOS	B

Movement	EBU	EBL	EBT	WBU	WBT	WBR	SBU	SBL	SBR
Lane Configurations		↘	↕↕		↕	↘		↘↘	↘
Traffic Vol, veh/h	0	294	253	0	84	267	0	190	7
Future Vol, veh/h	0	294	253	0	84	267	0	190	7
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	320	275	0	91	290	0	207	8
Number of Lanes	0	1	2	0	1	1	0	2	1

Approach	EB	WB	SB
Opposing Approach	WB	EB	
Opposing Lanes	2	3	0
Conflicting Approach Left	SB		WB
Conflicting Lanes Left	3	0	2
Conflicting Approach Right		SB	EB
Conflicting Lanes Right	0	3	3
HCM Control Delay	14.8	13.3	11.9
HCM LOS	B	B	B

Lane	EBLn1	EBLn2	EBLn3	WBLn1	WBLn2	SBLn1	SBLn2	SBLn3
Vol Left, %	100%	0%	0%	0%	0%	100%	100%	0%
Vol Thru, %	0%	100%	100%	100%	0%	0%	0%	0%
Vol Right, %	0%	0%	0%	0%	100%	0%	0%	100%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	294	127	127	84	267	95	95	7
LT Vol	294	0	0	0	0	95	95	0
Through Vol	0	127	127	84	0	0	0	0
RT Vol	0	0	0	0	267	0	0	7
Lane Flow Rate	320	138	138	91	290	103	103	8
Geometry Grp	8	8	8	8	8	7	7	7
Degree of Util (X)	0.601	0.24	0.173	0.169	0.48	0.212	0.212	0.009
Departure Headway (Hd)	6.776	6.271	4.518	6.658	5.951	7.381	7.381	4.415
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cap	530	571	789	537	604	485	485	805
Service Time	4.531	4.025	2.272	4.421	3.713	5.14	5.14	2.172
HCM Lane V/C Ratio	0.604	0.242	0.175	0.169	0.48	0.212	0.212	0.01
HCM Control Delay	19.3	11	8.2	10.8	14.1	12.1	12.1	7.2
HCM Lane LOS	C	B	A	B	B	B	B	A
HCM 95th-tile Q	3.9	0.9	0.6	0.6	2.6	0.8	0.8	0

HCM Signalized Intersection Capacity Analysis
 48: Greenville Rd & Northfront Road/Altamont Pass Road



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↗	↖	↑	↘	↗
Traffic Volume (vph)	611	146	1	51	375	1038
Future Volume (vph)	611	146	1	51	375	1038
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	1863	1583	1770	1863	1770	1583
Flt Permitted	1.00	1.00	0.10	1.00	0.95	1.00
Satd. Flow (perm)	1863	1583	191	1863	1770	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	664	159	1	55	408	1128
RTOR Reduction (vph)	0	65	0	0	0	28
Lane Group Flow (vph)	664	94	1	55	408	1100
Turn Type	NA	Perm	Perm	NA	Prot	Perm
Protected Phases	4			8	2	
Permitted Phases		4	8			2
Actuated Green, G (s)	39.0	39.0	39.0	39.0	73.0	73.0
Effective Green, g (s)	39.0	39.0	39.0	39.0	73.0	73.0
Actuated g/C Ratio	0.32	0.32	0.32	0.32	0.61	0.61
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	605	514	62	605	1076	962
v/s Ratio Prot	c0.36			0.03	0.23	
v/s Ratio Perm		0.06	0.01			c0.69
v/c Ratio	1.10	0.18	0.02	0.09	0.38	1.14
Uniform Delay, d1	40.5	29.1	27.5	28.2	12.0	23.5
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	66.1	0.2	0.1	0.1	0.2	77.1
Delay (s)	106.6	29.2	27.6	28.2	12.2	100.6
Level of Service	F	C	C	C	B	F
Approach Delay (s)	91.7			28.2	77.1	
Approach LOS	F			C	E	

Intersection Summary

HCM 2000 Control Delay	81.0	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.13		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	103.1%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
49: Greenville Rd & Southfront Rd



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	417	113	247	1039	67	80
Future Volume (vph)	417	113	247	1039	67	80
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.2	5.2	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.88	0.97	0.95	0.95	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	3433	2787	3433	3539	3539	1583
Flt Permitted	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (perm)	3433	2787	3433	3539	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	453	123	268	1129	73	87
RTOR Reduction (vph)	0	103	0	0	0	53
Lane Group Flow (vph)	453	20	268	1129	73	34
Turn Type	Prot	Perm	Prot	NA	NA	Perm
Protected Phases	8		1	6	2	
Permitted Phases		8				2
Actuated Green, G (s)	6.5	6.5	3.0	19.2	12.2	12.2
Effective Green, g (s)	5.9	5.9	3.0	20.9	13.9	13.9
Actuated g/C Ratio	0.16	0.16	0.08	0.58	0.39	0.39
Clearance Time (s)	4.6	4.6	4.0	5.7	5.7	5.7
Vehicle Extension (s)	5.0	5.0	6.0	2.5	2.5	2.5
Lane Grp Cap (vph)	562	456	286	2054	1366	611
v/s Ratio Prot	c0.13		c0.08	c0.32	0.02	
v/s Ratio Perm		0.01				0.02
v/c Ratio	0.81	0.04	0.94	0.55	0.05	0.05
Uniform Delay, d1	14.5	12.7	16.4	4.7	6.9	6.9
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	9.4	0.1	38.2	0.2	0.0	0.0
Delay (s)	23.9	12.8	54.6	4.9	6.9	7.0
Level of Service	C	B	D	A	A	A
Approach Delay (s)	21.5			14.4	6.9	
Approach LOS	C			B	A	

Intersection Summary

HCM 2000 Control Delay	15.8	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.73		
Actuated Cycle Length (s)	36.0	Sum of lost time (s)	13.2
Intersection Capacity Utilization	48.3%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
50: Greenville Rd & Patterson Pass Rd

BART to Livermore Extension Project
2025 BART PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	42	558	61	5	12	8	63	407	287	428	203	46
Future Volume (vph)	42	558	61	5	12	8	63	407	287	428	203	46
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.99		1.00	0.94		1.00	0.94		1.00	0.97	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1835		1770	1748		1770	1747		1770	1811	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	1835		1770	1748		1770	1747		1770	1811	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	46	607	66	5	13	9	68	442	312	465	221	50
RTOR Reduction (vph)	0	4	0	0	7	0	0	21	0	0	6	0
Lane Group Flow (vph)	46	669	0	5	15	0	68	733	0	465	265	0
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												
Actuated Green, G (s)	10.0	34.0		0.8	24.8		7.5	42.8		24.0	59.3	
Effective Green, g (s)	10.0	34.0		0.8	24.8		7.5	42.8		24.0	59.3	
Actuated g/C Ratio	0.09	0.29		0.01	0.21		0.06	0.36		0.20	0.50	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	150	530		12	368		112	635		361	913	
v/s Ratio Prot	c0.03	c0.36		0.00	0.01		0.04	c0.42		c0.26	0.15	
v/s Ratio Perm												
v/c Ratio	0.31	1.26		0.42	0.04		0.61	1.15		1.29	0.29	
Uniform Delay, d1	50.5	41.8		58.2	36.9		53.6	37.4		46.8	16.9	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	1.2	132.9		21.8	0.0		9.0	86.5		149.0	0.8	
Delay (s)	51.7	174.7		79.9	37.0		62.6	123.9		195.8	17.7	
Level of Service	D	F		E	D		E	F		F	B	
Approach Delay (s)		166.9			44.9			118.8			130.3	
Approach LOS		F			D			F			F	

Intersection Summary

HCM 2000 Control Delay	136.6	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.22		
Actuated Cycle Length (s)	117.6	Sum of lost time (s)	16.0
Intersection Capacity Utilization	105.7%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
1: Dougherty Rd & Amador Valley Rd



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	88	552	389	713	1802	134
Future Volume (vph)	88	552	389	713	1802	134
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5	5.7	5.7	
Lane Util. Factor	1.00	1.00	0.97	0.91	0.91	
Frt	1.00	0.85	1.00	1.00	0.99	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1770	1583	3433	5085	5032	
Flt Permitted	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	1770	1583	3433	5085	5032	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	96	600	423	775	1959	146
RTOR Reduction (vph)	0	187	0	0	9	0
Lane Group Flow (vph)	96	413	423	775	2096	0
Turn Type	Perm	Perm	Prot	NA	NA	
Protected Phases			5	2	6	
Permitted Phases	4	4				
Actuated Green, G (s)	25.6	25.6	12.2	56.0	39.3	
Effective Green, g (s)	25.6	25.6	12.2	56.0	39.3	
Actuated g/C Ratio	0.28	0.28	0.13	0.61	0.43	
Clearance Time (s)	4.5	4.5	4.5	5.7	5.7	
Vehicle Extension (s)	1.8	1.8	2.0	4.0	4.0	
Lane Grp Cap (vph)	493	441	456	3101	2154	
v/s Ratio Prot			c0.12	0.15	c0.42	
v/s Ratio Perm	0.05	c0.26				
v/c Ratio	0.19	0.94	0.93	0.25	0.97	
Uniform Delay, d1	25.2	32.3	39.4	8.2	25.7	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.1	26.8	24.7	0.1	13.7	
Delay (s)	25.3	59.1	64.0	8.3	39.4	
Level of Service	C	E	E	A	D	
Approach Delay (s)	54.5			28.0	39.4	
Approach LOS	D			C	D	

Intersection Summary

HCM 2000 Control Delay	38.6	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.95		
Actuated Cycle Length (s)	91.8	Sum of lost time (s)	14.7
Intersection Capacity Utilization	80.5%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
2: Dougherty Rd & Dublin Blvd



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	40	379	414	267	618	360	641	1005	125	725	1770	77
Future Volume (vph)	40	379	414	267	618	360	641	1005	125	725	1770	77
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	6.0	5.0	5.0	5.5	5.0	5.0	5.5	5.0	5.0	5.5	
Lane Util. Factor	0.97	0.91	0.88	0.94	0.91	1.00	0.94	0.91	0.88	0.97	0.86	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	3433	5085	2787	4990	5085	1583	4990	5085	2787	3433	6368	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	3433	5085	2787	4990	5085	1583	4990	5085	2787	3433	6368	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	43	412	450	290	672	391	697	1092	136	788	1924	84
RTOR Reduction (vph)	0	0	41	0	0	101	0	0	80	0	4	0
Lane Group Flow (vph)	43	412	409	290	672	290	697	1092	56	788	2004	0
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	
Protected Phases	5	2	3	1	6	7	3	8	1	7	4	
Permitted Phases			2			6			8			
Actuated Green, G (s)	11.8	22.7	38.7	15.0	26.4	52.2	16.0	33.3	48.3	25.8	43.1	
Effective Green, g (s)	11.8	22.7	38.7	15.0	26.4	52.2	16.0	33.3	48.3	25.8	43.1	
Actuated g/C Ratio	0.10	0.19	0.33	0.13	0.22	0.44	0.14	0.28	0.41	0.22	0.36	
Clearance Time (s)	5.0	6.0	5.0	5.0	5.5	5.0	5.0	5.5	5.0	5.0	5.5	
Vehicle Extension (s)	2.0	4.5	2.0	2.0	4.5	2.0	2.0	4.5	2.0	2.0	4.5	
Lane Grp Cap (vph)	342	975	911	632	1134	698	674	1431	1137	748	2320	
v/s Ratio Prot	0.01	0.08	0.06	c0.06	c0.13	0.09	0.14	0.21	0.01	c0.23	c0.31	
v/s Ratio Perm			0.09			0.09			0.01			
v/c Ratio	0.13	0.42	0.45	0.46	0.59	0.42	1.03	0.76	0.05	1.05	0.86	
Uniform Delay, d1	48.5	42.0	31.4	47.9	41.1	22.6	51.1	38.9	21.1	46.2	34.9	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.1	0.5	0.1	0.2	1.1	0.1	43.8	2.8	0.0	47.9	3.8	
Delay (s)	48.6	42.5	31.5	48.1	42.3	22.8	94.9	41.7	21.1	94.1	38.7	
Level of Service	D	D	C	D	D	C	F	D	C	F	D	
Approach Delay (s)		37.4			37.9			59.5			54.3	
Approach LOS		D			D			E			D	

Intersection Summary

HCM 2000 Control Delay	50.4	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.83		
Actuated Cycle Length (s)	118.3	Sum of lost time (s)	21.5
Intersection Capacity Utilization	82.2%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

3: Dougherty Rd & I-580 WB Ramps

BART to Livermore Extension Project
2025 DMU AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↔↔		↔↔		↑↑↑			↑↑↑	↔
Traffic Volume (vph)	0	0	0	393	0	637	0	1277	0	0	1670	0
Future Volume (vph)	0	0	0	393	0	637	0	1277	0	0	1670	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0		4.0		4.0			4.0	
Lane Util. Factor				0.97		0.88		0.91			0.86	
Frt				1.00		0.85		1.00			1.00	
Flt Protected				0.95		1.00		1.00			1.00	
Satd. Flow (prot)				3433		2787		5085			4806	
Flt Permitted				0.95		1.00		1.00			1.00	
Satd. Flow (perm)				3433		2787		5085			4806	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	427	0	692	0	1388	0	0	1815	0
RTOR Reduction (vph)	0	0	0	0	0	36	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	427	0	656	0	1388	0	0	1815	0
Turn Type				Prot		Prot		NA			NA	Perm
Protected Phases				4		4		2			6	
Permitted Phases												6
Actuated Green, G (s)				14.0		14.0		25.2			25.2	
Effective Green, g (s)				15.4		15.4		26.6			26.6	
Actuated g/C Ratio				0.31		0.31		0.53			0.53	
Clearance Time (s)				5.4		5.4		5.4			5.4	
Vehicle Extension (s)				3.0		3.0		3.0			3.0	
Lane Grp Cap (vph)				1057		858		2705			2556	
v/s Ratio Prot				0.12		c0.24		0.27			c0.38	
v/s Ratio Perm												
v/c Ratio				0.40		0.76		0.51			0.71	
Uniform Delay, d1				13.7		15.7		7.5			8.8	
Progression Factor				1.00		1.00		0.74			1.00	
Incremental Delay, d2				0.3		4.1		0.6			1.7	
Delay (s)				13.9		19.8		6.2			10.5	
Level of Service				B		B		A			B	
Approach Delay (s)		0.0			17.5			6.2			10.5	
Approach LOS		A			B			A			B	

Intersection Summary

HCM 2000 Control Delay	10.9	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.73		
Actuated Cycle Length (s)	50.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	53.6%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
4: Hopyard Rd/Dougherty Rd & I-580 EB Ramps



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗		↖↗					↑↑↑	↖		↑↑↑	↖
Traffic Volume (vph)	756	0	1446	0	0	0	0	760	0	0	1520	0
Future Volume (vph)	756	0	1446	0	0	0	0	760	0	0	1520	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0					4.0			4.0	
Lane Util. Factor	0.97		0.88					0.91			0.86	
Frt	1.00		0.85					1.00			1.00	
Flt Protected	0.95		1.00					1.00			1.00	
Satd. Flow (prot)	3433		2787					5085			4806	
Flt Permitted	0.95		1.00					1.00			1.00	
Satd. Flow (perm)	3433		2787					5085			4806	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	822	0	1572	0	0	0	0	826	0	0	1652	0
RTOR Reduction (vph)	0	0	27	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	822	0	1545	0	0	0	0	826	0	0	1652	0
Turn Type	Prot		Prot					NA	Free		NA	Perm
Protected Phases	4		4					2			6	
Permitted Phases									Free			6
Actuated Green, G (s)	22.6		22.6					16.6			16.6	
Effective Green, g (s)	24.0		24.0					18.0			18.0	
Actuated g/C Ratio	0.48		0.48					0.36			0.36	
Clearance Time (s)	5.4		5.4					5.4			5.4	
Vehicle Extension (s)	3.0		3.0					3.0			3.0	
Lane Grp Cap (vph)	1647		1337					1830			1730	
v/s Ratio Prot	0.24		c0.55					0.16			c0.34	
v/s Ratio Perm												
v/c Ratio	0.50		1.16					0.45			0.95	
Uniform Delay, d1	8.9		13.0					12.2			15.6	
Progression Factor	1.00		1.00					1.00			0.70	
Incremental Delay, d2	0.2		78.9					0.8			10.9	
Delay (s)	9.1		91.9					13.0			21.7	
Level of Service	A		F					B			C	
Approach Delay (s)		63.5			0.0			13.0			21.7	
Approach LOS		E			A			B			C	

Intersection Summary

HCM 2000 Control Delay	40.8	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	1.07		
Actuated Cycle Length (s)	50.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	86.6%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
5: Hopyard Rd & Owens Rd



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↔↗		↖	↗	↗	↖	↑↑↑	↗	↖↗	↑↑↗	
Traffic Volume (vph)	195	101	53	120	134	195	146	693	155	852	1621	545
Future Volume (vph)	195	101	53	120	134	195	146	693	155	852	1621	545
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	2.7	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	0.91	0.91		1.00	0.95	0.95	1.00	0.91	1.00	0.97	0.91	
Frt	1.00	0.97		1.00	0.95	0.85	1.00	1.00	0.85	1.00	0.96	
Flt Protected	0.95	0.98		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1610	3220		1770	1687	1504	1770	5085	1583	3433	4893	
Flt Permitted	0.95	0.98		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1610	3220		1770	1687	1504	1770	5085	1583	3433	4893	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	212	110	58	130	146	212	159	753	168	926	1762	592
RTOR Reduction (vph)	0	26	0	0	18	50	0	0	124	0	67	0
Lane Group Flow (vph)	117	237	0	130	194	96	159	753	44	926	2287	0
Turn Type	Split	NA		Split	NA	pm+ov	Prot	NA	Perm	Prot	NA	
Protected Phases	8	8		4	4	1	5	2		1	6	
Permitted Phases						4			2			
Actuated Green, G (s)	6.5	6.5		10.0	10.0	41.3	9.0	21.9	21.9	31.3	44.2	
Effective Green, g (s)	7.8	7.8		11.3	11.3	43.9	9.0	23.6	23.6	31.3	45.9	
Actuated g/C Ratio	0.09	0.09		0.13	0.13	0.49	0.10	0.26	0.26	0.35	0.51	
Clearance Time (s)	5.3	5.3		5.3	5.3	4.0	4.0	5.7	5.7	4.0	5.7	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	139	279		222	211	778	177	1333	415	1193	2495	
v/s Ratio Prot	0.07	c0.07		0.07	c0.11	0.04	0.09	0.15		c0.27	c0.47	
v/s Ratio Perm						0.02			0.03			
v/c Ratio	0.84	0.85		0.59	0.92	0.12	0.90	0.56	0.11	0.78	0.92	
Uniform Delay, d1	40.5	40.5		37.1	38.9	12.6	40.0	28.8	25.2	26.2	20.3	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	34.5	20.6		3.9	39.4	0.1	39.7	0.6	0.1	3.2	5.9	
Delay (s)	75.0	61.1		41.0	78.3	12.6	79.7	29.3	25.3	29.5	26.2	
Level of Service	E	E		D	E	B	E	C	C	C	C	
Approach Delay (s)		65.4			48.7			36.1			27.1	
Approach LOS		E			D			D			C	

Intersection Summary

HCM 2000 Control Delay	33.8	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.92		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	82.7%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
6: Hopyard Rd & Stoneridge Dr



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	154	733	442	82	998	120	646	751	86	278	972	234
Future Volume (vph)	154	733	442	82	998	120	646	751	86	278	972	234
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.91	1.00	0.97	0.91	1.00	0.94	0.95	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5085	1583	3433	5085	1583	4990	3539	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5085	1583	3433	5085	1583	4990	3539	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	167	797	480	89	1085	130	702	816	93	302	1057	254
RTOR Reduction (vph)	0	0	222	0	0	94	0	0	67	0	0	121
Lane Group Flow (vph)	167	797	258	89	1085	36	702	816	26	302	1057	133
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	NA	6
Permitted Phases			4			8			2			6
Actuated Green, G (s)	4.0	17.6	17.6	3.2	16.8	16.8	8.0	17.0	17.0	7.0	16.0	16.0
Effective Green, g (s)	4.0	17.6	17.6	3.2	16.8	16.8	8.0	17.0	17.0	7.0	16.0	16.0
Actuated g/C Ratio	0.07	0.29	0.29	0.05	0.28	0.28	0.13	0.28	0.28	0.12	0.26	0.26
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	225	1471	458	180	1405	437	656	989	442	395	1338	416
v/s Ratio Prot	c0.05	0.16		0.03	c0.21		c0.14	c0.23		0.09	0.21	
v/s Ratio Perm			0.16			0.02			0.02			0.08
v/c Ratio	0.74	0.54	0.56	0.49	0.77	0.08	1.07	0.83	0.06	0.76	0.79	0.32
Uniform Delay, d1	27.9	18.2	18.3	28.0	20.2	16.3	26.4	20.5	16.0	26.1	20.8	18.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	12.4	0.4	1.6	2.1	2.7	0.1	55.4	5.7	0.1	8.5	3.2	0.4
Delay (s)	40.3	18.6	19.9	30.1	22.9	16.4	81.8	26.2	16.1	34.6	24.0	18.5
Level of Service	D	B	B	C	C	B	F	C	B	C	C	B
Approach Delay (s)		21.6			22.8			49.9			25.1	
Approach LOS		C			C			D			C	

Intersection Summary		
HCM 2000 Control Delay	30.4	HCM 2000 Level of Service C
HCM 2000 Volume to Capacity ratio	0.86	
Actuated Cycle Length (s)	60.8	Sum of lost time (s) 16.0
Intersection Capacity Utilization	68.1%	ICU Level of Service C
Analysis Period (min)	15	

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
7: Hopyard Rd & Las Positas Blvd

BART to Livermore Extension Project
2025 DMU AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	153	462	374	350	447	57	412	1159	365	111	1013	90
Future Volume (vph)	153	462	374	350	447	57	412	1159	365	111	1013	90
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.95	1.00	0.97	0.95	1.00	0.97	0.91	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	3433	3539	1583	3433	5085	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	3433	3539	1583	3433	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	166	502	407	380	486	62	448	1260	397	121	1101	98
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	72
Lane Group Flow (vph)	166	502	407	380	486	62	448	1260	397	121	1101	26
Turn Type	Prot	NA	Free	Prot	NA	Free	Prot	NA	Free	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1		6
Permitted Phases			Free			Free			Free			6
Actuated Green, G (s)	5.5	14.6	64.5	8.0	17.1	64.5	9.0	22.7	64.5	3.2	16.9	16.9
Effective Green, g (s)	5.5	14.6	64.5	8.0	17.1	64.5	9.0	22.7	64.5	3.2	16.9	16.9
Actuated g/C Ratio	0.09	0.23	1.00	0.12	0.27	1.00	0.14	0.35	1.00	0.05	0.26	0.26
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	292	801	1583	425	938	1583	479	1789	1583	170	1332	414
v/s Ratio Prot	0.05	c0.14		c0.11	0.14		c0.13	0.25		0.04	c0.22	
v/s Ratio Perm			c0.26			0.04			0.25			0.02
v/c Ratio	0.57	0.63	0.26	0.89	0.52	0.04	0.94	0.70	0.25	0.71	0.83	0.06
Uniform Delay, d1	28.4	22.5	0.0	27.8	20.2	0.0	27.5	18.0	0.0	30.2	22.4	17.9
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	2.5	1.5	0.4	20.6	0.5	0.0	25.6	1.3	0.4	13.2	4.3	0.1
Delay (s)	30.9	24.0	0.4	48.4	20.7	0.0	53.1	19.3	0.4	43.3	26.8	17.9
Level of Service	C	C	A	D	C	A	D	B	A	D	C	B
Approach Delay (s)		16.1			30.7			22.9			27.6	
Approach LOS		B			C			C			C	

Intersection Summary

HCM 2000 Control Delay	24.0	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.79		
Actuated Cycle Length (s)	64.5	Sum of lost time (s)	16.0
Intersection Capacity Utilization	67.4%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
8: Willow Rd & Owens Rd

BART to Livermore Extension Project
2025 DMU AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↖↗↘		↖↗	↖↗↘	↖	↖	↖↗	↖	↖	↖	↖
Traffic Volume (vph)	151	358	223	102	331	98	91	96	0	93	88	92
Future Volume (vph)	151	358	223	102	331	98	91	96	0	93	88	92
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	5.3	4.0		5.3	4.0	4.0
Lane Util. Factor	0.97	0.91		0.97	0.91	1.00	1.00	0.95		1.00	1.00	1.00
Frt	1.00	0.94		1.00	1.00	0.85	1.00	1.00		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	4793		3433	5085	1583	1770	3539		1770	1863	1583
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.69	1.00		0.69	1.00	1.00
Satd. Flow (perm)	3433	4793		3433	5085	1583	1294	3539		1279	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	164	389	242	111	360	107	99	104	0	101	96	100
RTOR Reduction (vph)	0	136	0	0	0	66	0	0	0	0	0	80
Lane Group Flow (vph)	164	495	0	111	360	41	99	104	0	101	96	20
Turn Type	Prot	NA		Prot	NA	Perm	Perm	NA	Perm	Perm	NA	Perm
Protected Phases	1	6		5	2			4			8	
Permitted Phases						2	4		4	8		8
Actuated Green, G (s)	5.2	16.4		2.7	13.9	13.9	7.1	7.1		7.1	7.1	7.1
Effective Green, g (s)	5.2	18.1		2.7	15.6	15.6	7.1	8.4		7.1	8.4	8.4
Actuated g/C Ratio	0.13	0.44		0.07	0.38	0.38	0.17	0.20		0.17	0.20	0.20
Clearance Time (s)	4.0	5.7		4.0	5.7	5.7	5.3	5.3		5.3	5.3	5.3
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	433	2105		224	1925	599	222	721		220	379	322
v/s Ratio Prot	c0.05	c0.10		0.03	0.07			0.03			0.05	
v/s Ratio Perm						0.03	0.08			c0.08		0.01
v/c Ratio	0.38	0.24		0.50	0.19	0.07	0.45	0.14		0.46	0.25	0.06
Uniform Delay, d1	16.5	7.2		18.6	8.6	8.2	15.3	13.5		15.3	13.8	13.2
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	0.6	0.1		1.7	0.0	0.0	1.4	0.1		1.5	0.4	0.1
Delay (s)	17.1	7.3		20.3	8.6	8.2	16.7	13.5		16.8	14.1	13.3
Level of Service	B	A		C	A	A	B	B		B	B	B
Approach Delay (s)		9.3			10.8			15.1			14.8	
Approach LOS		A			B			B			B	

Intersection Summary

HCM 2000 Control Delay	11.3	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.31		
Actuated Cycle Length (s)	41.2	Sum of lost time (s)	12.0
Intersection Capacity Utilization	37.1%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
9: Hacienda Dr & Dublin Blvd

BART to Livermore Extension Project
2025 DMU AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↑↑↑	↖↗	↖↗	↑↑↑		↖↗	↑↑	↖↗	↖↗	↑↑↑	↖↗
Traffic Volume (vph)	73	337	94	271	744	80	157	632	115	12	390	132
Future Volume (vph)	73	337	94	271	744	80	157	632	115	12	390	132
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	6.0	5.0	4.5	6.0		5.0	6.0	6.0	4.5	5.5	5.5
Lane Util. Factor	0.97	0.91	0.88	0.97	0.91		0.94	0.95	0.88	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5085	2787	3433	5011		4990	3539	2787	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5085	2787	3433	5011		4990	3539	2787	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	79	366	102	295	809	87	171	687	125	13	424	143
RTOR Reduction (vph)	0	0	71	0	12	0	0	0	86	0	0	117
Lane Group Flow (vph)	79	366	31	295	884	0	171	687	39	13	424	26
Turn Type	Prot	NA	pm+ov	Prot	NA		Prot	NA	Perm	Prot	NA	Perm
Protected Phases	5	2	3	1	6		3	8		7	NA	4
Permitted Phases			2						8			4
Actuated Green, G (s)	4.8	12.1	22.4	17.3	24.6		10.3	23.5	23.5	0.6	13.8	13.8
Effective Green, g (s)	4.8	12.1	22.4	17.3	24.6		10.3	23.5	23.5	0.6	13.8	13.8
Actuated g/C Ratio	0.06	0.16	0.30	0.23	0.33		0.14	0.32	0.32	0.01	0.19	0.19
Clearance Time (s)	4.5	6.0	5.0	4.5	6.0		5.0	6.0	6.0	4.5	5.5	5.5
Vehicle Extension (s)	2.0	3.5	2.0	2.0	3.5		2.0	3.5	3.5	2.0	3.5	3.5
Lane Grp Cap (vph)	221	825	1025	797	1654		689	1116	879	27	941	293
v/s Ratio Prot	0.02	c0.07	0.00	0.09	c0.18		0.03	c0.19		0.00	c0.08	
v/s Ratio Perm			0.01						0.01			0.02
v/c Ratio	0.36	0.44	0.03	0.37	0.53		0.25	0.62	0.04	0.48	0.45	0.09
Uniform Delay, d1	33.4	28.2	18.4	24.0	20.3		28.6	21.7	17.7	36.8	27.0	25.1
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.4	0.5	0.0	0.1	0.4		0.1	1.1	0.0	4.9	0.4	0.2
Delay (s)	33.7	28.6	18.4	24.1	20.7		28.7	22.7	17.7	41.6	27.4	25.3
Level of Service	C	C	B	C	C		C	C	B	D	C	C
Approach Delay (s)		27.4			21.5			23.1			27.2	
Approach LOS		C			C			C			C	

Intersection Summary

HCM 2000 Control Delay	24.0	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.59		
Actuated Cycle Length (s)	74.5	Sum of lost time (s)	21.0
Intersection Capacity Utilization	57.8%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 10: Hacienda Dr & Martinelli Blvd/Hacienda Crossings



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗	↖↗	↖↗	↗		↖↗↘	↖↗↘	↖	↖↗	↖↗↘	
Traffic Volume (vph)	11	8	175	110	12	8	244	867	112	17	727	49
Future Volume (vph)	11	8	175	110	12	8	244	867	112	17	727	49
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	3.0	3.0	5.5	3.0		3.5	3.0	3.0	5.0	3.5	
Lane Util. Factor	1.00	0.91	0.91	0.97	1.00		0.94	0.91	1.00	0.97	0.86	
Frt	1.00	0.90	0.85	1.00	0.94		1.00	1.00	0.85	1.00	0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1770	1523	2882	3433	1748		4990	5085	1583	3433	6347	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1770	1523	2882	3433	1748		4990	5085	1583	3433	6347	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	12	9	190	120	13	9	265	942	122	18	790	53
RTOR Reduction (vph)	0	14	129	0	6	0	0	0	54	0	8	0
Lane Group Flow (vph)	12	14	42	120	16	0	265	942	68	18	835	0
Turn Type	Prot	NA	Perm	Prot	NA		Prot	NA	pm+ov	Prot	NA	
Protected Phases	5	2		1	6		3	8	1	7	4	
Permitted Phases			2						8			
Actuated Green, G (s)	1.7	15.8	15.8	6.9	21.5		8.2	29.7	36.6	1.1	22.6	
Effective Green, g (s)	1.2	17.8	17.8	6.4	23.5		9.2	31.7	40.6	0.6	24.1	
Actuated g/C Ratio	0.02	0.24	0.24	0.09	0.32		0.13	0.43	0.56	0.01	0.33	
Clearance Time (s)	4.5	5.0	5.0	5.0	5.0		4.5	5.0	5.0	4.5	5.0	
Vehicle Extension (s)	3.0	4.0	4.0	2.0	4.0		3.0	4.0	2.0	3.0	4.0	
Lane Grp Cap (vph)	29	371	702	300	562		628	2208	945	28	2095	
v/s Ratio Prot	c0.01	0.01		c0.03	0.01		c0.05	c0.19	0.01	0.01	0.13	
v/s Ratio Perm			c0.01						0.03			
v/c Ratio	0.41	0.04	0.06	0.40	0.03		0.42	0.43	0.07	0.64	0.40	
Uniform Delay, d1	35.6	21.1	21.2	31.5	16.9		29.4	14.3	7.5	36.1	18.9	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	9.3	0.1	0.0	0.3	0.0		0.5	0.2	0.0	40.9	0.2	
Delay (s)	44.9	21.1	21.2	31.8	17.0		29.9	14.5	7.5	77.0	19.0	
Level of Service	D	C	C	C	B		C	B	A	E	B	
Approach Delay (s)		22.6			29.5			16.9			20.2	
Approach LOS		C			C			B			C	

Intersection Summary

HCM 2000 Control Delay	19.2	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.34		
Actuated Cycle Length (s)	73.0	Sum of lost time (s)	16.5
Intersection Capacity Utilization	42.6%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 11: Hacienda Dr & I-580 WB Ramps



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↔↔		↔↔		↑↑↑			↑↑↑	↔
Traffic Volume (vph)	0	0	0	281	0	452	0	1067	183	0	611	416
Future Volume (vph)	0	0	0	281	0	452	0	1067	183	0	611	416
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0		4.0		4.0			4.0	4.0
Lane Util. Factor				0.97		0.88		0.91			0.86	0.86
Frt				1.00		0.85		0.98			0.96	0.85
Flt Protected				0.95		1.00		1.00			1.00	1.00
Satd. Flow (prot)				3433		2787		4974			4623	1362
Flt Permitted				0.95		1.00		1.00			1.00	1.00
Satd. Flow (perm)				3433		2787		4974			4623	1362
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	305	0	491	0	1160	199	0	664	452
RTOR Reduction (vph)	0	0	0	0	0	97	0	45	0	0	92	92
Lane Group Flow (vph)	0	0	0	305	0	394	0	1314	0	0	798	134
Turn Type				Prot		Prot		NA			NA	Perm
Protected Phases				4		4		2			6	
Permitted Phases												6
Actuated Green, G (s)				10.9		10.9		27.8			27.8	27.8
Effective Green, g (s)				12.3		12.3		29.7			29.7	29.7
Actuated g/C Ratio				0.25		0.25		0.59			0.59	0.59
Clearance Time (s)				5.4		5.4		5.9			5.9	5.9
Vehicle Extension (s)				3.0		3.0		3.0			3.0	3.0
Lane Grp Cap (vph)				844		685		2954			2746	809
v/s Ratio Prot				0.09		c0.14		c0.26			0.17	
v/s Ratio Perm												0.10
v/c Ratio				0.36		0.57		0.44			0.29	0.17
Uniform Delay, d1				15.6		16.6		5.6			5.0	4.6
Progression Factor				1.00		1.00		0.56			1.00	1.00
Incremental Delay, d2				0.3		1.2		0.4			0.3	0.4
Delay (s)				15.9		17.7		3.6			5.2	5.0
Level of Service				B		B		A			A	A
Approach Delay (s)		0.0			17.0			3.6			5.2	
Approach LOS		A			B			A			A	

Intersection Summary		
HCM 2000 Control Delay	7.4	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.48	A
Actuated Cycle Length (s)	50.0	Sum of lost time (s)
Intersection Capacity Utilization	47.2%	8.0
Analysis Period (min)	15	ICU Level of Service
		A

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 12: Hacienda Dr & I-580 EB Ramps




































Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↗↘		↗↘					↑↑↑	↗		↑↑↑	
Traffic Volume (vph)	751	0	1094	0	0	0	0	462	166	0	998	148
Future Volume (vph)	751	0	1094	0	0	0	0	462	166	0	998	148
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0					4.0	4.0		4.0	
Lane Util. Factor	0.97		0.88					0.86	0.86		0.91	
Frt	1.00		0.85					0.98	0.85		0.98	
Flt Protected	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (prot)	3433		2787					4734	1362		4987	
Flt Permitted	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (perm)	3433		2787					4734	1362		4987	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	816	0	1189	0	0	0	0	502	180	0	1085	161
RTOR Reduction (vph)	0	0	86	0	0	0	0	32	70	0	51	0
Lane Group Flow (vph)	816	0	1103	0	0	0	0	526	54	0	1195	0
Turn Type	Prot		Prot					NA	Perm		NA	
Protected Phases	4		4					2			6	
Permitted Phases									2			
Actuated Green, G (s)	19.0		19.0					19.7	19.7		19.7	
Effective Green, g (s)	20.4		20.4					21.6	21.6		21.6	
Actuated g/C Ratio	0.41		0.41					0.43	0.43		0.43	
Clearance Time (s)	5.4		5.4					5.9	5.9		5.9	
Vehicle Extension (s)	2.0		2.0					2.0	2.0		2.0	
Lane Grp Cap (vph)	1400		1137					2045	588		2154	
v/s Ratio Prot	0.24		c0.40					0.11			c0.24	
v/s Ratio Perm									0.04			
v/c Ratio	0.58		0.97					0.26	0.09		0.55	
Uniform Delay, d1	11.5		14.5					9.1	8.4		10.6	
Progression Factor	1.00		1.00					1.00	1.00		0.81	
Incremental Delay, d2	0.4		19.4					0.3	0.3		1.0	
Delay (s)	11.9		33.9					9.4	8.7		9.6	
Level of Service	B		C					A	A		A	
Approach Delay (s)		24.9			0.0			9.3			9.6	
Approach LOS		C			A			A			A	

Intersection Summary	
HCM 2000 Control Delay	17.4 HCM 2000 Level of Service B
HCM 2000 Volume to Capacity ratio	0.76
Actuated Cycle Length (s)	50.0 Sum of lost time (s) 8.0
Intersection Capacity Utilization	67.5% ICU Level of Service C
Analysis Period (min)	15

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
13: Hacienda Dr & Owens Rd

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 	  		 	  		 	  		  		
Traffic Volume (vph)	107	183	21	93	235	226	25	268	118	562	969	533
Future Volume (vph)	107	183	21	93	235	226	25	268	118	562	969	533
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	2.3	4.0	4.0	2.3	4.0	4.0	2.7	4.0	4.0	2.7
Lane Util. Factor	0.97	0.91	1.00	0.97	0.91	1.00	0.97	0.91	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5085	1583	3433	5085	1583	3433	5085	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5085	1583	3433	5085	1583	3433	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	116	199	23	101	255	246	27	291	128	611	1053	579
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	116	199	23	101	255	246	27	291	128	611	1053	579
Turn Type	Prot	NA	Free	Prot	NA	Free	Prot	NA	Free	Prot	NA	Free
Protected Phases	1	6		5	2		7	4		3	8	
Permitted Phases			Free			Free			Free			Free
Actuated Green, G (s)	4.0	8.5	59.4	4.0	8.5	59.4	1.5	8.9	59.4	19.0	26.4	59.4
Effective Green, g (s)	4.0	10.2	59.4	4.0	10.2	59.4	1.5	10.2	59.4	19.0	27.7	59.4
Actuated g/C Ratio	0.07	0.17	1.00	0.07	0.17	1.00	0.03	0.17	1.00	0.32	0.47	1.00
Clearance Time (s)	4.0	5.7		4.0	5.7		4.0	5.3		4.0	5.3	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	231	873	1583	231	873	1583	86	873	1583	1098	2371	1583
v/s Ratio Prot	0.03	0.04		0.03	0.05		0.01	0.06		c0.18	0.21	
v/s Ratio Perm			0.01			0.16			0.08			c0.37
v/c Ratio	0.50	0.23	0.01	0.44	0.29	0.16	0.31	0.33	0.08	0.56	0.44	0.37
Uniform Delay, d1	26.7	21.2	0.0	26.6	21.5	0.0	28.4	21.6	0.0	16.7	10.7	0.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.7	0.1	0.0	1.3	0.2	0.2	2.1	0.2	0.1	0.6	0.1	0.7
Delay (s)	28.5	21.3	0.0	27.9	21.6	0.2	30.5	21.8	0.1	17.3	10.8	0.7
Level of Service	C	C	A	C	C	A	C	C	A	B	B	A
Approach Delay (s)		22.3			13.9			16.1			10.0	
Approach LOS		C			B			B			A	

Intersection Summary		
HCM 2000 Control Delay	12.5	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.55	B
Actuated Cycle Length (s)	59.4	Sum of lost time (s)
Intersection Capacity Utilization	44.6%	16.0
Analysis Period (min)	15	ICU Level of Service
		A

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 14: Tassajara Rd & Dublin Blvd



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↑↑	↖↗	↖↗↖	↑↓		↖↗↖	↑↑↑	↖	↖↗	↑↑↑	↖↗
Traffic Volume (vph)	92	149	161	489	600	40	222	512	146	25	1246	225
Future Volume (vph)	92	149	161	489	600	40	222	512	146	25	1246	225
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	6.0	6.0	5.0	6.0		5.0	6.0	6.0	5.0	6.0	6.0
Lane Util. Factor	0.97	0.95	0.88	0.94	0.95		0.94	0.91	1.00	0.97	0.86	0.88
Frt	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	2787	4990	3506		4990	5085	1583	3433	6408	2787
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	2787	4990	3506		4990	5085	1583	3433	6408	2787
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	100	162	175	532	652	43	241	557	159	27	1354	245
RTOR Reduction (vph)	0	0	135	0	4	0	0	0	96	0	0	163
Lane Group Flow (vph)	100	162	40	532	691	0	241	557	63	27	1354	82
Turn Type	Prot	NA	Perm	Prot	NA		Prot	NA	Perm	Prot	NA	Perm
Protected Phases	5	2		1	6		3	8		7	NA	4
Permitted Phases			2						8			4
Actuated Green, G (s)	16.2	29.7	29.7	18.5	32.0		16.2	51.5	51.5	8.4	43.7	43.7
Effective Green, g (s)	16.2	29.7	29.7	18.5	32.0		16.2	51.5	51.5	8.4	43.7	43.7
Actuated g/C Ratio	0.12	0.23	0.23	0.14	0.25		0.12	0.40	0.40	0.06	0.34	0.34
Clearance Time (s)	5.0	6.0	6.0	5.0	6.0		5.0	6.0	6.0	5.0	6.0	6.0
Vehicle Extension (s)	2.0	3.0	3.0	2.0	3.0		2.0	4.0	4.0	2.0	4.0	4.0
Lane Grp Cap (vph)	427	807	636	709	862		621	2012	626	221	2152	936
v/s Ratio Prot	0.03	0.05		c0.11	c0.20		c0.05	0.11		0.01	c0.21	
v/s Ratio Perm			0.01						0.04			0.03
v/c Ratio	0.23	0.20	0.06	0.75	0.80		0.39	0.28	0.10	0.12	0.63	0.09
Uniform Delay, d1	51.4	40.6	39.3	53.6	46.1		52.4	26.7	24.7	57.4	36.4	29.6
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.1	0.1	0.0	4.0	5.4		0.1	0.1	0.1	0.1	0.7	0.1
Delay (s)	51.5	40.7	39.3	57.6	51.5		52.5	26.8	24.8	57.5	37.0	29.6
Level of Service	D	D	D	E	D		D	C	C	E	D	C
Approach Delay (s)		42.6			54.1			32.9			36.3	
Approach LOS		D			D			C			D	

Intersection Summary		
HCM 2000 Control Delay	41.3	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.68	D
Actuated Cycle Length (s)	130.1	Sum of lost time (s)
Intersection Capacity Utilization	80.9%	22.0
Analysis Period (min)	15	ICU Level of Service
		D

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 15: Tassajara Rd & I-580 WB Ramps



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↔		↔		↕	↔		↕↔	↔
Traffic Volume (vph)	0	0	0	545	0	293	0	1036	467	0	945	935
Future Volume (vph)	0	0	0	545	0	293	0	1036	467	0	945	935
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0		4.0		4.0	4.0		4.0	4.0
Lane Util. Factor				0.97		0.88		0.95	1.00		0.86	0.86
Frt				1.00		0.85		1.00	0.85		0.95	0.85
Flt Protected				0.95		1.00		1.00	1.00		1.00	1.00
Satd. Flow (prot)				3433		2787		3539	1583		4567	1362
Flt Permitted				0.95		1.00		1.00	1.00		1.00	1.00
Satd. Flow (perm)				3433		2787		3539	1583		4567	1362
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	592	0	318	0	1126	508	0	1027	1016
RTOR Reduction (vph)	0	0	0	0	0	28	0	0	281	0	206	281
Lane Group Flow (vph)	0	0	0	592	0	290	0	1126	227	0	1329	227
Turn Type				Perm		Perm		NA	Perm		NA	Perm
Protected Phases								2			6	
Permitted Phases				8		8			2			6
Actuated Green, G (s)				11.9		11.9		16.1	16.1		16.1	16.1
Effective Green, g (s)				11.9		11.9		16.1	16.1		16.1	16.1
Actuated g/C Ratio				0.33		0.33		0.45	0.45		0.45	0.45
Clearance Time (s)				4.0		4.0		4.0	4.0		4.0	4.0
Vehicle Extension (s)				3.0		3.0		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)				1134		921		1582	707		2042	609
v/s Ratio Prot								c0.32			0.29	
v/s Ratio Perm				c0.17		0.10			0.14			0.17
v/c Ratio				0.52		0.31		0.71	0.32		0.65	0.37
Uniform Delay, d1				9.7		9.0		8.1	6.4		7.8	6.6
Progression Factor				1.00		1.00		1.00	1.00		1.00	1.00
Incremental Delay, d2				0.4		0.2		1.5	0.3		0.8	0.4
Delay (s)				10.2		9.2		9.6	6.7		8.5	7.0
Level of Service				B		A		A	A		A	A
Approach Delay (s)		0.0			9.8			8.7			8.1	
Approach LOS		A			A			A			A	

Intersection Summary

HCM 2000 Control Delay	8.7	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.63		
Actuated Cycle Length (s)	36.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	50.9%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 16: Santa Rita Rd & I-580 EB Ramps/Pimilco Dr



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	533	123	677	183	0	191	0	738	111	194	1232	0
Future Volume (vph)	533	123	677	183	0	191	0	738	111	194	1232	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0		4.0		4.0		4.0	4.0	
Lane Util. Factor	0.97	1.00	1.00	0.97		0.88		0.86		1.00	0.95	
Frt	1.00	1.00	0.85	1.00		0.85		0.98		1.00	1.00	
Flt Protected	0.95	1.00	1.00	0.95		1.00		1.00		0.95	1.00	
Satd. Flow (prot)	3433	1863	1583	3433		2787		6282		1770	3539	
Flt Permitted	0.95	1.00	1.00	0.95		1.00		1.00		0.95	1.00	
Satd. Flow (perm)	3433	1863	1583	3433		2787		6282		1770	3539	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	579	134	736	199	0	208	0	802	121	211	1339	0
RTOR Reduction (vph)	0	0	0	0	0	72	0	46	0	0	0	0
Lane Group Flow (vph)	579	134	736	199	0	136	0	877	0	211	1339	0
Turn Type	Perm	NA	Free	Prot		pm+ov		NA		Prot	NA	Perm
Protected Phases		4		3		1		2		1	6	
Permitted Phases	4		Free			3						6
Actuated Green, G (s)	14.3	14.3	57.2	4.0		12.1		14.8		8.1	26.9	
Effective Green, g (s)	14.3	14.3	57.2	4.0		12.1		14.8		8.1	26.9	
Actuated g/C Ratio	0.25	0.25	1.00	0.07		0.21		0.26		0.14	0.47	
Clearance Time (s)	4.0	4.0		4.0		4.0		4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0		3.0		3.0		3.0	3.0	
Lane Grp Cap (vph)	858	465	1583	240		589		1625		250	1664	
v/s Ratio Prot		0.07		0.06		0.03		0.14		0.12	c0.38	
v/s Ratio Perm	c0.17		c0.46			0.02						
v/c Ratio	0.67	0.29	0.46	0.83		0.23		0.54		0.84	0.80	
Uniform Delay, d1	19.4	17.3	0.0	26.3		18.7		18.3		23.9	12.9	
Progression Factor	1.00	1.00	1.00	1.00		1.00		1.00		1.00	1.00	
Incremental Delay, d2	2.1	0.3	1.0	20.5		0.2		0.3		22.1	2.9	
Delay (s)	21.5	17.7	1.0	46.7		18.9		18.6		46.0	15.8	
Level of Service	C	B	A	D		B		B		D	B	
Approach Delay (s)		10.7			32.5			18.6			19.9	
Approach LOS		B			C			B			B	

Intersection Summary		
HCM 2000 Control Delay	17.8	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.85	B
Actuated Cycle Length (s)	57.2	Sum of lost time (s)
Intersection Capacity Utilization	55.9%	16.0
Analysis Period (min)	15	ICU Level of Service
		B

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
17: Santa Rita Rd & Valley Ave

BART to Livermore Extension Project
2025 DMU AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	188	225	78	177	330	830	94	485	74	575	909	155
Future Volume (vph)	188	225	78	177	330	830	94	485	74	575	909	155
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.97	0.95		0.97	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.98		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	3433	3469		3433	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	3433	3469		3433	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	204	245	85	192	359	902	102	527	80	625	988	168
RTOR Reduction (vph)	0	0	70	0	0	0	0	17	0	0	0	100
Lane Group Flow (vph)	204	245	15	192	359	902	102	590	0	625	988	68
Turn Type	Prot	NA	Perm	Prot	NA	Free	Prot	NA		Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1		6
Permitted Phases			4			Free						6
Actuated Green, G (s)	7.7	11.5	11.5	8.1	11.9	64.9	3.1	16.2		13.1	26.2	26.2
Effective Green, g (s)	7.7	11.5	11.5	8.1	11.9	64.9	3.1	16.2		13.1	26.2	26.2
Actuated g/C Ratio	0.12	0.18	0.18	0.12	0.18	1.00	0.05	0.25		0.20	0.40	0.40
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	407	627	280	220	648	1583	163	865		692	1428	639
v/s Ratio Prot	0.06	0.07		c0.11	0.10		0.03	0.17		c0.18	c0.28	
v/s Ratio Perm			0.01			c0.57						0.04
v/c Ratio	0.50	0.39	0.05	0.87	0.55	0.57	0.63	0.68		0.90	0.69	0.11
Uniform Delay, d1	26.8	23.6	22.2	27.9	24.1	0.0	30.3	22.0		25.3	16.0	12.1
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	1.0	0.4	0.1	29.4	1.0	1.5	7.3	2.2		15.1	1.5	0.1
Delay (s)	27.8	24.0	22.3	57.3	25.1	1.5	37.6	24.2		40.4	17.5	12.1
Level of Service	C	C	C	E	C	A	D	C		D	B	B
Approach Delay (s)		25.2			14.7			26.2			25.0	
Approach LOS		C			B			C			C	

Intersection Summary

HCM 2000 Control Delay	21.9	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.84		
Actuated Cycle Length (s)	64.9	Sum of lost time (s)	16.0
Intersection Capacity Utilization	61.5%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
18: Bernal Ave/Valley Ave & Stanley Blvd



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	204	202	52	251	894	953	173	476	106	139	346	116
Future Volume (vph)	204	202	52	251	894	953	173	476	106	139	346	116
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.95	1.00	0.97	0.91	0.91	1.00	0.95	1.00	0.97	0.95	0.95
Frt	1.00	1.00	0.85	1.00	0.96	0.85	1.00	1.00	0.85	1.00	0.96	0.96
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	3433	3238	1441	1770	3539	1583	3433	3406	3406
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	3433	3238	1441	1770	3539	1583	3433	3406	3406
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	222	220	57	273	972	1036	188	517	115	151	376	126
RTOR Reduction (vph)	0	0	28	0	47	28	0	0	91	0	37	0
Lane Group Flow (vph)	222	220	29	273	1339	594	188	517	24	151	465	0
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	NA
Protected Phases	7	4	5	3	8	1	5	2		1	6	
Permitted Phases			4			8			2			
Actuated Green, G (s)	6.0	32.1	43.7	11.0	37.1	46.9	11.6	18.3	18.3	9.8	16.5	
Effective Green, g (s)	6.0	32.1	43.7	11.0	37.1	46.9	11.6	18.3	18.3	9.8	16.5	
Actuated g/C Ratio	0.07	0.37	0.50	0.13	0.43	0.54	0.13	0.21	0.21	0.11	0.19	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	236	1302	865	433	1377	841	235	742	332	385	644	
v/s Ratio Prot	c0.06	0.06	0.00	0.08	c0.41	0.08	c0.11	c0.15		0.04	0.14	
v/s Ratio Perm			0.01			0.33			0.02			
v/c Ratio	0.94	0.17	0.03	0.63	0.97	0.71	0.80	0.70	0.07	0.39	0.72	
Uniform Delay, d1	40.4	18.6	11.0	36.2	24.6	15.0	36.7	31.9	27.6	35.9	33.2	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	42.3	0.1	0.0	3.0	18.0	2.7	17.5	2.9	0.1	0.7	4.0	
Delay (s)	82.7	18.6	11.0	39.2	42.6	17.7	54.1	34.7	27.7	36.6	37.2	
Level of Service	F	B	B	D	D	B	D	C	C	D	D	
Approach Delay (s)		46.3			35.4			38.2			37.0	
Approach LOS		D			D			D			D	

Intersection Summary

HCM 2000 Control Delay	37.5	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.89		
Actuated Cycle Length (s)	87.2	Sum of lost time (s)	16.0
Intersection Capacity Utilization	76.9%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
19: Fallon Rd & Dublin Blvd

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations													
Traffic Volume (vph)	45	51	85	265	895	318	715	261	28	55	699	294	
Future Volume (vph)	45	51	85	265	895	318	715	261	28	55	699	294	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)	5.3	5.3	5.3	4.0	4.0	4.0	5.3	4.9	4.9	5.3	4.9	4.9	
Lane Util. Factor	0.97	0.91	0.88	0.94	0.91	1.00	0.97	0.91	0.88	0.97	0.91	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	3090	4577	2508	4491	4577	1425	3090	4577	2508	3090	4577	1425	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	3090	4577	2508	4491	4577	1425	3090	4577	2508	3090	4577	1425	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	
Adj. Flow (vph)	49	55	92	288	973	346	777	284	30	60	760	320	
RTOR Reduction (vph)	0	0	60	0	0	267	0	0	15	0	0	157	
Lane Group Flow (vph)	49	55	32	288	973	79	777	284	15	60	760	163	
Turn Type	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm	
Protected Phases	5	2	3	1	6		3	8		7	4		
Permitted Phases			2			6			8			4	
Actuated Green, G (s)	3.1	9.2	35.3	16.7	22.8	22.8	26.1	50.3	50.3	4.4	28.6	28.6	
Effective Green, g (s)	3.1	9.2	35.3	16.7	22.8	22.8	26.1	50.3	50.3	4.4	28.6	28.6	
Actuated g/C Ratio	0.03	0.09	0.35	0.17	0.23	0.23	0.26	0.50	0.50	0.04	0.29	0.29	
Clearance Time (s)	5.3	5.3	5.3	4.0	4.0	4.0	5.3	4.9	4.9	5.3	4.9	4.9	
Vehicle Extension (s)	2.0	4.0	2.0	2.0	2.0	2.0	2.0	4.0	4.0	2.0	4.0	4.0	
Lane Grp Cap (vph)	95	420	884	749	1042	324	805	2299	1260	135	1307	407	
v/s Ratio Prot	0.02	0.01	0.01	c0.06	c0.21		c0.25	0.06		0.02	c0.17		
v/s Ratio Perm			0.00			0.06			0.01			0.11	
v/c Ratio	0.52	0.13	0.04	0.38	0.93	0.24	0.97	0.12	0.01	0.44	0.58	0.40	
Uniform Delay, d1	47.8	41.8	21.2	37.1	37.9	31.6	36.6	13.2	12.5	46.7	30.6	28.8	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	2.0	0.2	0.0	0.1	14.4	0.1	23.2	0.0	0.0	0.9	0.8	0.9	
Delay (s)	49.7	42.0	21.3	37.2	52.3	31.7	59.8	13.2	12.5	47.5	31.4	29.7	
Level of Service	D	D	C	D	D	C	E	B	B	D	C	C	
Approach Delay (s)		34.2			45.2			46.3			31.8		
Approach LOS		C			D			D			C		
Intersection Summary													
HCM 2000 Control Delay			41.2									HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio			0.82										
Actuated Cycle Length (s)			100.1									Sum of lost time (s)	19.5
Intersection Capacity Utilization			73.6%									ICU Level of Service	D
Analysis Period (min)			15										
c Critical Lane Group													

HCM Signalized Intersection Capacity Analysis
 20: El Charro Rd/Fallon Rd & I-580 WB Ramps



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↖	↖	↖↖		↖	↖		↗↗	↖
Traffic Volume (vph)	0	0	0	175	0	609	0	554	478	0	526	399
Future Volume (vph)	0	0	0	175	0	609	0	554	478	0	526	399
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0	4.0	4.0		4.0	4.0		4.0	4.0
Lane Util. Factor				0.95	0.95	0.88		0.95	0.95		0.95	1.00
Frt				1.00	1.00	0.85		0.99	0.85		1.00	0.85
Flt Protected				0.95	0.95	1.00		1.00	1.00		1.00	1.00
Satd. Flow (prot)				1681	1681	2787		1749	1504		3539	1583
Flt Permitted				0.95	0.95	1.00		1.00	1.00		1.00	1.00
Satd. Flow (perm)				1681	1681	2787		1749	1504		3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	190	0	662	0	602	520	0	572	434
RTOR Reduction (vph)	0	0	0	0	0	370	0	5	177	0	0	164
Lane Group Flow (vph)	0	0	0	97	93	292	0	649	291	0	572	270
Turn Type				Perm	NA	Perm		NA	Perm		NA	Perm
Protected Phases					8			2			6	
Permitted Phases				8		8			2			6
Actuated Green, G (s)				11.4	11.4	11.4		31.1	31.1		31.1	31.1
Effective Green, g (s)				10.9	10.9	10.9		31.1	31.1		31.1	31.1
Actuated g/C Ratio				0.22	0.22	0.22		0.62	0.62		0.62	0.62
Clearance Time (s)				3.5	3.5	3.5		4.0	4.0		4.0	4.0
Vehicle Extension (s)				2.0	2.0	2.0		2.0	2.0		2.0	2.0
Lane Grp Cap (vph)				366	366	607		1087	935		2201	984
v/s Ratio Prot								c0.37			0.16	
v/s Ratio Perm				0.06	0.06	c0.10			0.19			0.17
v/c Ratio				0.27	0.25	0.48		0.60	0.31		0.26	0.27
Uniform Delay, d1				16.2	16.2	17.1		5.7	4.4		4.3	4.3
Progression Factor				1.00	1.00	1.00		0.68	0.24		1.00	1.00
Incremental Delay, d2				0.1	0.1	0.2		2.3	0.8		0.3	0.7
Delay (s)				16.4	16.3	17.3		6.2	1.9		4.5	5.0
Level of Service				B	B	B		A	A		A	A
Approach Delay (s)		0.0			17.1			4.4			4.7	
Approach LOS		A			B			A			A	

Intersection Summary			
HCM 2000 Control Delay	8.1	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.57		
Actuated Cycle Length (s)	50.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	66.8%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 21: El Charro Rd & I-580 EB Ramps



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔↔		↔↔					↕↔	↔		↕↔	↔
Traffic Volume (vph)	245	0	407	0	0	0	0	759	147	0	377	0
Future Volume (vph)	245	0	407	0	0	0	0	759	147	0	377	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0					4.0	4.0		4.0	
Lane Util. Factor	0.97		0.88					0.91	0.91		0.91	
Frt	1.00		0.85					1.00	0.85		1.00	
Flt Protected	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (prot)	3433		2787					3379	1441		3390	
Flt Permitted	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (perm)	3433		2787					3379	1441		3390	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	266	0	442	0	0	0	0	825	160	0	410	0
RTOR Reduction (vph)	0	0	370	0	0	0	0	2	46	0	0	0
Lane Group Flow (vph)	266	0	72	0	0	0	0	842	95	0	410	0
Turn Type	Prot		Perm					NA	Perm		NA	Perm
Protected Phases	4							2			6	
Permitted Phases			4						2			6
Actuated Green, G (s)	8.2		8.2					33.8	33.8		33.8	
Effective Green, g (s)	8.2		8.2					33.8	33.8		33.8	
Actuated g/C Ratio	0.16		0.16					0.68	0.68		0.68	
Clearance Time (s)	4.0		4.0					4.0	4.0		4.0	
Vehicle Extension (s)	2.0		2.0					3.0	3.0		3.0	
Lane Grp Cap (vph)	563		457					2284	974		2291	
v/s Ratio Prot	c0.08							c0.25			0.12	
v/s Ratio Perm			0.03						0.07			
v/c Ratio	0.47		0.16					0.37	0.10		0.18	
Uniform Delay, d1	18.9		17.9					3.5	2.8		3.0	
Progression Factor	1.00		1.00					1.00	1.00		1.04	
Incremental Delay, d2	0.2		0.1					0.5	0.2		0.2	
Delay (s)	19.2		18.0					4.0	3.0		3.3	
Level of Service	B		B					A	A		A	
Approach Delay (s)		18.4			0.0			3.8			3.3	
Approach LOS		B			A			A			A	

Intersection Summary		
HCM 2000 Control Delay	8.6	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.39	A
Actuated Cycle Length (s)	50.0	Sum of lost time (s)
Intersection Capacity Utilization	36.2%	8.0
Analysis Period (min)	15	ICU Level of Service
		A

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 22: El Charro Rd & Stoneridge Dr/Jack London Blvd

BART to Livermore Extension Project
 2025 DMU AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔↔↔	↑↑	↔	↔	↑↑	↔↔	↔	↑↑		↔↔↔	↑	↔↔
Traffic Volume (vph)	146	100	8	16	595	633	7	97	2	213	90	175
Future Volume (vph)	146	100	8	16	595	633	7	97	2	213	90	175
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	0.94	0.95	1.00	1.00	0.95	0.88	1.00	0.95		0.94	1.00	0.88
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	4491	3185	1425	1593	3185	2508	1593	3176		4491	1676	2508
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	4491	3185	1425	1593	3185	2508	1593	3176		4491	1676	2508
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	159	109	9	17	647	688	8	105	2	232	98	190
RTOR Reduction (vph)	0	0	6	0	0	367	0	2	0	0	0	132
Lane Group Flow (vph)	159	109	3	17	647	321	8	105	0	232	98	58
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Prot	NA		Prot	NA	Perm
Protected Phases	7	4		3	8	1	5	2		1	6	
Permitted Phases			4			8						6
Actuated Green, G (s)	5.3	19.5	19.5	0.7	14.9	24.8	0.7	7.1		9.9	16.3	16.3
Effective Green, g (s)	5.3	19.5	19.5	0.7	14.9	24.8	0.7	7.1		9.9	16.3	16.3
Actuated g/C Ratio	0.10	0.37	0.37	0.01	0.28	0.47	0.01	0.13		0.19	0.31	0.31
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	447	1167	522	20	892	1357	20	423		835	513	768
v/s Ratio Prot	c0.04	0.03		0.01	c0.20	0.04	0.01	c0.03		c0.05	0.06	
v/s Ratio Perm			0.00			0.08						0.02
v/c Ratio	0.36	0.09	0.01	0.85	0.73	0.24	0.40	0.25		0.28	0.19	0.08
Uniform Delay, d1	22.4	11.1	10.7	26.2	17.3	8.5	26.0	20.7		18.6	13.6	13.1
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	0.5	0.0	0.0	129.8	3.0	0.1	12.6	0.3		0.2	0.2	0.0
Delay (s)	22.8	11.1	10.7	156.0	20.3	8.6	38.7	21.0		18.8	13.8	13.1
Level of Service	C	B	B	F	C	A	D	C		B	B	B
Approach Delay (s)		17.8			16.0			22.2			15.8	
Approach LOS		B			B			C			B	

Intersection Summary

HCM 2000 Control Delay	16.5	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.46		
Actuated Cycle Length (s)	53.2	Sum of lost time (s)	16.0
Intersection Capacity Utilization	42.8%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
24: Airway Blvd/Driveway & N Canyons Pkwy



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑	↗	↘↗	↑	↗		↑	↗↘		↕	
Traffic Volume (vph)	0	54	88	688	379	0	1009	0	879	0	0	0
Future Volume (vph)	0	54	88	688	379	0	1009	0	879	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0	4.0	4.0			4.4	4.0			
Lane Util. Factor		0.95	1.00	0.97	1.00			1.00	0.88			
Frt		1.00	0.85	1.00	1.00			1.00	0.85			
Flt Protected		1.00	1.00	0.95	1.00			0.95	1.00			
Satd. Flow (prot)		3539	1583	3433	1863			1770	2787			
Flt Permitted		1.00	1.00	0.95	1.00			0.95	1.00			
Satd. Flow (perm)		3539	1583	3433	1863			1770	2787			
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	59	96	748	412	0	1097	0	955	0	0	0
RTOR Reduction (vph)	0	0	83	0	0	0	0	0	87	0	0	0
Lane Group Flow (vph)	0	59	13	748	412	0	0	1097	868	0	0	0
Turn Type		NA	Perm	Prot	NA	Perm	Split	NA	pm+ov			
Protected Phases		2		1	6		8	8	1	4	4	
Permitted Phases			2			6			8			
Actuated Green, G (s)		16.9	16.9	19.8	42.7			87.1	106.9			
Effective Green, g (s)		18.9	18.9	21.8	44.7			86.9	110.9			
Actuated g/C Ratio		0.13	0.13	0.16	0.32			0.62	0.79			
Clearance Time (s)		6.0	6.0	6.0	6.0			4.2	6.0			
Vehicle Extension (s)		3.0	3.0	3.0	3.0			3.0	3.0			
Lane Grp Cap (vph)		477	213	534	594			1098	2207			
v/s Ratio Prot		0.02		c0.22	c0.22			c0.62	0.06			
v/s Ratio Perm			0.01						0.25			
v/c Ratio		0.12	0.06	1.40	0.69			1.00	0.39			
Uniform Delay, d1		53.3	52.8	59.1	41.7			26.5	4.4			
Progression Factor		1.00	1.00	1.00	1.00			1.13	1.21			
Incremental Delay, d2		0.5	0.5	191.4	6.5			23.4	0.1			
Delay (s)		53.8	53.4	250.5	48.2			53.5	5.4			
Level of Service		D	D	F	D			D	A			
Approach Delay (s)		53.5			178.7			31.1			0.0	
Approach LOS		D			F			C			A	

Intersection Summary			
HCM 2000 Control Delay	83.0	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.07		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	16.4
Intersection Capacity Utilization	89.2%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
25: Airway Blvd & I-580 WB Ramps

BART to Livermore Extension Project
2025 DMU AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↙	↖	↗		↕	↘		↕	↘
Traffic Volume (vph)	0	0	0	57	38	682	0	1288	343	0	285	558
Future Volume (vph)	0	0	0	57	38	682	0	1288	343	0	285	558
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0	4.0	4.0		4.0	4.0		4.0	
Lane Util. Factor				0.95	0.95	0.88		0.95	1.00		0.91	
Frt				1.00	1.00	0.85		1.00	0.85		0.90	
Flt Protected				0.95	0.98	1.00		1.00	1.00		1.00	
Satd. Flow (prot)				1681	1734	2787		3539	1583		4580	
Flt Permitted				0.95	0.98	1.00		1.00	1.00		1.00	
Satd. Flow (perm)				1681	1734	2787		3539	1583		4580	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	62	41	741	0	1400	373	0	310	607
RTOR Reduction (vph)	0	0	0	0	0	53	0	0	117	0	205	0
Lane Group Flow (vph)	0	0	0	33	70	688	0	1400	256	0	712	0
Turn Type				Split	NA	Perm		NA	Perm		NA	
Protected Phases				8	8			2			6	
Permitted Phases						8			2			
Actuated Green, G (s)				40.1	40.1	40.1		90.6	90.6		90.6	
Effective Green, g (s)				40.1	40.1	40.1		91.9	91.9		91.9	
Actuated g/C Ratio				0.29	0.29	0.29		0.66	0.66		0.66	
Clearance Time (s)				4.0	4.0	4.0		5.3	5.3		5.3	
Vehicle Extension (s)				2.0	2.0	2.0		4.0	4.0		4.0	
Lane Grp Cap (vph)				481	496	798		2323	1039		3006	
v/s Ratio Prot				0.02	0.04			c0.40			0.16	
v/s Ratio Perm						c0.25			0.16			
v/c Ratio				0.07	0.14	0.86		0.60	0.25		0.24	
Uniform Delay, d1				36.4	37.1	47.3		13.7	9.9		9.8	
Progression Factor				1.00	1.00	1.00		1.00	1.00		2.22	
Incremental Delay, d2				0.0	0.0	9.2		1.2	0.6		0.0	
Delay (s)				36.4	37.2	56.5		14.8	10.4		21.7	
Level of Service				D	D	E		B	B		C	
Approach Delay (s)		0.0			54.1			13.9			21.7	
Approach LOS		A			D			B			C	

Intersection Summary

HCM 2000 Control Delay	25.5	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.68		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	66.1%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
26: Airway Blvd & I-580 EB Ramps/Kitty Hawk Rd



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↑	↖	↖	↑	↖	↖	↕↗		↖	↕↗	
Traffic Volume (vph)	650	197	207	26	36	95	29	506	161	74	130	150
Future Volume (vph)	650	197	207	26	36	95	29	506	161	74	130	150
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.4	4.4	4.4	4.0	4.0		4.0	4.0	
Lane Util. Factor	0.97	1.00	1.00	1.00	1.00	1.00	1.00	0.95		1.00	0.95	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.96		1.00	0.92	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	3433	1863	1583	1770	1863	1583	1770	3411		1770	3255	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	3433	1863	1583	1770	1863	1583	1770	3411		1770	3255	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	707	214	225	28	39	103	32	550	175	80	141	163
RTOR Reduction (vph)	0	0	160	0	0	86	0	44	0	0	111	0
Lane Group Flow (vph)	707	214	65	28	39	17	32	681	0	80	193	0
Turn Type	Split	NA	Perm	Split	NA	pm+ov	Prot	NA		Prot	NA	
Protected Phases	7	7		8	8	1	5	2		1	6	
Permitted Phases			7			8						
Actuated Green, G (s)	23.2	23.2	23.2	8.4	8.4	13.8	7.5	25.7		5.4	24.1	
Effective Green, g (s)	23.2	23.2	23.2	8.0	8.0	13.0	7.0	27.0		5.4	25.4	
Actuated g/C Ratio	0.29	0.29	0.29	0.10	0.10	0.16	0.09	0.34		0.07	0.32	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	3.5	5.3		4.0	5.3	
Vehicle Extension (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	3.5		2.0	4.0	
Lane Grp Cap (vph)	995	540	459	177	186	344	154	1151		119	1033	
v/s Ratio Prot	c0.21	0.11		0.02	c0.02	0.00	0.02	c0.20		c0.05	0.06	
v/s Ratio Perm			0.04			0.01						
v/c Ratio	0.71	0.40	0.14	0.16	0.21	0.05	0.21	0.59		0.67	0.19	
Uniform Delay, d1	25.4	22.8	21.0	32.9	33.1	28.3	33.9	21.9		36.4	19.8	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	2.0	0.2	0.1	0.2	0.2	0.0	0.2	2.2		11.1	0.4	
Delay (s)	27.4	23.0	21.1	33.1	33.3	28.3	34.2	24.2		47.6	20.2	
Level of Service	C	C	C	C	C	C	C	C		D	C	
Approach Delay (s)		25.3			30.2			24.6			25.9	
Approach LOS		C			C			C			C	

Intersection Summary

HCM 2000 Control Delay	25.5	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.60		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	16.8
Intersection Capacity Utilization	58.4%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 27: Collier Canyon Rd & N Canyons Pkwy/Portola Ave

BART to Livermore Extension Project
 2025 DMU AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	184	221	102	231	824	59	47	5	116	64	14	124
Future Volume (vph)	184	221	102	231	824	59	47	5	116	64	14	124
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	5.2	5.2
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.86		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	1770	1594		1770	1863	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	1770	1594		1770	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	200	240	111	251	896	64	51	5	126	70	15	135
RTOR Reduction (vph)	0	0	76	0	0	38	0	105	0	0	0	111
Lane Group Flow (vph)	200	240	35	251	896	26	51	26	0	70	15	24
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA		Prot	NA	Perm
Protected Phases	1	6		5	2		3	8		7		4
Permitted Phases			6			2						4
Actuated Green, G (s)	9.9	21.3	21.3	16.3	27.7	27.7	3.6	11.1		5.6	13.5	13.5
Effective Green, g (s)	9.9	22.6	22.6	16.3	29.0	29.0	3.6	12.1		5.6	12.9	12.9
Actuated g/C Ratio	0.14	0.31	0.31	0.22	0.40	0.40	0.05	0.17		0.08	0.18	0.18
Clearance Time (s)	4.0	5.3	5.3	4.0	5.3	5.3	4.0	5.0		4.0	4.6	4.6
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	468	1101	492	397	1413	632	87	265		136	331	281
v/s Ratio Prot	0.06	0.07		c0.14	c0.25		0.03	c0.02		c0.04	0.01	
v/s Ratio Perm			0.02			0.02						0.02
v/c Ratio	0.43	0.22	0.07	0.63	0.63	0.04	0.59	0.10		0.51	0.05	0.09
Uniform Delay, d1	28.8	18.5	17.6	25.4	17.5	13.3	33.8	25.6		32.2	24.7	24.9
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	0.6	0.1	0.1	3.3	0.9	0.0	9.7	0.2		3.3	0.1	0.1
Delay (s)	29.4	18.6	17.7	28.7	18.5	13.3	43.5	25.8		35.5	24.8	25.1
Level of Service	C	B	B	C	B	B	D	C		D	C	C
Approach Delay (s)		22.3			20.3			30.7			28.3	
Approach LOS		C			C			C			C	

Intersection Summary

HCM 2000 Control Delay	22.5	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.54		
Actuated Cycle Length (s)	72.6	Sum of lost time (s)	17.2
Intersection Capacity Utilization	55.7%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
28: Isabel Ave/Campus Hill Dr & Portola Ave

BART to Livermore Extension Project
2025 DMU AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↘	↑↑	↗↗	↘↘↘	↑↑		↘↘	↑↑	↗	↘	↑↑	↗
Traffic Volume (vph)	1	196	279	559	590	140	501	301	73	43	163	2
Future Volume (vph)	1	196	279	559	590	140	501	301	73	43	163	2
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	5.8	5.8
Lane Util. Factor	1.00	0.95	0.88	0.94	0.95		0.97	0.95	1.00	1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	0.97		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3539	2787	4990	3437		3433	3539	1583	1770	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	3539	2787	4990	3437		3433	3539	1583	1770	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	1	213	303	608	641	152	545	327	79	47	177	2
RTOR Reduction (vph)	0	0	235	0	14	0	0	0	51	0	0	2
Lane Group Flow (vph)	1	213	68	608	779	0	545	327	28	47	177	0
Turn Type	Prot	NA	Perm	Prot	NA		Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4						2			6
Actuated Green, G (s)	1.5	18.5	18.5	16.1	33.1		21.1	29.4	29.4	5.3	14.0	14.0
Effective Green, g (s)	1.5	19.8	19.8	16.1	34.4		21.1	30.7	30.7	5.3	13.1	13.1
Actuated g/C Ratio	0.02	0.23	0.23	0.18	0.39		0.24	0.35	0.35	0.06	0.15	0.15
Clearance Time (s)	4.0	5.3	5.3	4.0	5.3		4.0	5.3	5.3	4.0	4.9	4.9
Vehicle Extension (s)	2.0	3.0	3.0	2.0	3.0		2.0	3.0	3.0	2.0	3.0	3.0
Lane Grp Cap (vph)	30	797	627	913	1345		824	1236	552	106	527	235
v/s Ratio Prot	0.00	0.06		c0.12	c0.23		c0.16	c0.09		0.03	0.05	
v/s Ratio Perm			0.02						0.02			0.00
v/c Ratio	0.03	0.27	0.11	0.67	0.58		0.66	0.26	0.05	0.44	0.34	0.00
Uniform Delay, d1	42.5	28.1	27.0	33.4	21.1		30.2	20.5	18.9	39.9	33.5	31.8
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.2	0.2	0.1	1.4	0.6		1.6	0.1	0.0	1.1	0.4	0.0
Delay (s)	42.7	28.3	27.1	34.8	21.7		31.7	20.6	19.0	41.0	33.9	31.8
Level of Service	D	C	C	C	C		C	C	B	D	C	C
Approach Delay (s)		27.6			27.4			26.8			35.3	
Approach LOS		C			C			C			D	

Intersection Summary		
HCM 2000 Control Delay	27.8	HCM 2000 Level of Service C
HCM 2000 Volume to Capacity ratio	0.60	
Actuated Cycle Length (s)	87.9	Sum of lost time (s) 17.8
Intersection Capacity Utilization	67.4%	ICU Level of Service C
Analysis Period (min)	15	

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
29: Isabel Ave & I-580 WB Ramps

BART to Livermore Extension Project
2025 DMU AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↶↷		↶		↶↶	↶↷		↶↶	↶
Traffic Volume (vph)	0	0	0	987	0	409	0	494	0	0	520	559
Future Volume (vph)	0	0	0	987	0	409	0	494	0	0	520	559
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0		4.0		5.6			5.6	5.6
Lane Util. Factor				0.97		1.00		0.95			0.95	1.00
Frt				1.00		0.85		1.00			1.00	0.85
Flt Protected				0.95		1.00		1.00			1.00	1.00
Satd. Flow (prot)				3433		1583		3539			3539	1583
Flt Permitted				0.95		1.00		1.00			1.00	1.00
Satd. Flow (perm)				3433		1583		3539			3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	1073	0	445	0	537	0	0	565	608
RTOR Reduction (vph)	0	0	0	0	0	144	0	0	0	0	0	307
Lane Group Flow (vph)	0	0	0	1073	0	301	0	537	0	0	565	301
Turn Type				Prot		Prot		NA	Free		NA	Prot
Protected Phases				8		8		2			6	6
Permitted Phases									Free			
Actuated Green, G (s)				25.8		25.8		35.4			35.4	35.4
Effective Green, g (s)				25.8		25.8		34.6			34.6	34.6
Actuated g/C Ratio				0.37		0.37		0.49			0.49	0.49
Clearance Time (s)				4.0		4.0		4.8			4.8	4.8
Vehicle Extension (s)				2.0		2.0		4.0			4.0	4.0
Lane Grp Cap (vph)				1265		583		1749			1749	782
v/s Ratio Prot				c0.31		0.19		0.15			0.16	c0.19
v/s Ratio Perm												
v/c Ratio				0.85		0.52		0.31			0.32	0.38
Uniform Delay, d1				20.3		17.2		10.6			10.7	11.1
Progression Factor				1.00		1.00		1.23			1.00	1.00
Incremental Delay, d2				5.3		0.3		0.4			0.1	0.4
Delay (s)				25.6		17.6		13.4			10.8	11.5
Level of Service				C		B		B			B	B
Approach Delay (s)		0.0			23.2			13.4			11.2	
Approach LOS		A			C			B			B	























Intersection Summary

HCM 2000 Control Delay	17.2	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.58		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	9.6
Intersection Capacity Utilization	50.5%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
30: Isabel Ave & I-580 EB Ramps

BART to Livermore Extension Project
2025 DMU AM

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations	 		 					 			 		
Traffic Volume (vph)	202	0	428	0	0	0	0	724	554	0	1341	265	
Future Volume (vph)	202	0	428	0	0	0	0	724	554	0	1341	265	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)	4.0		4.0					4.0	4.0		4.0	4.0	
Lane Util. Factor	0.97		0.88					0.95	1.00		0.95	1.00	
Frt	1.00		0.85					1.00	0.85		1.00	0.85	
Flt Protected	0.95		1.00					1.00	1.00		1.00	1.00	
Satd. Flow (prot)	3433		2787					3539	1583		3539	1583	
Flt Permitted	0.95		1.00					1.00	1.00		1.00	1.00	
Satd. Flow (perm)	3433		2787					3539	1583		3539	1583	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	
Adj. Flow (vph)	220	0	465	0	0	0	0	787	602	0	1458	288	
RTOR Reduction (vph)	0	0	68	0	0	0	0	0	0	0	0	0	
Lane Group Flow (vph)	220	0	397	0	0	0	0	787	602	0	1458	288	
Turn Type	Prot		Perm					NA	Free		NA	Free	
Protected Phases	4							2			6		
Permitted Phases			4						Free			Free	
Actuated Green, G (s)	13.9		13.9					47.1	70.0		47.1	70.0	
Effective Green, g (s)	13.9		13.9					48.1	70.0		48.1	70.0	
Actuated g/C Ratio	0.20		0.20					0.69	1.00		0.69	1.00	
Clearance Time (s)	4.0		4.0					5.0			5.0		
Vehicle Extension (s)	2.0		2.0					4.0			4.0		
Lane Grp Cap (vph)	681		553					2431	1583		2431	1583	
v/s Ratio Prot	0.06							0.22			c0.41		
v/s Ratio Perm			c0.14						0.38			0.18	
v/c Ratio	0.32		0.72					0.32	0.38		0.60	0.18	
Uniform Delay, d1	24.0		26.2					4.4	0.0		5.8	0.0	
Progression Factor	1.00		1.00					1.00	1.00		0.40	1.00	
Incremental Delay, d2	0.1		3.7					0.1	0.7		0.9	0.2	
Delay (s)	24.1		29.9					4.5	0.7		3.3	0.2	
Level of Service	C		C					A	A		A	A	
Approach Delay (s)		28.1			0.0			2.9			2.8		
Approach LOS		C			A			A			A		
Intersection Summary													
HCM 2000 Control Delay			7.3									HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio			0.63										
Actuated Cycle Length (s)			70.0									Sum of lost time (s)	8.0
Intersection Capacity Utilization			58.7%									ICU Level of Service	B
Analysis Period (min)			15										
c Critical Lane Group													

HCM Signalized Intersection Capacity Analysis
31: Isabel Ave & Airway Blvd

BART to Livermore Extension Project
2025 DMU AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗	↘	↖	↗	↘	↖	↑↑↑	↘	↖↗	↑↑↑	↘
Traffic Volume (vph)	0	85	234	150	258	184	318	1075	359	722	1226	29
Future Volume (vph)	0	85	234	150	258	184	318	1075	359	722	1226	29
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.2	5.6	5.2	5.2	5.6	4.0	4.0	4.0	4.0	4.0	5.0
Lane Util. Factor		1.00	1.00	1.00	1.00	1.00	1.00	0.91	1.00	0.97	0.91	1.00
Frt		1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1863	1583	1770	1863	1583	1770	5085	1583	3433	5085	1583
Flt Permitted		1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)		1863	1583	1770	1863	1583	1770	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	92	254	163	280	200	346	1168	390	785	1333	32
RTOR Reduction (vph)	0	0	71	0	0	70	0	0	266	0	0	21
Lane Group Flow (vph)	0	92	183	163	280	130	346	1168	124	785	1333	11
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4	5	3	8	1	5	2		1	NA	6
Permitted Phases			4			8			2			6
Actuated Green, G (s)		8.1	27.2	10.7	23.4	45.5	19.1	26.5	26.5	22.1	29.5	29.5
Effective Green, g (s)		7.5	26.0	10.1	22.8	44.3	20.1	27.5	27.5	23.1	30.5	29.5
Actuated g/C Ratio		0.09	0.30	0.12	0.26	0.51	0.23	0.32	0.32	0.27	0.35	0.34
Clearance Time (s)		4.6	5.0	4.6	4.6	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Extension (s)		3.0	3.0	3.0	3.0	3.0	3.0	5.0	5.0	3.0	5.0	5.0
Lane Grp Cap (vph)		161	475	206	490	809	410	1614	502	915	1790	539
v/s Ratio Prot		0.05	0.08	c0.09	c0.15	0.04	0.20	0.23		c0.23	c0.26	
v/s Ratio Perm			0.03			0.04			0.08			0.01
v/c Ratio		0.57	0.38	0.79	0.57	0.16	0.84	0.72	0.25	0.86	0.74	0.02
Uniform Delay, d1		38.0	24.0	37.2	27.7	11.3	31.8	26.2	21.9	30.2	24.6	19.0
Progression Factor		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2		4.8	0.5	18.4	1.6	0.1	14.6	2.0	0.5	8.0	2.1	0.0
Delay (s)		42.8	24.5	55.7	29.3	11.3	46.4	28.2	22.4	38.2	26.7	19.0
Level of Service		D	C	E	C	B	D	C	C	D	C	B
Approach Delay (s)		29.4			30.4			30.3			30.8	
Approach LOS		C			C			C			C	

Intersection Summary

HCM 2000 Control Delay	30.5	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.82		
Actuated Cycle Length (s)	86.6	Sum of lost time (s)	20.0
Intersection Capacity Utilization	67.3%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
32: Isabel Ave & Jack London Blvd

BART to Livermore Extension Project
2025 DMU AM



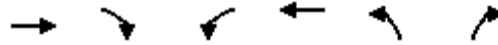
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↕	↖	↖	↕	↖	↖↗	↕↕	↖	↖↗	↕↕	↖
Traffic Volume (vph)	29	52	52	206	733	336	348	964	98	156	1135	274
Future Volume (vph)	29	52	52	206	733	336	348	964	98	156	1135	274
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.97	0.91	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	3433	5085	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	3433	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	32	57	57	224	797	365	378	1048	107	170	1234	298
RTOR Reduction (vph)	0	0	47	0	0	66	0	0	70	0	0	123
Lane Group Flow (vph)	32	57	10	224	797	299	378	1048	37	170	1234	175
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8	1	5	2		1	NA	6
Permitted Phases			4			8			2			6
Actuated Green, G (s)	3.7	17.2	17.2	13.6	27.1	36.8	11.1	32.5	32.5	9.7	31.1	31.1
Effective Green, g (s)	3.7	17.2	17.2	13.6	27.1	36.8	11.1	32.5	32.5	9.7	31.1	31.1
Actuated g/C Ratio	0.04	0.18	0.18	0.14	0.29	0.39	0.12	0.35	0.35	0.10	0.33	0.33
Clearance Time (s)	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	134	646	289	255	1018	707	404	1754	546	353	1678	522
v/s Ratio Prot	0.01	0.02		c0.13	c0.23	0.04	c0.11	0.21		0.05	c0.24	
v/s Ratio Perm			0.01			0.15			0.02			0.11
v/c Ratio	0.24	0.09	0.04	0.88	0.78	0.42	0.94	0.60	0.07	0.48	0.74	0.34
Uniform Delay, d1	43.9	32.0	31.7	39.5	30.8	21.0	41.2	25.5	20.7	39.9	27.9	23.8
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.9	0.1	0.1	27.0	4.0	0.4	28.8	0.6	0.1	1.0	1.7	0.4
Delay (s)	44.8	32.0	31.7	66.5	34.8	21.4	70.0	26.0	20.7	40.9	29.6	24.2
Level of Service	D	C	C	E	C	C	E	C	C	D	C	C
Approach Delay (s)		34.7			36.4			36.5			29.8	
Approach LOS		C			D			D			C	

Intersection Summary

HCM 2000 Control Delay	34.0	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.83		
Actuated Cycle Length (s)	94.2	Sum of lost time (s)	21.2
Intersection Capacity Utilization	65.4%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 33: Isabel Ave Connector & Stanley Blvd



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑	↑	↑↓	↑↑	↑↓	↑↓
Traffic Volume (vph)	346	172	321	1946	388	202
Future Volume (vph)	346	172	321	1946	388	202
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	3.8	4.0	4.0	4.0	2.5
Lane Util. Factor	0.95	1.00	0.97	0.95	0.97	0.88
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	3539	1583	3433	3539	3433	2787
Flt Permitted	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (perm)	3539	1583	3433	3539	3433	2787
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	376	187	349	2115	422	220
RTOR Reduction (vph)	0	17	0	0	0	140
Lane Group Flow (vph)	376	170	349	2115	422	80
Turn Type	NA	pm+ov	Prot	NA	Prot	pm+ov
Protected Phases	2	8	1	6	8	1
Permitted Phases		2				8
Actuated Green, G (s)	37.9	51.8	12.0	53.9	13.9	25.9
Effective Green, g (s)	39.6	55.2	12.0	55.6	15.4	28.9
Actuated g/C Ratio	0.50	0.70	0.15	0.70	0.19	0.37
Clearance Time (s)	5.7	5.5	4.0	5.7	5.5	4.0
Vehicle Extension (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Grp Cap (vph)	1773	1106	521	2490	669	1019
v/s Ratio Prot	0.11	0.03	0.10	c0.60	c0.12	0.01
v/s Ratio Perm		0.08				0.02
v/c Ratio	0.21	0.15	0.67	0.85	0.63	0.08
Uniform Delay, d1	11.0	4.0	31.6	8.6	29.2	16.4
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.0	0.0	2.5	2.8	1.4	0.0
Delay (s)	11.0	4.0	34.2	11.4	30.6	16.4
Level of Service	B	A	C	B	C	B
Approach Delay (s)	8.7			14.6	25.7	
Approach LOS	A			B	C	

Intersection Summary

HCM 2000 Control Delay	15.7	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.85		
Actuated Cycle Length (s)	79.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	71.5%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 34: Murrieta Blvd/Driveway & Portola Ave



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗		↖	↗		↖	↗	↗		↗	
Traffic Volume (vph)	0	475	93	270	1552	1	190	6	146	1	3	0
Future Volume (vph)	0	475	93	270	1552	1	190	6	146	1	3	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.8		4.0	5.8		5.2	5.2	5.2		4.0	
Lane Util. Factor		0.95		1.00	0.95		0.95	0.95	1.00		1.00	
Frt		0.98		1.00	1.00		1.00	1.00	0.85		1.00	
Flt Protected		1.00		0.95	1.00		0.95	0.96	1.00		0.99	
Satd. Flow (prot)		3452		1770	3539		1681	1691	1583		1840	
Flt Permitted		1.00		0.95	1.00		0.95	0.96	1.00		0.99	
Satd. Flow (perm)		3452		1770	3539		1681	1691	1583		1840	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	516	101	293	1687	1	207	7	159	1	3	0
RTOR Reduction (vph)	0	17	0	0	0	0	0	0	139	0	0	0
Lane Group Flow (vph)	0	600	0	293	1688	0	108	106	20	0	4	0
Turn Type	Prot	NA		Prot	NA		Split	NA	Perm		Split	NA
Protected Phases	5	2		1	6		8	8		4	4	
Permitted Phases									8			
Actuated Green, G (s)		23.7		12.1	39.8		8.3	8.3	8.3		0.7	
Effective Green, g (s)		22.8		12.1	38.9		7.7	7.7	7.7		0.7	
Actuated g/C Ratio		0.37		0.19	0.62		0.12	0.12	0.12		0.01	
Clearance Time (s)		4.9		4.0	4.9		4.6	4.6	4.6		4.0	
Vehicle Extension (s)		2.0		2.0	2.0		2.0	2.0	2.0		2.0	
Lane Grp Cap (vph)		1263		343	2209		207	209	195		20	
v/s Ratio Prot		0.17		0.17	c0.48		c0.06	0.06			c0.00	
v/s Ratio Perm									0.01			
v/c Ratio		0.47		0.85	0.76		0.52	0.51	0.10		0.20	
Uniform Delay, d1		15.2		24.2	8.4		25.6	25.5	24.2		30.5	
Progression Factor		1.00		1.00	1.00		1.00	1.00	1.00		1.00	
Incremental Delay, d2		0.1		17.7	1.5		1.1	0.7	0.1		1.8	
Delay (s)		15.3		41.9	9.9		26.7	26.2	24.3		32.3	
Level of Service		B		D	A		C	C	C		C	
Approach Delay (s)		15.3			14.6			25.5			32.3	
Approach LOS		B			B			C			C	

Intersection Summary		
HCM 2000 Control Delay	16.1	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.78	B
Actuated Cycle Length (s)	62.3	Sum of lost time (s)
Intersection Capacity Utilization	70.9%	19.0
Analysis Period (min)	15	ICU Level of Service
		C

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
35: Murrieta Blvd & Jack London Blvd



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	76	259	623	206	248	167
Future Volume (vph)	76	259	623	206	248	167
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00	1.00	0.95	0.91	
Frt	1.00	0.85	1.00	1.00	0.94	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1770	1583	1770	3539	4778	
Flt Permitted	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	1770	1583	1770	3539	4778	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	83	282	677	224	270	182
RTOR Reduction (vph)	0	240	0	0	152	0
Lane Group Flow (vph)	83	42	677	224	300	0
Turn Type	Prot	Perm	Prot	NA	NA	
Protected Phases	4		5	2	6	
Permitted Phases		4				
Actuated Green, G (s)	8.5	8.5	27.3	40.9	9.6	
Effective Green, g (s)	8.5	8.5	27.3	40.9	9.6	
Actuated g/C Ratio	0.15	0.15	0.48	0.71	0.17	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	262	234	841	2521	799	
v/s Ratio Prot	c0.05		c0.38	0.06	c0.06	
v/s Ratio Perm		0.03				
v/c Ratio	0.32	0.18	0.80	0.09	0.38	
Uniform Delay, d1	21.9	21.4	12.8	2.5	21.2	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.7	0.4	5.6	0.0	0.3	
Delay (s)	22.6	21.8	18.4	2.5	21.5	
Level of Service	C	C	B	A	C	
Approach Delay (s)	21.9			14.5	21.5	
Approach LOS	C			B	C	

Intersection Summary

HCM 2000 Control Delay	17.9	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.62		
Actuated Cycle Length (s)	57.4	Sum of lost time (s)	12.0
Intersection Capacity Utilization	57.3%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 36: Murrieta Blvd & Stanley Blvd



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↕	↖	↖	↕	↖	↖↗	↕		↖	↕	↖
Traffic Volume (vph)	212	436	222	18	825	116	427	338	8	155	225	446
Future Volume (vph)	212	436	222	18	825	116	427	338	8	155	225	446
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.9	4.9	4.0	4.9	4.9	4.9	4.9		4.9	4.9	4.0
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.97	0.95		1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	3433	3527		1770	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	3433	3527		1770	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	230	474	241	20	897	126	464	367	9	168	245	485
RTOR Reduction (vph)	0	0	157	0	0	63	0	2	0	0	0	98
Lane Group Flow (vph)	230	474	84	20	897	63	464	374	0	168	245	387
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Prot	NA		Prot	NA	Perm
Protected Phases	7	4		3	8	1	5	2		1	6	
Permitted Phases			4			8						6
Actuated Green, G (s)	6.0	27.8	27.8	1.6	23.4	35.0	12.0	19.9		11.6	19.5	19.5
Effective Green, g (s)	6.0	26.9	26.9	1.6	22.5	33.2	11.1	19.0		10.7	18.6	19.5
Actuated g/C Ratio	0.08	0.35	0.35	0.02	0.29	0.43	0.14	0.25		0.14	0.24	0.25
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	267	1237	553	36	1035	784	495	871		246	855	401
v/s Ratio Prot	c0.07	0.13		0.01	c0.25	0.01	c0.14	0.11		0.09	0.07	
v/s Ratio Perm			0.05			0.03						c0.24
v/c Ratio	0.86	0.38	0.15	0.56	0.87	0.08	0.94	0.43		0.68	0.29	0.97
Uniform Delay, d1	35.0	18.8	17.2	37.3	25.8	12.9	32.6	24.4		31.5	23.7	28.4
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	23.6	0.2	0.1	17.3	7.8	0.0	25.4	0.3		7.6	0.2	35.7
Delay (s)	58.6	19.0	17.3	54.6	33.5	12.9	58.0	24.7		39.1	23.9	64.1
Level of Service	E	B	B	D	C	B	E	C		D	C	E
Approach Delay (s)		28.2			31.5			43.1			48.4	
Approach LOS		C			C			D			D	

Intersection Summary

HCM 2000 Control Delay	37.3	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.93		
Actuated Cycle Length (s)	76.9	Sum of lost time (s)	18.7
Intersection Capacity Utilization	74.1%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
37: Livermore Ave & I-580 WB Ramps



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↖	↔		↗	↑			↕	
Traffic Volume (vph)	0	0	0	344	88	28	444	79	0	0	151	0
Future Volume (vph)	0	0	0	344	88	28	444	79	0	0	151	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)					4.0		4.0	4.0			4.0	
Lane Util. Factor					0.95		0.97	1.00			0.95	
Frt					0.99		1.00	1.00			1.00	
Flt Protected					0.96		0.95	1.00			1.00	
Satd. Flow (prot)					1690		3433	1863			3539	
Flt Permitted					0.96		0.95	1.00			1.00	
Satd. Flow (perm)					1690		3433	1863			3539	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	374	96	30	483	86	0	0	164	0
RTOR Reduction (vph)	0	0	0	0	5	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	0	495	0	483	86	0	0	164	0
Turn Type				Split	NA		Prot	NA			NA	
Protected Phases				8	8		5	2			6	
Permitted Phases												
Actuated Green, G (s)					21.1		12.0	29.2			13.7	
Effective Green, g (s)					21.1		11.5	30.9			15.4	
Actuated g/C Ratio					0.35		0.19	0.51			0.26	
Clearance Time (s)					4.0		3.5	5.7			5.7	
Vehicle Extension (s)					2.0		2.0	2.5			2.5	
Lane Grp Cap (vph)					594		657	959			908	
v/s Ratio Prot					c0.29		c0.14	0.05			c0.05	
v/s Ratio Perm												
v/c Ratio					0.83		0.74	0.09			0.18	
Uniform Delay, d1					17.8		22.8	7.4			17.4	
Progression Factor					1.00		0.73	0.32			1.00	
Incremental Delay, d2					9.4		3.4	0.2			0.4	
Delay (s)					27.2		20.1	2.5			17.8	
Level of Service					C		C	A			B	
Approach Delay (s)		0.0			27.2			17.5			17.8	
Approach LOS		A			C			B			B	

Intersection Summary

HCM 2000 Control Delay	21.5	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.60		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	49.6%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 38: Livermore Ave & I-580 EB Ramps































Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕	↗					↕		↗	↕	
Traffic Volume (vph)	13	1	608	0	0	0	0	508	280	20	480	0
Future Volume (vph)	13	1	608	0	0	0	0	508	280	20	480	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0					4.0		4.0	4.0	
Lane Util. Factor		0.95	0.95					0.95		1.00	0.95	
Frt		0.86	0.85					0.95		1.00	1.00	
Flt Protected		1.00	1.00					1.00		0.95	1.00	
Satd. Flow (prot)		1513	1504					3351		1770	3539	
Flt Permitted		1.00	1.00					1.00		0.95	1.00	
Satd. Flow (perm)		1513	1504					3351		1770	3539	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	14	1	661	0	0	0	0	552	304	22	522	0
RTOR Reduction (vph)	0	225	225	0	0	0	0	92	0	0	0	0
Lane Group Flow (vph)	0	114	112	0	0	0	0	764	0	22	522	0
Turn Type	Prot	NA	Perm					NA		Prot	NA	
Protected Phases	7	4						2		1	6	
Permitted Phases			4									
Actuated Green, G (s)		15.8	15.8					30.9		1.3	35.2	
Effective Green, g (s)		15.8	15.8					31.9		0.3	36.2	
Actuated g/C Ratio		0.26	0.26					0.53		0.00	0.60	
Clearance Time (s)		4.0	4.0					5.0		3.0	5.0	
Vehicle Extension (s)		2.0	2.0					2.5		2.0	2.5	
Lane Grp Cap (vph)		398	396					1781		8	2135	
v/s Ratio Prot								c0.23		c0.01	0.15	
v/s Ratio Perm		0.08	0.07									
v/c Ratio		0.29	0.28					0.43		2.75	0.24	
Uniform Delay, d1		17.6	17.6					8.5		29.9	5.5	
Progression Factor		1.00	1.00					1.00		1.08	0.23	
Incremental Delay, d2		0.1	0.1					0.8		1020.0	0.2	
Delay (s)		17.7	17.7					9.3		1052.1	1.5	
Level of Service		B	B					A		F	A	
Approach Delay (s)		17.7			0.0			9.3			44.0	
Approach LOS		B			A			A			D	

Intersection Summary		
HCM 2000 Control Delay	21.1	HCM 2000 Level of Service C
HCM 2000 Volume to Capacity ratio	0.39	
Actuated Cycle Length (s)	60.0	Sum of lost time (s) 12.0
Intersection Capacity Utilization	49.6%	ICU Level of Service A
Analysis Period (min)	15	

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
39: Livermore Ave & Portola Ave

BART to Livermore Extension Project
2025 DMU AM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 	 			 			 			 	
Traffic Volume (vph)	269	278	110	25	697	59	354	459	77	94	544	391
Future Volume (vph)	269	278	110	25	697	59	354	459	77	94	544	391
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	5.3	4.0	4.0	5.3	4.0	5.8		4.0	5.8	4.9
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	1.00	0.95		1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.98		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	1770	3463		1770	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	1770	3463		1770	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	292	302	120	27	758	64	385	499	84	102	591	425
RTOR Reduction (vph)	0	0	79	0	0	47	0	12	0	0	0	89
Lane Group Flow (vph)	292	302	41	27	758	17	385	571	0	102	591	336
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA		Prot	NA	pm+ov
Protected Phases	3	8		7	4		1	6		5	2	3
Permitted Phases			8			4						2
Actuated Green, G (s)	11.9	37.2	37.2	3.4	28.7	28.7	25.3	38.6		10.7	24.0	35.9
Effective Green, g (s)	11.9	38.5	37.2	3.4	30.0	28.7	25.3	37.7		10.7	23.1	34.1
Actuated g/C Ratio	0.11	0.36	0.34	0.03	0.28	0.27	0.23	0.35		0.10	0.21	0.32
Clearance Time (s)	4.0	5.3	5.3	4.0	5.3	5.3	4.0	4.9		4.0	4.9	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	377	1260	544	55	982	420	414	1207		175	756	499
v/s Ratio Prot	c0.09	0.09		0.02	c0.21		c0.22	0.16		0.06	c0.17	0.07
v/s Ratio Perm			0.03			0.01						0.14
v/c Ratio	0.77	0.24	0.08	0.49	0.77	0.04	0.93	0.47		0.58	0.78	0.67
Uniform Delay, d1	46.8	24.5	23.9	51.5	35.9	29.5	40.5	27.5		46.6	40.1	32.2
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	9.6	0.1	0.1	6.7	3.8	0.0	27.1	0.3		4.9	5.3	3.6
Delay (s)	56.4	24.6	23.9	58.2	39.7	29.5	67.6	27.8		51.4	45.4	35.7
Level of Service	E	C	C	E	D	C	E	C		D	D	D
Approach Delay (s)		37.5			39.5			43.6			42.3	
Approach LOS		D			D			D			D	

Intersection Summary

HCM 2000 Control Delay	41.1	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.83		
Actuated Cycle Length (s)	108.1	Sum of lost time (s)	18.7
Intersection Capacity Utilization	76.4%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
40: First St/Springtown Blvd & I-580 WB Ramps





















Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations			↗↘			↗	↗↘	↑			↗↘	↗
Traffic Volume (vph)	0	0	443	0	0	0	341	375	0	0	875	606
Future Volume (vph)	0	0	443	0	0	0	341	375	0	0	875	606
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)			4.0				4.0	4.0			5.0	5.0
Lane Util. Factor			0.88				0.97	1.00			0.95	1.00
Frt			0.85				1.00	1.00			1.00	0.85
Flt Protected			1.00				0.95	1.00			1.00	1.00
Satd. Flow (prot)			2787				3433	1863			3539	1583
Flt Permitted			1.00				0.95	1.00			1.00	1.00
Satd. Flow (perm)			2787				3433	1863			3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	482	0	0	0	371	408	0	0	951	659
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	67
Lane Group Flow (vph)	0	0	482	0	0	0	371	408	0	0	951	592
Turn Type			Over			Free	Prot	NA			NA	Perm
Protected Phases			5				5	2			6	
Permitted Phases						Free						6
Actuated Green, G (s)			16.1				16.1	70.0			45.9	45.9
Effective Green, g (s)			15.6				15.6	70.0			45.4	45.4
Actuated g/C Ratio			0.22				0.22	1.00			0.65	0.65
Clearance Time (s)			3.5				3.5	4.0			4.5	4.5
Vehicle Extension (s)			2.0				2.0	0.2			4.0	4.0
Lane Grp Cap (vph)			621				765	1863			2295	1026
v/s Ratio Prot			c0.17				0.11	0.22			0.27	
v/s Ratio Perm												c0.37
v/c Ratio			0.78				0.48	0.22			0.41	0.58
Uniform Delay, d1			25.6				23.7	0.0			5.9	6.9
Progression Factor			1.00				0.82	1.00			1.00	1.00
Incremental Delay, d2			5.5				0.2	0.3			0.2	0.9
Delay (s)			31.1				19.7	0.3			6.1	7.9
Level of Service			C				B	A			A	A
Approach Delay (s)		31.1			0.0			9.5			6.8	
Approach LOS		C			A			A			A	

Intersection Summary		
HCM 2000 Control Delay	11.6	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.63	B
Actuated Cycle Length (s)	70.0	Sum of lost time (s)
Intersection Capacity Utilization	54.8%	9.0
Analysis Period (min)	15	ICU Level of Service
		A

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
41: First St & I-580 EB Ramps

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations													
Traffic Volume (vph)	90	1	356	0	0	0	0	633	362	71	1218	0	
Future Volume (vph)	90	1	356	0	0	0	0	633	362	71	1218	0	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)		4.0	4.0					5.0	5.0	4.0	5.0		
Lane Util. Factor		1.00	0.88					0.95	1.00	1.00	0.95		
Frt		1.00	0.85					1.00	0.85	1.00	1.00		
Flt Protected		0.95	1.00					1.00	1.00	0.95	1.00		
Satd. Flow (prot)		1775	2787					3539	1583	1770	3539		
Flt Permitted		0.95	1.00					1.00	1.00	0.95	1.00		
Satd. Flow (perm)		1775	2787					3539	1583	1770	3539		
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	
Adj. Flow (vph)	98	1	387	0	0	0	0	688	393	77	1324	0	
RTOR Reduction (vph)	0	0	96	0	0	0	0	0	167	0	0	0	
Lane Group Flow (vph)	0	99	291	0	0	0	0	688	226	77	1324	0	
Turn Type	Perm	NA	Perm					NA	Perm	Prot	NA		
Protected Phases		4						2		1	6		
Permitted Phases	4		4						2				
Actuated Green, G (s)		12.0	12.0					40.7	40.7	6.3	50.0		
Effective Green, g (s)		11.5	11.5					40.2	40.2	5.3	49.5		
Actuated g/C Ratio		0.16	0.16					0.57	0.57	0.08	0.71		
Clearance Time (s)		3.5	3.5					4.5	4.5	3.0	4.5		
Vehicle Extension (s)		2.5	2.5					4.0	4.0	2.0	4.0		
Lane Grp Cap (vph)		291	457					2032	909	134	2502		
v/s Ratio Prot								0.19		0.04	c0.37		
v/s Ratio Perm		0.06	c0.10						0.14				
v/c Ratio		0.34	0.64					0.34	0.25	0.57	0.53		
Uniform Delay, d1		25.9	27.3					7.9	7.4	31.3	4.8		
Progression Factor		1.00	1.00					1.00	1.00	1.09	0.62		
Incremental Delay, d2		0.5	2.5					0.5	0.7	3.3	0.7		
Delay (s)		26.4	29.8					8.3	8.1	37.5	3.7		
Level of Service		C	C					A	A	D	A		
Approach Delay (s)		29.1			0.0			8.2			5.5		
Approach LOS		C			A			A			A		
Intersection Summary													
HCM 2000 Control Delay			10.4									HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio			0.59										
Actuated Cycle Length (s)			70.0									Sum of lost time (s)	13.0
Intersection Capacity Utilization			53.6%									ICU Level of Service	A
Analysis Period (min)			15										
c Critical Lane Group													

HCM Signalized Intersection Capacity Analysis
42: 1st St & Mines Rd

BART to Livermore Extension Project
2025 DMU AM





















Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗		↖↗	↑	↖	↖	↑↑↑		↖↗	↑↑↑	
Traffic Volume (vph)	34	70	41	522	107	337	19	888	310	210	1218	21
Future Volume (vph)	34	70	41	522	107	337	19	888	310	210	1218	21
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		0.97	1.00	1.00	1.00	0.91		0.97	0.91	
Frt	1.00	0.94		1.00	1.00	0.85	1.00	0.96		1.00	1.00	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1759		3433	1863	1583	1770	4888		3433	5072	
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	1759		3433	1863	1583	1770	4888		3433	5072	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	37	76	45	567	116	366	21	965	337	228	1324	23
RTOR Reduction (vph)	0	34	0	0	0	75	0	82	0	0	2	0
Lane Group Flow (vph)	37	87	0	567	116	291	21	1220	0	228	1345	0
Turn Type	Prot	NA		Prot	NA	pm+ov	Prot	NA		Prot	NA	
Protected Phases	7	4		3	8	1	5	2		1	6	
Permitted Phases						8						
Actuated Green, G (s)	1.8	8.5		12.2	18.9	24.0	0.7	23.5		5.1	27.9	
Effective Green, g (s)	1.8	8.5		12.2	18.9	24.0	0.7	23.5		5.1	27.9	
Actuated g/C Ratio	0.03	0.13		0.19	0.29	0.37	0.01	0.36		0.08	0.43	
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	48	228		641	539	678	18	1759		268	2167	
v/s Ratio Prot	0.02	0.05		c0.17	0.06	c0.03	0.01	c0.25		c0.07	0.27	
v/s Ratio Perm						0.15						
v/c Ratio	0.77	0.38		0.88	0.22	0.43	1.17	0.69		0.85	0.62	
Uniform Delay, d1	31.5	26.0		25.9	17.6	15.5	32.3	17.8		29.7	14.6	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	53.1	1.1		13.7	0.2	0.4	269.7	1.2		21.9	0.6	
Delay (s)	84.7	27.1		39.6	17.8	15.9	302.0	19.0		51.7	15.1	
Level of Service	F	C		D	B	B	F	B		D	B	
Approach Delay (s)		40.6			28.9			23.5			20.4	
Approach LOS		D			C			C			C	

Intersection Summary




















HCM 2000 Control Delay	24.4	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.75		
Actuated Cycle Length (s)	65.3	Sum of lost time (s)	16.0
Intersection Capacity Utilization	61.6%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Unsignalized Intersection Capacity Analysis
43: Vasco Rd & I-580 WB Ramps

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	0	0	170	0	830	0	0	1558	0
Future Volume (Veh/h)	0	0	0	0	0	170	0	830	0	0	1558	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	0	0	0	185	0	902	0	0	1693	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage (veh)												
Upstream signal (ft)											487	
pX, platoon unblocked												
vC, conflicting volume	2329	2595	1693	2595	2595	451	1693			902		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	2329	2595	1693	2595	2595	451	1693			902		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	100	100	67	100			100		
cM capacity (veh/h)	13	25	82	12	25	556	373			749		
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	SB 1	SB 2					
Volume Total	0	185	451	451	0	1693	0					
Volume Left	0	0	0	0	0	0	0					
Volume Right	0	185	0	0	0	0	0					
cSH	1700	556	1700	1700	1700	1700	1700					
Volume to Capacity	0.00	0.33	0.27	0.27	0.00	1.00	0.00					
Queue Length 95th (ft)	0	36	0	0	0	0	0					
Control Delay (s)	0.0	14.7	0.0	0.0	0.0	0.0	0.0					
Lane LOS	A	B										
Approach Delay (s)	0.0	14.7	0.0			0.0						
Approach LOS	A	B										
Intersection Summary												
Average Delay			1.0									
Intersection Capacity Utilization			85.3%	ICU Level of Service	E							
Analysis Period (min)			15									

HCM Unsignalized Intersection Capacity Analysis
44: Vasco Rd & I-580 EB Ramps

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	0	0	0	0	1117	0	73	1775	0
Future Volume (Veh/h)	0	0	0	0	0	0	0	1117	0	73	1775	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	0	0	0	0	0	1214	0	79	1929	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	2694	3301	1929	3301	3301	607	1929			1214		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	2694	3301	1929	3301	3301	607	1929			1214		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	100	100	100	100			86		
cM capacity (veh/h)	9	7	56	3	7	439	302			570		
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2						
Volume Total	0	0	809	405	79	1929						
Volume Left	0	0	0	0	79	0						
Volume Right	0	0	0	0	0	0						
cSH	1700	1700	1700	1700	570	1700						
Volume to Capacity	0.00	0.00	0.48	0.24	0.14	1.13						
Queue Length 95th (ft)	0	0	0	0	12	0						
Control Delay (s)	0.0	0.0	0.0	0.0	12.3	0.0						
Lane LOS	A	A			B							
Approach Delay (s)	0.0	0.0	0.0		0.5							
Approach LOS	A	A										
Intersection Summary												
Average Delay			0.3									
Intersection Capacity Utilization			96.8%	ICU Level of Service	F							
Analysis Period (min)			15									

HCM Signalized Intersection Capacity Analysis
45: Vasco Rd & East Ave

BART to Livermore Extension Project
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Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	275	322	50	7	18	14	63	251	183	235	286	279
Future Volume (vph)	275	322	50	7	18	14	63	251	183	235	286	279
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	0.95		0.97	1.00	1.00
Frt	1.00	0.98		1.00	0.94		1.00	0.94		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	3468		1770	3312		1770	3315		3433	1863	1583
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1770	3468		1770	3312		1770	3315		3433	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	299	350	54	8	20	15	68	273	199	255	311	303
RTOR Reduction (vph)	0	21	0	0	14	0	0	146	0	0	0	203
Lane Group Flow (vph)	299	383	0	8	21	0	68	326	0	255	311	100
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												6
Actuated Green, G (s)	12.2	14.3		0.6	2.7		2.2	13.2		5.2	16.2	16.2
Effective Green, g (s)	12.2	14.3		0.6	2.7		2.2	13.2		5.2	16.2	16.2
Actuated g/C Ratio	0.25	0.29		0.01	0.05		0.04	0.27		0.11	0.33	0.33
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	438	1005		21	181		78	887		362	612	520
v/s Ratio Prot	c0.17	c0.11		0.00	0.01		0.04	0.10		c0.07	c0.17	
v/s Ratio Perm												0.06
v/c Ratio	0.68	0.38		0.38	0.12		0.87	0.37		0.70	0.51	0.19
Uniform Delay, d1	16.8	14.0		24.2	22.2		23.4	14.7		21.3	13.3	11.9
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	4.4	0.2		11.2	0.3		60.6	0.3		6.1	0.7	0.2
Delay (s)	21.2	14.2		35.3	22.4		84.0	14.9		27.4	14.0	12.0
Level of Service	C	B		D	C		F	B		C	B	B
Approach Delay (s)		17.2			24.8			23.6			17.3	
Approach LOS		B			C			C			B	

Intersection Summary

HCM 2000 Control Delay	19.0	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.63		
Actuated Cycle Length (s)	49.3	Sum of lost time (s)	16.0
Intersection Capacity Utilization	51.4%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Unsignalized Intersection Capacity Analysis
 46: I-580 WB Ramps & Northfront Rd/Northfront Road



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	116	213	1301	124	64	541
Future Volume (Veh/h)	116	213	1301	124	64	541
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	126	232	1414	135	70	588
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None		None			
Median storage (veh)						
Upstream signal (ft)	1007					
pX, platoon unblocked					0.50	
vC, conflicting volume			126	3205 242		
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			126	4909	242	
tC, single (s)			4.1	6.4	6.2	
tC, 2 stage (s)						
tF (s)			2.2	3.5	3.3	
p0 queue free %			3	0	26	
cM capacity (veh/h)			1460	0	797	
Direction, Lane #	EB 1	WB 1	NB 1	NB 2		
Volume Total	358	1549	70	588		
Volume Left	0	1414	70	0		
Volume Right	232	0	0	588		
cSH	1700	1460	0	797		
Volume to Capacity	0.21	0.97	5647.38	0.74		
Queue Length 95th (ft)	0	508	Err	168		
Control Delay (s)	0.0	33.9	Err	21.1		
Lane LOS	D		F	C		
Approach Delay (s)	0.0	33.9	1082.6			
Approach LOS			F			
Intersection Summary						
Average Delay			298.2			
Intersection Capacity Utilization			111.3%	ICU Level of Service	H	
Analysis Period (min)			15			

Intersection	
Intersection Delay, s/veh	9.9
Intersection LOS	A

Movement	EBU	EBL	EBT	WBU	WBT	WBR	SBU	SBL	SBR
Lane Configurations		↘	↕↕		↕	↘		↘↘	↘
Traffic Vol, veh/h	0	47	22	0	151	121	0	304	88
Future Vol, veh/h	0	47	22	0	151	121	0	304	88
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	51	24	0	164	132	0	330	96
Number of Lanes	0	1	2	0	1	1	0	2	1

Approach	EB	WB	SB
Opposing Approach	WB	EB	
Opposing Lanes	2	3	0
Conflicting Approach Left	SB		WB
Conflicting Lanes Left	3	0	2
Conflicting Approach Right		SB	EB
Conflicting Lanes Right	0	3	3
HCM Control Delay	9.7	10	9.9
HCM LOS	A	A	A

Lane	EBLn1	EBLn2	EBLn3	WBLn1	WBLn2	SBLn1	SBLn2	SBLn3
Vol Left, %	100%	0%	0%	0%	0%	100%	100%	0%
Vol Thru, %	0%	100%	100%	100%	0%	0%	0%	0%
Vol Right, %	0%	0%	0%	0%	100%	0%	0%	100%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	47	11	11	151	121	152	152	88
LT Vol	47	0	0	0	0	152	152	0
Through Vol	0	11	11	151	0	0	0	0
RT Vol	0	0	0	0	121	0	0	88
Lane Flow Rate	51	12	12	164	132	165	165	96
Geometry Grp	8	8	8	8	8	7	7	7
Degree of Util (X)	0.098	0.021	0.015	0.266	0.187	0.273	0.273	0.08
Departure Headway (Hd)	6.872	6.366	4.613	5.832	5.126	5.952	5.952	3.016
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cap	525	566	781	611	693	600	600	1165
Service Time	4.572	4.066	2.313	3.616	2.91	3.732	3.732	0.795
HCM Lane V/C Ratio	0.097	0.021	0.015	0.268	0.19	0.275	0.275	0.082
HCM Control Delay	10.3	9.2	7.4	10.7	9.1	11	11	6.1
HCM Lane LOS	B	A	A	B	A	B	B	A
HCM 95th-tile Q	0.3	0.1	0	1.1	0.7	1.1	1.1	0.3

HCM Signalized Intersection Capacity Analysis
48: Greenville Rd & Northfront Road/Altamont Pass Road



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↑	↑	↑	↑	↑
Traffic Volume (vph)	4	652	270	877	620	63
Future Volume (vph)	4	652	270	877	620	63
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	1863	1583	1770	1863	1770	1583
Flt Permitted	1.00	1.00	0.76	1.00	0.95	1.00
Satd. Flow (perm)	1863	1583	1407	1863	1770	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	4	709	293	953	674	68
RTOR Reduction (vph)	0	331	0	0	0	21
Lane Group Flow (vph)	4	378	293	953	674	47
Turn Type	NA	Perm	Perm	NA	Prot	Perm
Protected Phases	4			8	2	
Permitted Phases		4	8			2
Actuated Green, G (s)	61.8	61.8	61.8	61.8	46.1	46.1
Effective Green, g (s)	61.8	61.8	61.8	61.8	46.1	46.1
Actuated g/C Ratio	0.53	0.53	0.53	0.53	0.40	0.40
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	993	844	750	993	704	629
v/s Ratio Prot	0.00			c0.51	c0.38	
v/s Ratio Perm		0.24	0.21			0.03
v/c Ratio	0.00	0.45	0.39	0.96	0.96	0.07
Uniform Delay, d1	12.7	16.6	15.9	25.9	33.9	21.7
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.0	0.4	0.3	19.3	23.7	0.1
Delay (s)	12.7	17.0	16.3	45.1	57.6	21.7
Level of Service	B	B	B	D	E	C
Approach Delay (s)	16.9			38.3	54.3	
Approach LOS	B			D	D	

Intersection Summary

HCM 2000 Control Delay	37.1	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.96		
Actuated Cycle Length (s)	115.9	Sum of lost time (s)	8.0
Intersection Capacity Utilization	87.2%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	118	229	138	559	745	126
Future Volume (vph)	118	229	138	559	745	126
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.2	5.2	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.88	0.97	0.95	0.95	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	3433	2787	3433	3539	3539	1583
Flt Permitted	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (perm)	3433	2787	3433	3539	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	128	249	150	608	810	137
RTOR Reduction (vph)	0	218	0	0	0	72
Lane Group Flow (vph)	128	31	150	608	810	65
Turn Type	Prot	Perm	Prot	NA	NA	Perm
Protected Phases	8		1	6	2	
Permitted Phases		8				2
Actuated Green, G (s)	5.7	5.7	3.1	24.5	17.4	17.4
Effective Green, g (s)	5.1	5.1	3.1	26.2	19.1	19.1
Actuated g/C Ratio	0.13	0.13	0.08	0.65	0.47	0.47
Clearance Time (s)	4.6	4.6	4.0	5.7	5.7	5.7
Vehicle Extension (s)	5.0	5.0	6.0	2.5	2.5	2.5
Lane Grp Cap (vph)	432	350	262	2289	1669	746
v/s Ratio Prot	c0.04		c0.04	0.17	c0.23	
v/s Ratio Perm		0.01				0.04
v/c Ratio	0.30	0.09	0.57	0.27	0.49	0.09
Uniform Delay, d1	16.1	15.6	18.1	3.0	7.3	5.9
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.8	0.2	5.9	0.0	0.2	0.0
Delay (s)	16.9	15.9	24.0	3.1	7.5	5.9
Level of Service	B	B	C	A	A	A
Approach Delay (s)	16.2			7.2	7.3	
Approach LOS	B			A	A	

Intersection Summary

HCM 2000 Control Delay	8.9	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.46		
Actuated Cycle Length (s)	40.5	Sum of lost time (s)	13.2
Intersection Capacity Utilization	38.9%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
50: Greenville Rd & Patterson Pass Rd

BART to Livermore Extension Project
2025 DMU AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	30	3	25	221	353	595	8	145	1	9	343	48
Future Volume (vph)	30	3	25	221	353	595	8	145	1	9	343	48
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.86		1.00	0.91		1.00	1.00		1.00	0.98	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1611		1770	1687		1770	1861		1770	1829	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	1611		1770	1687		1770	1861		1770	1829	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	33	3	27	240	384	647	9	158	1	10	373	52
RTOR Reduction (vph)	0	20	0	0	48	0	0	0	0	0	4	0
Lane Group Flow (vph)	33	10	0	240	983	0	9	159	0	10	421	0
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												
Actuated Green, G (s)	2.3	30.1		40.4	68.2		0.7	28.1		0.7	28.1	
Effective Green, g (s)	2.3	30.1		40.4	68.2		0.7	28.1		0.7	28.1	
Actuated g/C Ratio	0.02	0.26		0.35	0.59		0.01	0.24		0.01	0.24	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	35	420		620	997		10	453		10	445	
v/s Ratio Prot	c0.02	0.01		0.14	c0.58		0.01	0.09		c0.01	c0.23	
v/s Ratio Perm												
v/c Ratio	0.94	0.02		0.39	0.99		0.90	0.35		1.00	0.95	
Uniform Delay, d1	56.4	31.7		28.1	23.1		57.3	36.1		57.3	42.9	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	128.2	0.0		0.4	24.9		226.0	2.1		284.6	31.2	
Delay (s)	184.6	31.7		28.5	48.0		283.2	38.2		341.9	74.1	
Level of Service	F	C		C	D		F	D		F	E	
Approach Delay (s)		111.8			44.3			51.3			80.2	
Approach LOS		F			D			D			F	

Intersection Summary

HCM 2000 Control Delay	55.2	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	0.97		
Actuated Cycle Length (s)	115.3	Sum of lost time (s)	16.0
Intersection Capacity Utilization	82.7%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
1: Dougherty Rd & Amador Valley Rd



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	325	464	660	1979	1078	214
Future Volume (vph)	325	464	660	1979	1078	214
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5	5.7	5.7	
Lane Util. Factor	1.00	1.00	0.97	0.91	0.91	
Frt	1.00	0.85	1.00	1.00	0.98	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1770	1583	3433	5085	4959	
Flt Permitted	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	1770	1583	3433	5085	4959	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	353	504	717	2151	1172	233
RTOR Reduction (vph)	0	229	0	0	30	0
Lane Group Flow (vph)	353	275	717	2151	1375	0
Turn Type	Perm	Perm	Prot	NA	NA	
Protected Phases			5	2	6	
Permitted Phases	4	4				
Actuated Green, G (s)	20.8	20.8	13.6	55.5	37.4	
Effective Green, g (s)	20.8	20.8	13.6	55.5	37.4	
Actuated g/C Ratio	0.24	0.24	0.16	0.64	0.43	
Clearance Time (s)	4.5	4.5	4.5	5.7	5.7	
Vehicle Extension (s)	1.8	1.8	2.0	4.0	4.0	
Lane Grp Cap (vph)	425	380	539	3262	2144	
v/s Ratio Prot			c0.21	c0.42	0.28	
v/s Ratio Perm	c0.20	0.17				
v/c Ratio	0.83	0.72	1.33	0.66	0.64	
Uniform Delay, d1	31.2	30.2	36.5	9.6	19.3	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	12.4	5.7	161.0	0.5	0.7	
Delay (s)	43.6	35.9	197.5	10.2	20.0	
Level of Service	D	D	F	B	C	
Approach Delay (s)	39.0			57.0	20.0	
Approach LOS	D			E	C	

Intersection Summary

HCM 2000 Control Delay	43.9	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.86		
Actuated Cycle Length (s)	86.5	Sum of lost time (s)	14.7
Intersection Capacity Utilization	74.7%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
2: Dougherty Rd & Dublin Blvd

BART to Livermore Extension Project
2025 DMU PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↑↑↑	↖↗	↖↗↘	↑↑↑	↖	↖↗↘	↑↑↑	↖↗	↖↗	↑↑↑	↖↗
Traffic Volume (vph)	87	1020	910	550	835	729	805	1888	293	626	1247	36
Future Volume (vph)	87	1020	910	550	835	729	805	1888	293	626	1247	36
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	6.0	5.0	5.0	5.5	5.0	5.0	5.5	5.0	5.0	5.5	
Lane Util. Factor	0.97	0.91	0.88	0.94	0.91	1.00	0.94	0.91	0.88	0.97	0.86	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	3433	5085	2787	4990	5085	1583	4990	5085	2787	3433	6381	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	3433	5085	2787	4990	5085	1583	4990	5085	2787	3433	6381	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	95	1109	989	598	908	792	875	2052	318	680	1355	39
RTOR Reduction (vph)	0	0	36	0	0	57	0	0	34	0	3	0
Lane Group Flow (vph)	95	1109	953	598	908	735	875	2052	284	680	1391	0
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	
Protected Phases	5	2	3	1	6	7	3	8	1	7	4	
Permitted Phases			2			6			8			
Actuated Green, G (s)	15.0	34.4	54.3	18.3	38.2	52.3	19.9	45.0	63.3	14.1	39.2	
Effective Green, g (s)	15.0	34.4	54.3	18.3	38.2	52.3	19.9	45.0	63.3	14.1	39.2	
Actuated g/C Ratio	0.11	0.26	0.41	0.14	0.29	0.39	0.15	0.34	0.47	0.11	0.29	
Clearance Time (s)	5.0	6.0	5.0	5.0	5.5	5.0	5.0	5.5	5.0	5.0	5.5	
Vehicle Extension (s)	2.0	4.5	2.0	2.0	4.5	2.0	2.0	4.5	2.0	2.0	4.5	
Lane Grp Cap (vph)	386	1312	1135	685	1457	621	744	1716	1323	363	1876	
v/s Ratio Prot	0.03	0.22	0.13	c0.12	0.18	c0.13	c0.18	c0.40	0.03	c0.20	0.22	
v/s Ratio Perm			0.22			0.34			0.07			
v/c Ratio	0.25	0.85	0.84	0.87	0.62	1.18	1.18	1.20	0.21	1.87	0.74	
Uniform Delay, d1	54.0	46.9	35.6	56.4	41.3	40.5	56.7	44.2	20.5	59.6	42.5	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.1	5.6	5.4	11.5	1.1	98.6	93.0	94.1	0.0	403.3	1.8	
Delay (s)	54.1	52.5	40.9	67.9	42.4	139.1	149.7	138.3	20.5	462.9	44.3	
Level of Service	D	D	D	E	D	F	F	F	C	F	D	
Approach Delay (s)		47.4			82.4			129.8			181.6	
Approach LOS		D			F			F			F	

Intersection Summary

HCM 2000 Control Delay	111.2	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.26		
Actuated Cycle Length (s)	133.3	Sum of lost time (s)	21.5
Intersection Capacity Utilization	107.0%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
3: Dougherty Rd & I-580 WB Ramps



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↔↔		↔↔		↑↑↑			↑↑↑	↔
Traffic Volume (vph)	0	0	0	313	0	659	0	2355	0	0	1638	0
Future Volume (vph)	0	0	0	313	0	659	0	2355	0	0	1638	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0		4.0		4.0			4.0	
Lane Util. Factor				0.97		0.88		0.91			0.86	
Frt				1.00		0.85		1.00			1.00	
Flt Protected				0.95		1.00		1.00			1.00	
Satd. Flow (prot)				3433		2787		5085			4806	
Flt Permitted				0.95		1.00		1.00			1.00	
Satd. Flow (perm)				3433		2787		5085			4806	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	340	0	716	0	2560	0	0	1780	0
RTOR Reduction (vph)	0	0	0	0	0	17	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	340	0	699	0	2560	0	0	1780	0
Turn Type				Prot		Prot		NA			NA	Perm
Protected Phases				4		4		2			6	
Permitted Phases												6
Actuated Green, G (s)				31.4		31.4		67.8			67.8	
Effective Green, g (s)				32.8		32.8		69.2			69.2	
Actuated g/C Ratio				0.30		0.30		0.63			0.63	
Clearance Time (s)				5.4		5.4		5.4			5.4	
Vehicle Extension (s)				3.0		3.0		3.0			3.0	
Lane Grp Cap (vph)				1023		831		3198			3023	
v/s Ratio Prot				0.10		c0.25		c0.50			0.37	
v/s Ratio Perm												
v/c Ratio				0.33		0.84		0.80			0.59	
Uniform Delay, d1				30.1		36.2		15.2			12.0	
Progression Factor				1.00		1.00		0.87			1.00	
Incremental Delay, d2				0.2		7.7		0.7			0.8	
Delay (s)				30.3		43.9		14.0			12.9	
Level of Service				C		D		B			B	
Approach Delay (s)		0.0			39.5			14.0			12.9	
Approach LOS		A			D			B			B	

Intersection Summary

HCM 2000 Control Delay	18.6	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.81		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	75.2%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
4: Hopyard Rd/Dougherty Rd & I-580 EB Ramps



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗		↖↗					↑↑↑	↖		↑↑↑	↖
Traffic Volume (vph)	1110	0	845	0	0	0	0	2452	0	0	1145	0
Future Volume (vph)	1110	0	845	0	0	0	0	2452	0	0	1145	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0					4.0			4.0	
Lane Util. Factor	0.97		0.88					0.91			0.86	
Frt	1.00		0.85					1.00			1.00	
Flt Protected	0.95		1.00					1.00			1.00	
Satd. Flow (prot)	3433		2787					5085			4806	
Flt Permitted	0.95		1.00					1.00			1.00	
Satd. Flow (perm)	3433		2787					5085			4806	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	1207	0	918	0	0	0	0	2665	0	0	1245	0
RTOR Reduction (vph)	0	0	60	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	1207	0	858	0	0	0	0	2665	0	0	1245	0
Turn Type	Prot		Prot					NA	Free		NA	Perm
Protected Phases	4		4					2			6	
Permitted Phases									Free			6
Actuated Green, G (s)	39.6		39.6					59.6			59.6	
Effective Green, g (s)	41.0		41.0					61.0			61.0	
Actuated g/C Ratio	0.37		0.37					0.55			0.55	
Clearance Time (s)	5.4		5.4					5.4			5.4	
Vehicle Extension (s)	3.0		3.0					3.0			3.0	
Lane Grp Cap (vph)	1279		1038					2819			2665	
v/s Ratio Prot	c0.35		0.31					c0.52			0.26	
v/s Ratio Perm												
v/c Ratio	0.94		0.83					0.95			0.47	
Uniform Delay, d1	33.4		31.3					22.9			14.7	
Progression Factor	1.00		1.00					1.00			1.81	
Incremental Delay, d2	13.8		5.5					8.3			0.5	
Delay (s)	47.2		36.8					31.2			27.1	
Level of Service	D		D					C			C	
Approach Delay (s)		42.7			0.0			31.2			27.1	
Approach LOS		D			A			C			C	

Intersection Summary

HCM 2000 Control Delay	34.4	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.94		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	85.7%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
5: Hopyard Rd & Owens Rd



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↔↗		↖	↗	↗	↖	↑↑↑	↗	↖↗	↑↑↗	
Traffic Volume (vph)	366	245	305	547	290	293	275	906	262	330	1472	235
Future Volume (vph)	366	245	305	547	290	293	275	906	262	330	1472	235
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	2.7	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	0.91	0.91		1.00	0.95	0.95	1.00	0.91	1.00	0.97	0.91	
Frt	1.00	0.94		1.00	0.96	0.85	1.00	1.00	0.85	1.00	0.98	
Flt Protected	0.95	0.99		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1610	3137		1770	1706	1504	1770	5085	1583	3433	4980	
Flt Permitted	0.95	0.99		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1610	3137		1770	1706	1504	1770	5085	1583	3433	4980	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	398	266	332	595	315	318	299	985	285	359	1600	255
RTOR Reduction (vph)	0	105	0	0	9	41	0	0	201	0	18	0
Lane Group Flow (vph)	219	672	0	595	405	178	299	985	84	359	1837	0
Turn Type	Split	NA		Split	NA	pm+ov	Prot	NA	Perm	Prot	NA	
Protected Phases	8	8		4	4	1	5	2		1	6	
Permitted Phases						4			2			
Actuated Green, G (s)	15.7	15.7		27.7	27.7	50.5	15.0	33.5	33.5	22.8	41.3	
Effective Green, g (s)	17.0	17.0		29.0	29.0	53.1	15.0	35.2	35.2	22.8	43.0	
Actuated g/C Ratio	0.14	0.14		0.24	0.24	0.44	0.12	0.29	0.29	0.19	0.36	
Clearance Time (s)	5.3	5.3		5.3	5.3	4.0	4.0	5.7	5.7	4.0	5.7	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	228	444		427	412	699	221	1491	464	652	1784	
v/s Ratio Prot	0.14	c0.21		c0.34	0.24	0.05	c0.17	0.19		0.10	c0.37	
v/s Ratio Perm						0.07			0.05			
v/c Ratio	0.96	1.51		1.39	0.98	0.26	1.35	0.66	0.18	0.55	1.03	
Uniform Delay, d1	51.2	51.5		45.5	45.3	21.0	52.5	37.2	31.6	44.0	38.5	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	48.3	242.7		190.9	39.5	0.2	185.5	2.3	0.9	1.0	29.3	
Delay (s)	99.5	294.2		236.4	84.8	21.2	238.0	39.5	32.5	45.0	67.8	
Level of Service	F	F		F	F	C	F	D	C	D	E	
Approach Delay (s)		251.4			146.9			76.0			64.1	
Approach LOS		F			F			E			E	

Intersection Summary

HCM 2000 Control Delay	115.2	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.26		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	110.7%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
6: Hopyard Rd & Stoneridge Dr

BART to Livermore Extension Project
2025 DMU PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↖	↗↗↗	↘	↖↖	↗↗↗	↘	↖↖↖	↗↗	↘	↖↖	↗↗↗	↘
Traffic Volume (vph)	271	1356	707	118	1309	189	592	828	99	290	877	193
Future Volume (vph)	271	1356	707	118	1309	189	592	828	99	290	877	193
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.91	1.00	0.97	0.91	1.00	0.94	0.95	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5085	1583	3433	5085	1583	4990	3539	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5085	1583	3433	5085	1583	4990	3539	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	295	1474	768	128	1423	205	643	900	108	315	953	210
RTOR Reduction (vph)	0	0	174	0	0	136	0	0	77	0	0	120
Lane Group Flow (vph)	295	1474	594	128	1423	69	643	900	31	315	953	90
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8			2			6
Actuated Green, G (s)	9.0	35.0	35.0	4.0	30.0	30.0	13.0	25.6	25.6	9.0	21.6	21.6
Effective Green, g (s)	9.0	35.0	35.0	4.0	30.0	30.0	13.0	25.6	25.6	9.0	21.6	21.6
Actuated g/C Ratio	0.10	0.39	0.39	0.04	0.33	0.33	0.15	0.29	0.29	0.10	0.24	0.24
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	344	1986	618	153	1702	530	723	1011	452	344	1225	381
v/s Ratio Prot	c0.09	0.29		0.04	0.28		c0.13	c0.25		0.09	0.19	
v/s Ratio Perm			c0.37			0.04			0.02			0.06
v/c Ratio	0.86	0.74	0.96	0.84	0.84	0.13	0.89	0.89	0.07	0.92	0.78	0.24
Uniform Delay, d1	39.7	23.4	26.6	42.5	27.5	20.7	37.6	30.7	23.3	39.9	31.8	27.4
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	18.6	1.5	26.6	30.9	3.7	0.1	12.9	9.9	0.1	28.0	3.2	0.3
Delay (s)	58.2	25.0	53.2	73.4	31.3	20.8	50.4	40.6	23.4	67.9	34.9	27.7
Level of Service	E	C	D	E	C	C	D	D	C	E	C	C
Approach Delay (s)		37.4			33.1			43.3			40.9	
Approach LOS		D			C			D			D	



































Intersection Summary

HCM 2000 Control Delay	38.4	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.96		
Actuated Cycle Length (s)	89.6	Sum of lost time (s)	16.0
Intersection Capacity Utilization	77.5%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
7: Hopyard Rd & Las Positas Blvd

BART to Livermore Extension Project
2025 DMU PM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 	 		 	 		 	  		 	  	
Traffic Volume (vph)	99	247	420	539	408	51	345	941	244	72	1387	73
Future Volume (vph)	99	247	420	539	408	51	345	941	244	72	1387	73
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.95	1.00	0.97	0.95	1.00	0.97	0.91	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	3433	3539	1583	3433	5085	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	3433	3539	1583	3433	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	108	268	457	586	443	55	375	1023	265	78	1508	79
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	52
Lane Group Flow (vph)	108	268	457	586	443	55	375	1023	265	78	1508	27
Turn Type	Prot	NA	Free	Prot	NA	Free	Prot	NA	Free	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			Free			Free			Free			6
Actuated Green, G (s)	4.0	11.8	76.7	14.0	21.8	76.7	9.0	30.9	76.7	4.0	25.9	25.9
Effective Green, g (s)	4.0	11.8	76.7	14.0	21.8	76.7	9.0	30.9	76.7	4.0	25.9	25.9
Actuated g/C Ratio	0.05	0.15	1.00	0.18	0.28	1.00	0.12	0.40	1.00	0.05	0.34	0.34
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	179	544	1583	626	1005	1583	402	2048	1583	179	1717	534
v/s Ratio Prot	0.03	0.08		c0.17	c0.13		c0.11	0.20		0.02	c0.30	
v/s Ratio Perm			0.29			0.03			0.17			0.02
v/c Ratio	0.60	0.49	0.29	0.94	0.44	0.03	0.93	0.50	0.17	0.44	0.88	0.05
Uniform Delay, d1	35.6	29.7	0.0	30.9	22.5	0.0	33.6	17.1	0.0	35.3	23.9	17.1
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	5.6	0.7	0.5	21.4	0.3	0.0	28.4	0.2	0.2	1.7	5.4	0.0
Delay (s)	41.2	30.4	0.5	52.3	22.8	0.0	62.0	17.3	0.2	37.0	29.4	17.2
Level of Service	D	C	A	D	C	A	E	B	A	D	C	B
Approach Delay (s)		15.4			37.6			24.7			29.1	
Approach LOS		B			D			C			C	

Intersection Summary

HCM 2000 Control Delay	27.3	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.83		
Actuated Cycle Length (s)	76.7	Sum of lost time (s)	16.0
Intersection Capacity Utilization	72.2%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
8: Willow Rd & Owens Rd



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↖↗↘		↖↗	↖↗↘	↖	↖	↖↗	↖	↖	↖	↖
Traffic Volume (vph)	90	612	166	112	625	86	161	80	0	186	76	137
Future Volume (vph)	90	612	166	112	625	86	161	80	0	186	76	137
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	5.3	4.0		5.3	4.0	4.0
Lane Util. Factor	0.97	0.91		0.97	0.91	1.00	1.00	0.95		1.00	1.00	1.00
Frt	1.00	0.97		1.00	1.00	0.85	1.00	1.00		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	4923		3433	5085	1583	1770	3539		1770	1863	1583
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.70	1.00		0.70	1.00	1.00
Satd. Flow (perm)	3433	4923		3433	5085	1583	1310	3539		1300	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	98	665	180	122	679	93	175	87	0	202	83	149
RTOR Reduction (vph)	0	58	0	0	0	49	0	0	0	0	0	111
Lane Group Flow (vph)	98	787	0	122	679	44	175	87	0	202	83	38
Turn Type	Prot	NA		Prot	NA	Perm	Perm	NA	Perm	Perm	NA	Perm
Protected Phases	1	6		5	2			4				8
Permitted Phases						2	4		4	8		8
Actuated Green, G (s)	7.0	32.5		6.0	31.5	31.5	16.5	16.5		16.5	16.5	16.5
Effective Green, g (s)	7.0	34.2		6.0	33.2	33.2	16.5	17.8		16.5	17.8	17.8
Actuated g/C Ratio	0.10	0.49		0.09	0.47	0.47	0.24	0.25		0.24	0.25	0.25
Clearance Time (s)	4.0	5.7		4.0	5.7	5.7	5.3	5.3		5.3	5.3	5.3
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	343	2405		294	2411	750	308	899		306	473	402
v/s Ratio Prot	0.03	c0.16		c0.04	0.13			0.02			0.04	
v/s Ratio Perm						0.03	0.13			c0.16		0.02
v/c Ratio	0.29	0.33		0.41	0.28	0.06	0.57	0.10		0.66	0.18	0.09
Uniform Delay, d1	29.2	10.9		30.3	11.2	10.0	23.6	20.0		24.2	20.4	19.9
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	0.5	0.4		1.0	0.3	0.1	2.4	0.0		5.3	0.2	0.1
Delay (s)	29.6	11.3		31.3	11.5	10.1	26.0	20.0		29.5	20.6	20.0
Level of Service	C	B		C	B	B	C	C		C	C	C
Approach Delay (s)		13.2			14.0			24.0			24.5	
Approach LOS		B			B			C			C	

Intersection Summary		
HCM 2000 Control Delay	16.5	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.42	B
Actuated Cycle Length (s)	70.0	Sum of lost time (s)
Intersection Capacity Utilization	45.8%	12.0
Analysis Period (min)	15	ICU Level of Service
		A

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
9: Hacienda Dr & Dublin Blvd



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	51	1017	130	228	487	34	221	580	452	42	630	166
Future Volume (vph)	51	1017	130	228	487	34	221	580	452	42	630	166
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	6.0	5.0	4.5	6.0		5.0	6.0	6.0	4.5	5.5	5.5
Lane Util. Factor	0.97	0.91	0.88	0.97	0.91		0.94	0.95	0.88	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5085	2787	3433	5035		4990	3539	2787	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5085	2787	3433	5035		4990	3539	2787	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	55	1105	141	248	529	37	240	630	491	46	685	180
RTOR Reduction (vph)	0	0	65	0	7	0	0	0	234	0	0	139
Lane Group Flow (vph)	55	1105	76	248	559	0	240	630	257	46	685	41
Turn Type	Prot	NA	pm+ov	Prot	NA		Prot	NA	Perm	Prot	NA	Perm
Protected Phases	5	2	3	1	6		3	8		7	NA	4
Permitted Phases			2						8			4
Actuated Green, G (s)	4.2	29.5	40.1	11.0	36.3		10.6	29.4	29.4	2.7	21.5	21.5
Effective Green, g (s)	4.2	29.5	40.1	11.0	36.3		10.6	29.4	29.4	2.7	21.5	21.5
Actuated g/C Ratio	0.04	0.32	0.43	0.12	0.39		0.11	0.31	0.31	0.03	0.23	0.23
Clearance Time (s)	4.5	6.0	5.0	4.5	6.0		5.0	6.0	6.0	4.5	5.5	5.5
Vehicle Extension (s)	2.0	3.5	2.0	2.0	3.5		2.0	3.5	3.5	2.0	3.5	3.5
Lane Grp Cap (vph)	154	1602	1342	403	1952		565	1111	875	99	1168	363
v/s Ratio Prot	0.02	c0.22	0.01	c0.07	0.11		0.05	c0.18		0.01	c0.13	
v/s Ratio Perm			0.02						0.09			0.03
v/c Ratio	0.36	0.69	0.06	0.62	0.29		0.42	0.57	0.29	0.46	0.59	0.11
Uniform Delay, d1	43.4	28.0	15.7	39.3	19.7		38.7	26.8	24.3	44.7	32.1	28.5
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.5	1.3	0.0	2.0	0.1		0.2	0.7	0.2	1.3	0.8	0.2
Delay (s)	43.9	29.4	15.7	41.3	19.8		38.8	27.5	24.5	46.0	32.9	28.7
Level of Service	D	C	B	D	B		D	C	C	D	C	C
Approach Delay (s)		28.5			26.4			28.4			32.7	
Approach LOS		C			C			C			C	

Intersection Summary

HCM 2000 Control Delay	29.0	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.64		
Actuated Cycle Length (s)	93.6	Sum of lost time (s)	21.0
Intersection Capacity Utilization	63.2%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 10: Hacienda Dr & Martinelli Blvd/Hacienda Crossings



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗	↖↗	↖↗	↗		↖↗↘	↖↗↘	↗	↖↗	↖↗↘	
Traffic Volume (vph)	24	51	376	292	33	22	351	1238	463	63	916	65
Future Volume (vph)	24	51	376	292	33	22	351	1238	463	63	916	65
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	3.0	3.0	5.5	3.0		3.5	3.0	3.0	5.0	3.5	
Lane Util. Factor	1.00	0.91	0.91	0.97	1.00		0.94	0.91	1.00	0.97	0.86	
Frt	1.00	0.94	0.85	1.00	0.94		1.00	1.00	0.85	1.00	0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1770	1587	2882	3433	1751		4990	5085	1583	3433	6344	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1770	1587	2882	3433	1751		4990	5085	1583	3433	6344	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	26	55	409	317	36	24	382	1346	503	68	996	71
RTOR Reduction (vph)	0	28	203	0	17	0	0	0	211	0	8	0
Lane Group Flow (vph)	26	68	165	317	43	0	382	1346	292	68	1059	0
Turn Type	Prot	NA	Perm	Prot	NA		Prot	NA	pm+ov	Prot	NA	
Protected Phases	5	2		1	6		3	8	1	7	4	
Permitted Phases			2						8			
Actuated Green, G (s)	7.4	16.6	16.6	12.3	22.0		8.9	34.7	47.0	4.7	30.5	
Effective Green, g (s)	6.9	18.6	18.6	11.8	24.0		9.9	36.7	51.0	4.2	32.0	
Actuated g/C Ratio	0.08	0.21	0.21	0.13	0.27		0.11	0.42	0.58	0.05	0.36	
Clearance Time (s)	4.5	5.0	5.0	5.0	5.0		4.5	5.0	5.0	4.5	5.0	
Vehicle Extension (s)	3.0	4.0	4.0	2.0	4.0		3.0	4.0	2.0	3.0	4.0	
Lane Grp Cap (vph)	139	336	610	461	478		562	2125	973	164	2312	
v/s Ratio Prot	0.01	0.04		c0.09	0.02		c0.08	c0.26	0.05	0.02	0.17	
v/s Ratio Perm			c0.06						0.14			
v/c Ratio	0.19	0.20	0.27	0.69	0.09		0.68	0.63	0.30	0.41	0.46	
Uniform Delay, d1	37.8	28.5	28.9	36.2	23.8		37.4	20.2	9.3	40.6	21.3	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.7	0.4	0.3	3.4	0.1		3.3	0.7	0.1	1.7	0.2	
Delay (s)	38.5	28.9	29.3	39.6	23.9		40.7	20.9	9.4	42.3	21.5	
Level of Service	D	C	C	D	C		D	C	A	D	C	
Approach Delay (s)		29.7			37.1			21.7			22.7	
Approach LOS		C			D			C			C	

Intersection Summary

HCM 2000 Control Delay	24.3	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.59		
Actuated Cycle Length (s)	87.8	Sum of lost time (s)	16.5
Intersection Capacity Utilization	62.3%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 11: Hacienda Dr & I-580 WB Ramps



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↔↔		↔↔		↑↑↑			↑↑↑	↔
Traffic Volume (vph)	0	0	0	347	0	295	0	1492	758	0	803	755
Future Volume (vph)	0	0	0	347	0	295	0	1492	758	0	803	755
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0		4.0		4.0			4.0	4.0
Lane Util. Factor				0.97		0.88		0.91			0.86	0.86
Frt				1.00		0.85		0.95			0.95	0.85
Flt Protected				0.95		1.00		1.00			1.00	1.00
Satd. Flow (prot)				3433		2787		4828			4575	1362
Flt Permitted				0.95		1.00		1.00			1.00	1.00
Satd. Flow (perm)				3433		2787		4828			4575	1362
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	377	0	321	0	1622	824	0	873	821
RTOR Reduction (vph)	0	0	0	0	0	51	0	162	0	0	143	142
Lane Group Flow (vph)	0	0	0	377	0	270	0	2284	0	0	1141	268
Turn Type				Prot		Prot		NA			NA	Perm
Protected Phases				4		4		2			6	
Permitted Phases												6
Actuated Green, G (s)				9.7		9.7		34.0			34.0	34.0
Effective Green, g (s)				11.1		11.1		35.9			35.9	35.9
Actuated g/C Ratio				0.20		0.20		0.65			0.65	0.65
Clearance Time (s)				5.4		5.4		5.9			5.9	5.9
Vehicle Extension (s)				3.0		3.0		3.0			3.0	3.0
Lane Grp Cap (vph)				692		562		3151			2986	889
v/s Ratio Prot				c0.11		0.10		c0.47			0.25	
v/s Ratio Perm												0.20
v/c Ratio				0.54		0.48		0.72			0.38	0.30
Uniform Delay, d1				19.7		19.4		6.3			4.4	4.1
Progression Factor				1.00		1.00		0.69			1.00	1.00
Incremental Delay, d2				0.9		0.6		1.0			0.4	0.9
Delay (s)				20.6		20.0		5.3			4.8	5.0
Level of Service				C		C		A			A	A
Approach Delay (s)		0.0			20.3			5.3			4.8	
Approach LOS		A			C			A			A	

Intersection Summary		
HCM 2000 Control Delay	7.3	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.68	A
Actuated Cycle Length (s)	55.0	Sum of lost time (s)
Intersection Capacity Utilization	62.8%	8.0
Analysis Period (min)	15	ICU Level of Service
		B

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 12: Hacienda Dr & I-580 EB Ramps



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗		↖↗					↖↗↘	↖		↖↗↘	
Traffic Volume (vph)	885	0	435	0	0	0	0	1549	839	0	740	313
Future Volume (vph)	885	0	435	0	0	0	0	1549	839	0	740	313
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0					4.0	4.0		4.0	
Lane Util. Factor	0.97		0.88					0.86	0.86		0.91	
Frt	1.00		0.85					0.98	0.85		0.96	
Flt Protected	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (prot)	3433		2787					4702	1362		4859	
Flt Permitted	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (perm)	3433		2787					4702	1362		4859	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	962	0	473	0	0	0	0	1684	912	0	804	340
RTOR Reduction (vph)	0	0	176	0	0	0	0	17	261	0	62	0
Lane Group Flow (vph)	962	0	297	0	0	0	0	1950	368	0	1082	0
Turn Type	Prot		Prot					NA	Perm		NA	
Protected Phases	4		4					2			6	
Permitted Phases									2			
Actuated Green, G (s)	36.2		36.2					62.5	62.5		62.5	
Effective Green, g (s)	37.6		37.6					64.4	64.4		64.4	
Actuated g/C Ratio	0.34		0.34					0.59	0.59		0.59	
Clearance Time (s)	5.4		5.4					5.9	5.9		5.9	
Vehicle Extension (s)	2.0		2.0					2.0	2.0		2.0	
Lane Grp Cap (vph)	1173		952					2752	797		2844	
v/s Ratio Prot	c0.28		0.11					c0.41			0.22	
v/s Ratio Perm									0.27			
v/c Ratio	0.82		0.31					0.71	0.46		0.38	
Uniform Delay, d1	33.1		26.7					16.1	13.0		12.2	
Progression Factor	1.00		1.00					1.00	1.00		0.89	
Incremental Delay, d2	4.5		0.1					1.6	1.9		0.4	
Delay (s)	37.6		26.7					17.7	14.9		11.2	
Level of Service	D		C					B	B		B	
Approach Delay (s)		34.0			0.0			17.0			11.2	
Approach LOS		C			A			B			B	

Intersection Summary		
HCM 2000 Control Delay	20.5	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.75	C
Actuated Cycle Length (s)	110.0	Sum of lost time (s)
Intersection Capacity Utilization	68.1%	8.0
Analysis Period (min)	15	ICU Level of Service
		C

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
13: Hacienda Dr & Owens Rd



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↑↑↑	↗	↖↗	↑↑↑	↗	↖↗	↑↑↑	↗	↖↗	↑↑↑	↗
Traffic Volume (vph)	661	705	51	120	309	748	36	964	266	433	465	261
Future Volume (vph)	661	705	51	120	309	748	36	964	266	433	465	261
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	2.3	4.0	4.0	2.3	4.0	4.0	2.7	4.0	4.0	2.7
Lane Util. Factor	0.97	0.91	1.00	0.97	0.91	1.00	0.97	0.91	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5085	1583	3433	5085	1583	3433	5085	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5085	1583	3433	5085	1583	3433	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	718	766	55	130	336	813	39	1048	289	471	505	284
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	718	766	55	130	336	813	39	1048	289	471	505	284
Turn Type	Prot	NA	Free	Prot	NA	Free	Prot	NA	Free	Prot	NA	Free
Protected Phases	1	6		5	2		7	4		3	8	
Permitted Phases			Free			Free			Free			Free
Actuated Green, G (s)	37.6	41.2	115.0	7.8	11.4	115.0	2.8	31.7	115.0	15.3	44.2	115.0
Effective Green, g (s)	37.6	42.9	115.0	7.8	13.1	115.0	2.8	33.0	115.0	15.3	45.5	115.0
Actuated g/C Ratio	0.33	0.37	1.00	0.07	0.11	1.00	0.02	0.29	1.00	0.13	0.40	1.00
Clearance Time (s)	4.0	5.7		4.0	5.7		4.0	5.3		4.0	5.3	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	1122	1896	1583	232	579	1583	83	1459	1583	456	2011	1583
v/s Ratio Prot	c0.21	0.15		0.04	0.07		0.01	c0.21		c0.14	0.10	
v/s Ratio Perm			0.03			c0.51			0.18			0.18
v/c Ratio	0.64	0.40	0.03	0.56	0.58	0.51	0.47	0.72	0.18	1.03	0.25	0.18
Uniform Delay, d1	32.9	26.6	0.0	51.9	48.3	0.0	55.4	36.8	0.0	49.9	23.3	0.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.2	0.6	0.0	3.1	4.2	1.2	4.2	1.7	0.3	50.9	0.1	0.2
Delay (s)	34.1	27.3	0.0	55.0	52.5	1.2	59.5	38.5	0.3	100.7	23.4	0.2
Level of Service	C	C	A	E	D	A	E	D	A	F	C	A
Approach Delay (s)		29.5			20.2			31.1			47.1	
Approach LOS		C			C			C			D	

Intersection Summary

HCM 2000 Control Delay	31.8	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.73		
Actuated Cycle Length (s)	115.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	69.1%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
14: Tassajara Rd & Dublin Blvd

BART to Livermore Extension Project
2025 DMU PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↑↑	↖↗	↖↗↘	↑↓		↖↗↘	↑↑↑	↖	↖↗	↑↑↑	↖↗
Traffic Volume (vph)	249	767	449	245	292	19	381	874	476	29	786	138
Future Volume (vph)	249	767	449	245	292	19	381	874	476	29	786	138
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	6.0	6.0	5.0	6.0		5.0	6.0	6.0	5.0	6.0	6.0
Lane Util. Factor	0.97	0.95	0.88	0.94	0.95		0.94	0.91	1.00	0.97	0.86	0.88
Frt	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	2787	4990	3506		4990	5085	1583	3433	6408	2787
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	2787	4990	3506		4990	5085	1583	3433	6408	2787
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	271	834	488	266	317	21	414	950	517	32	854	150
RTOR Reduction (vph)	0	0	287	0	3	0	0	0	254	0	0	109
Lane Group Flow (vph)	271	834	201	266	335	0	414	950	263	32	854	41
Turn Type	Prot	NA	Perm	Prot	NA		Prot	NA	Perm	Prot	NA	Perm
Protected Phases	5	2		1	6		3	8		7	NA	4
Permitted Phases			2						8			4
Actuated Green, G (s)	17.0	40.4	40.4	16.4	39.8		17.1	45.3	45.3	8.1	36.3	36.3
Effective Green, g (s)	17.0	40.4	40.4	16.4	39.8		17.1	45.3	45.3	8.1	36.3	36.3
Actuated g/C Ratio	0.13	0.31	0.31	0.12	0.30		0.13	0.34	0.34	0.06	0.27	0.27
Clearance Time (s)	5.0	6.0	6.0	5.0	6.0		5.0	6.0	6.0	5.0	6.0	6.0
Vehicle Extension (s)	2.0	3.0	3.0	2.0	3.0		2.0	4.0	4.0	2.0	4.0	4.0
Lane Grp Cap (vph)	441	1081	851	619	1055		645	1742	542	210	1759	765
v/s Ratio Prot	c0.08	c0.24		0.05	0.10		c0.08	c0.19		0.01	0.13	
v/s Ratio Perm			0.07						0.17			0.01
v/c Ratio	0.61	0.77	0.24	0.43	0.32		0.64	0.55	0.48	0.15	0.49	0.05
Uniform Delay, d1	54.5	41.7	34.3	53.6	35.7		54.6	35.1	34.2	58.8	40.1	35.3
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.8	3.5	0.1	0.2	0.2		1.6	0.4	0.9	0.1	0.3	0.0
Delay (s)	56.3	45.2	34.5	53.7	35.9		56.3	35.6	35.2	58.9	40.4	35.3
Level of Service	E	D	C	D	D		E	D	D	E	D	D
Approach Delay (s)		43.8			43.7			40.0			40.3	
Approach LOS		D			D			D			D	

Intersection Summary

HCM 2000 Control Delay	41.7	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.67		
Actuated Cycle Length (s)	132.2	Sum of lost time (s)	22.0
Intersection Capacity Utilization	82.3%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
15: Tassajara Rd & I-580 WB Ramps



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↔		↔		↑↑	↔		↑↑↑	↔
Traffic Volume (vph)	0	0	0	494	0	233	0	1340	644	0	1157	614
Future Volume (vph)	0	0	0	494	0	233	0	1340	644	0	1157	614
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0		4.0		4.0	4.0		4.0	4.0
Lane Util. Factor				0.97		0.88		0.95	1.00		0.86	0.86
Frt				1.00		0.85		1.00	0.85		0.98	0.85
Flt Protected				0.95		1.00		1.00	1.00		1.00	1.00
Satd. Flow (prot)				3433		2787		3539	1583		4693	1362
Flt Permitted				0.95		1.00		1.00	1.00		1.00	1.00
Satd. Flow (perm)				3433		2787		3539	1583		4693	1362
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	537	0	253	0	1457	700	0	1258	667
RTOR Reduction (vph)	0	0	0	0	0	44	0	0	276	0	40	171
Lane Group Flow (vph)	0	0	0	537	0	209	0	1457	424	0	1451	263
Turn Type				Perm		Perm		NA	Perm		NA	Perm
Protected Phases								2			6	
Permitted Phases				8		8			2			6
Actuated Green, G (s)				13.7		13.7		33.3	33.3		33.3	33.3
Effective Green, g (s)				13.7		13.7		33.3	33.3		33.3	33.3
Actuated g/C Ratio				0.25		0.25		0.61	0.61		0.61	0.61
Clearance Time (s)				4.0		4.0		4.0	4.0		4.0	4.0
Vehicle Extension (s)				3.0		3.0		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)				855		694		2142	958		2841	824
v/s Ratio Prot								c0.41			0.31	
v/s Ratio Perm				c0.16		0.08			0.27			0.19
v/c Ratio				0.63		0.30		0.68	0.44		0.51	0.32
Uniform Delay, d1				18.4		16.8		7.3	5.8		6.2	5.3
Progression Factor				1.00		1.00		1.00	1.00		1.00	1.00
Incremental Delay, d2				1.5		0.2		1.8	1.5		0.7	1.0
Delay (s)				19.8		17.0		9.0	7.3		6.9	6.3
Level of Service				B		B		A	A		A	A
Approach Delay (s)		0.0			18.9			8.5			6.7	
Approach LOS		A			B			A			A	

Intersection Summary			
HCM 2000 Control Delay	9.5	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.66		
Actuated Cycle Length (s)	55.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	57.8%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 16: Santa Rita Rd & I-580 EB Ramps/Pimilco Dr



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	388	90	235	144	0	314	0	1180	178	319	955	0
Future Volume (vph)	388	90	235	144	0	314	0	1180	178	319	955	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0		4.0		4.0		4.0	4.0	
Lane Util. Factor	0.97	1.00	1.00	0.97		0.88		0.86		1.00	0.95	
Frt	1.00	1.00	0.85	1.00		0.85		0.98		1.00	1.00	
Flt Protected	0.95	1.00	1.00	0.95		1.00		1.00		0.95	1.00	
Satd. Flow (prot)	3433	1863	1583	3433		2787		6282		1770	3539	
Flt Permitted	0.95	1.00	1.00	0.95		1.00		1.00		0.95	1.00	
Satd. Flow (perm)	3433	1863	1583	3433		2787		6282		1770	3539	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	422	98	255	157	0	341	0	1283	193	347	1038	0
RTOR Reduction (vph)	0	0	92	0	0	34	0	22	0	0	0	0
Lane Group Flow (vph)	422	98	163	157	0	307	0	1454	0	347	1038	0
Turn Type	Perm	NA	Perm	Prot		pm+ov		NA		Prot	NA	Perm
Protected Phases		4		3		1		2		1	6	
Permitted Phases	4		4			3						6
Actuated Green, G (s)	19.6	19.6	19.6	7.9		34.4		40.0		26.5	70.5	
Effective Green, g (s)	19.6	19.6	19.6	7.9		34.4		40.0		26.5	70.5	
Actuated g/C Ratio	0.18	0.18	0.18	0.07		0.31		0.36		0.24	0.64	
Clearance Time (s)	4.0	4.0	4.0	4.0		4.0		4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0		3.0		3.0		3.0	3.0	
Lane Grp Cap (vph)	611	331	282	246		871		2284		426	2268	
v/s Ratio Prot		0.05		c0.05		0.08		c0.23		c0.20	0.29	
v/s Ratio Perm	c0.12		0.10			0.03						
v/c Ratio	0.69	0.30	0.58	0.64		0.35		0.64		0.81	0.46	
Uniform Delay, d1	42.4	39.2	41.4	49.7		29.2		29.0		39.4	10.0	
Progression Factor	1.00	1.00	1.00	1.00		1.00		1.00		1.00	1.00	
Incremental Delay, d2	3.4	0.5	2.9	5.3		0.2		1.4		11.4	0.7	
Delay (s)	45.7	39.7	44.3	55.0		29.4		30.4		50.8	10.7	
Level of Service	D	D	D	E		C		C		D	B	
Approach Delay (s)		44.5			37.5			30.4			20.7	
Approach LOS		D			D			C			C	

Intersection Summary

HCM 2000 Control Delay	30.6	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.70		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	59.9%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 17: Santa Rita Rd & Valley Ave

BART to Livermore Extension Project
 2025 DMU PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	357	475	119	134	320	779	152	760	129	963	1096	240
Future Volume (vph)	357	475	119	134	320	779	152	760	129	963	1096	240
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.97	0.95		0.97	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.98		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	3433	3462		3433	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	3433	3462		3433	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	388	516	129	146	348	847	165	826	140	1047	1191	261
RTOR Reduction (vph)	0	0	107	0	0	0	0	15	0	0	0	141
Lane Group Flow (vph)	388	516	22	146	348	847	165	951	0	1047	1191	120
Turn Type	Prot	NA	Perm	Prot	NA	Free	Prot	NA		Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			Free						6
Actuated Green, G (s)	10.0	15.5	15.5	9.7	15.2	89.2	7.0	23.0		25.0	41.0	41.0
Effective Green, g (s)	10.0	15.5	15.5	9.7	15.2	89.2	7.0	23.0		25.0	41.0	41.0
Actuated g/C Ratio	0.11	0.17	0.17	0.11	0.17	1.00	0.08	0.26		0.28	0.46	0.46
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	384	614	275	192	603	1583	269	892		962	1626	727
v/s Ratio Prot	c0.11	c0.15		0.08	0.10		0.05	c0.27		c0.30	0.34	
v/s Ratio Perm			0.01			c0.53						0.08
v/c Ratio	1.01	0.84	0.08	0.76	0.58	0.54	0.61	1.07		1.09	0.73	0.17
Uniform Delay, d1	39.6	35.7	30.9	38.6	34.0	0.0	39.8	33.1		32.1	19.6	14.1
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	48.6	10.1	0.1	16.1	1.3	1.3	4.1	49.4		56.1	1.7	0.1
Delay (s)	88.2	45.7	31.0	54.8	35.4	1.3	43.9	82.5		88.2	21.4	14.2
Level of Service	F	D	C	D	D	A	D	F		F	C	B
Approach Delay (s)		59.8			16.0			76.9			48.6	
Approach LOS		E			B			E			D	

Intersection Summary

HCM 2000 Control Delay	48.6	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	1.02		
Actuated Cycle Length (s)	89.2	Sum of lost time (s)	16.0
Intersection Capacity Utilization	86.5%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
18: Bernal Ave/Valley Ave & Stanley Blvd










































Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	205	837	58	101	233	345	86	331	305	820	543	118
Future Volume (vph)	205	837	58	101	233	345	86	331	305	820	543	118
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.95	1.00	0.97	0.91	0.91	1.00	0.95	1.00	0.97	0.95	
Frt	1.00	1.00	0.85	1.00	0.94	0.85	1.00	1.00	0.85	1.00	0.97	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	3433	3539	1583	3433	3179	1441	1770	3539	1583	3433	3445	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	3433	3539	1583	3433	3179	1441	1770	3539	1583	3433	3445	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	223	910	63	110	253	375	93	360	332	891	590	128
RTOR Reduction (vph)	0	0	39	0	123	52	0	0	168	0	20	0
Lane Group Flow (vph)	223	910	24	110	310	143	93	360	164	891	698	0
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	
Protected Phases	7	4	5	3	8	1	5	2		1	6	
Permitted Phases			4			8			2			
Actuated Green, G (s)	9.4	25.2	32.6	4.0	19.8	44.8	7.4	15.9	15.9	25.0	33.5	
Effective Green, g (s)	9.4	25.2	32.6	4.0	19.8	44.8	7.4	15.9	15.9	25.0	33.5	
Actuated g/C Ratio	0.11	0.29	0.38	0.05	0.23	0.52	0.09	0.18	0.18	0.29	0.39	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	374	1035	672	159	731	816	152	653	292	996	1340	
v/s Ratio Prot	c0.06	c0.26	0.00	0.03	0.10	0.05	0.05	0.10		c0.26	c0.20	
v/s Ratio Perm			0.01			0.05			0.10			
v/c Ratio	0.60	0.88	0.04	0.69	0.42	0.17	0.61	0.55	0.56	0.89	0.52	
Uniform Delay, d1	36.5	29.0	16.8	40.4	28.3	10.9	38.0	31.9	31.9	29.3	20.2	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	2.6	8.7	0.0	12.2	0.4	0.1	7.1	1.0	2.5	10.4	0.4	
Delay (s)	39.1	37.7	16.9	52.7	28.7	11.0	45.1	32.9	34.4	39.7	20.5	
Level of Service	D	D	B	D	C	B	D	C	C	D	C	
Approach Delay (s)		36.8			27.6			35.0			31.1	
Approach LOS		D			C			C			C	

Intersection Summary

HCM 2000 Control Delay	32.8	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.82		
Actuated Cycle Length (s)	86.1	Sum of lost time (s)	16.0
Intersection Capacity Utilization	75.4%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
19: Fallon Rd & Dublin Blvd

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 	  	 	  	  		 	  	 	 	  	
Traffic Volume (vph)	203	497	395	48	17	55	193	632	148	99	601	27
Future Volume (vph)	203	497	395	48	17	55	193	632	148	99	601	27
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.3	5.3	5.3	4.0	4.0	4.0	5.3	4.9	4.9	5.3	4.9	4.9
Lane Util. Factor	0.97	0.91	0.88	0.94	0.91	1.00	0.97	0.91	0.88	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3090	4577	2508	4491	4577	1425	3090	4577	2508	3090	4577	1425
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3090	4577	2508	4491	4577	1425	3090	4577	2508	3090	4577	1425
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	221	540	429	52	18	60	210	687	161	108	653	29
RTOR Reduction (vph)	0	0	131	0	0	57	0	0	105	0	0	20
Lane Group Flow (vph)	221	540	298	52	18	3	210	687	56	108	653	9
Turn Type	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	5	2	3	1	6		3	8		7	4	
Permitted Phases			2			6			8			4
Actuated Green, G (s)	16.7	17.4	27.0	3.0	3.7	3.7	9.6	24.6	24.6	5.8	20.8	20.8
Effective Green, g (s)	16.7	17.4	27.0	3.0	3.7	3.7	9.6	24.6	24.6	5.8	20.8	20.8
Actuated g/C Ratio	0.24	0.25	0.38	0.04	0.05	0.05	0.14	0.35	0.35	0.08	0.30	0.30
Clearance Time (s)	5.3	5.3	5.3	4.0	4.0	4.0	5.3	4.9	4.9	5.3	4.9	4.9
Vehicle Extension (s)	2.0	4.0	2.0	2.0	2.0	2.0	2.0	4.0	4.0	2.0	4.0	4.0
Lane Grp Cap (vph)	734	1132	963	191	240	75	421	1601	877	254	1354	421
v/s Ratio Prot	c0.07	c0.12	0.04	0.01	0.00		c0.07	c0.15		0.03	c0.14	
v/s Ratio Perm			0.08			0.00			0.02			0.01
v/c Ratio	0.30	0.48	0.31	0.27	0.07	0.04	0.50	0.43	0.06	0.43	0.48	0.02
Uniform Delay, d1	22.0	22.6	15.1	32.6	31.7	31.6	28.1	17.5	15.2	30.7	20.3	17.5
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.1	0.4	0.1	0.3	0.0	0.1	0.3	0.3	0.0	0.4	0.4	0.0
Delay (s)	22.1	23.0	15.2	32.9	31.7	31.7	28.5	17.7	15.2	31.1	20.7	17.6
Level of Service	C	C	B	C	C	C	C	B	B	C	C	B
Approach Delay (s)		20.0			32.2			19.5			22.0	
Approach LOS		C			C			B			C	

Intersection Summary		
HCM 2000 Control Delay	20.8	HCM 2000 Level of Service C
HCM 2000 Volume to Capacity ratio	0.48	
Actuated Cycle Length (s)	70.3	Sum of lost time (s) 19.5
Intersection Capacity Utilization	46.1%	ICU Level of Service A
Analysis Period (min)	15	

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
20: El Charro Rd/Fallon Rd & I-580 WB Ramps



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↖	↖	↖↖		↖	↖		↗↗	↖
Traffic Volume (vph)	0	0	0	271	0	444	0	651	245	0	857	376
Future Volume (vph)	0	0	0	271	0	444	0	651	245	0	857	376
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0	4.0	4.0		4.0	4.0		4.0	4.0
Lane Util. Factor				0.95	0.95	0.88		0.95	0.95		0.95	1.00
Frt				1.00	1.00	0.85		0.99	0.85		1.00	0.85
Flt Protected				0.95	0.95	1.00		1.00	1.00		1.00	1.00
Satd. Flow (prot)				1681	1681	2787		1760	1504		3539	1583
Flt Permitted				0.95	0.95	1.00		1.00	1.00		1.00	1.00
Satd. Flow (perm)				1681	1681	2787		1760	1504		3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	295	0	483	0	708	266	0	932	409
RTOR Reduction (vph)	0	0	0	0	0	362	0	2	80	0	0	137
Lane Group Flow (vph)	0	0	0	150	145	121	0	733	159	0	932	272
Turn Type				Perm	NA	Perm		NA	Perm		NA	Perm
Protected Phases					8			2			6	
Permitted Phases				8		8			2			6
Actuated Green, G (s)				10.9	10.9	10.9		36.6	36.6		36.6	36.6
Effective Green, g (s)				10.4	10.4	10.4		36.6	36.6		36.6	36.6
Actuated g/C Ratio				0.19	0.19	0.19		0.67	0.67		0.67	0.67
Clearance Time (s)				3.5	3.5	3.5		4.0	4.0		4.0	4.0
Vehicle Extension (s)				2.0	2.0	2.0		2.0	2.0		2.0	2.0
Lane Grp Cap (vph)				317	317	526		1171	1000		2355	1053
v/s Ratio Prot								c0.42			0.26	
v/s Ratio Perm				c0.09	0.09	0.04			0.11			0.17
v/c Ratio				0.47	0.46	0.23		0.63	0.16		0.40	0.26
Uniform Delay, d1				19.9	19.8	18.9		5.3	3.4		4.2	3.7
Progression Factor				1.00	1.00	1.00		1.08	2.50		1.00	1.00
Incremental Delay, d2				0.4	0.4	0.1		2.3	0.3		0.5	0.6
Delay (s)				20.3	20.2	19.0		8.0	8.9		4.7	4.3
Level of Service				C	C	B		A	A		A	A
Approach Delay (s)		0.0			19.5			8.2			4.6	
Approach LOS		A			B			A			A	

Intersection Summary

HCM 2000 Control Delay	9.5	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.59		
Actuated Cycle Length (s)	55.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	61.4%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 21: El Charro Rd & I-580 EB Ramps



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↗↘		↗↘					↕↔	↗		↕↔	↗
Traffic Volume (vph)	321	0	357	0	0	0	0	913	281	0	858	0
Future Volume (vph)	321	0	357	0	0	0	0	913	281	0	858	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0					4.0	4.0		4.0	
Lane Util. Factor	0.97		0.88					0.91	0.91		0.91	
Frt	1.00		0.85					0.99	0.85		1.00	
Flt Protected	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (prot)	3433		2787					3372	1441		3390	
Flt Permitted	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (perm)	3433		2787					3372	1441		3390	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	349	0	388	0	0	0	0	992	305	0	933	0
RTOR Reduction (vph)	0	0	189	0	0	0	0	4	87	0	0	0
Lane Group Flow (vph)	349	0	199	0	0	0	0	1025	181	0	933	0
Turn Type	Prot		Perm					NA	Perm		NA	Perm
Protected Phases	4							2			6	
Permitted Phases			4						2			6
Actuated Green, G (s)	9.9		9.9					37.1	37.1		37.1	
Effective Green, g (s)	9.9		9.9					37.1	37.1		37.1	
Actuated g/C Ratio	0.18		0.18					0.67	0.67		0.67	
Clearance Time (s)	4.0		4.0					4.0	4.0		4.0	
Vehicle Extension (s)	2.0		2.0					3.0	3.0		3.0	
Lane Grp Cap (vph)	617		501					2274	972		2286	
v/s Ratio Prot	c0.10							c0.30			0.28	
v/s Ratio Perm			0.07						0.13			
v/c Ratio	0.57		0.40					0.45	0.19		0.41	
Uniform Delay, d1	20.6		19.9					4.2	3.3		4.0	
Progression Factor	1.00		1.00					1.00	1.00		0.72	
Incremental Delay, d2	0.7		0.2					0.6	0.4		0.5	
Delay (s)	21.3		20.1					4.8	3.8		3.4	
Level of Service	C		C					A	A		A	
Approach Delay (s)		20.7			0.0			4.6			3.4	
Approach LOS		C			A			A			A	

Intersection Summary

HCM 2000 Control Delay	8.2	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.47		
Actuated Cycle Length (s)	55.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	44.0%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 22: El Charro Rd & Stoneridge Dr/Jack London Blvd



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔↔↔	↑↑	↗	↖	↑↑	↗↗	↖	↑↑		↖↖↖	↑	↗↗
Traffic Volume (vph)	260	545	3	3	304	474	2	34	3	747	26	136
Future Volume (vph)	260	545	3	3	304	474	2	34	3	747	26	136
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	0.94	0.95	1.00	1.00	0.95	0.88	1.00	0.95		0.94	1.00	0.88
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	4491	3185	1425	1593	3185	2508	1593	3149		4491	1676	2508
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	4491	3185	1425	1593	3185	2508	1593	3149		4491	1676	2508
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	283	592	3	3	330	515	2	37	3	812	28	148
RTOR Reduction (vph)	0	0	2	0	0	238	0	3	0	0	0	90
Lane Group Flow (vph)	283	592	1	3	330	277	2	37	0	812	28	58
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Prot	NA		Prot	NA	Perm
Protected Phases	7	4		3	8	1	5	2		1	6	
Permitted Phases			4			8						6
Actuated Green, G (s)	8.5	23.0	23.0	0.7	15.2	35.9	0.7	6.3		20.7	26.3	26.3
Effective Green, g (s)	8.5	23.0	23.0	0.7	15.2	35.9	0.7	6.3		20.7	26.3	26.3
Actuated g/C Ratio	0.13	0.34	0.34	0.01	0.23	0.54	0.01	0.09		0.31	0.39	0.39
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	572	1098	491	16	725	1349	16	297		1393	660	988
v/s Ratio Prot	0.06	c0.19		0.00	c0.10	0.06	0.00	c0.01		c0.18	0.02	
v/s Ratio Perm			0.00			0.05						0.02
v/c Ratio	0.49	0.54	0.00	0.19	0.46	0.21	0.12	0.13		0.58	0.04	0.06
Uniform Delay, d1	27.1	17.6	14.3	32.7	22.2	8.0	32.7	27.7		19.4	12.4	12.5
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	0.7	0.5	0.0	5.6	0.5	0.1	3.5	0.2		0.6	0.0	0.0
Delay (s)	27.8	18.1	14.3	38.3	22.6	8.1	36.2	27.9		20.0	12.5	12.6
Level of Service	C	B	B	D	C	A	D	C		B	B	B
Approach Delay (s)		21.2			13.8			28.3			18.7	
Approach LOS		C			B			C			B	

Intersection Summary		
HCM 2000 Control Delay	18.1	HCM 2000 Level of Service B
HCM 2000 Volume to Capacity ratio	0.53	
Actuated Cycle Length (s)	66.7	Sum of lost time (s) 16.0
Intersection Capacity Utilization	52.5%	ICU Level of Service A
Analysis Period (min)	15	

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 24: Airway Blvd/Driveway & N Canyons Pkwy



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑	↑	↑↑	↑	↑		↑	↑↑		↑	
Traffic Volume (vph)	0	384	310	834	65	0	60	0	742	0	0	0
Future Volume (vph)	0	384	310	834	65	0	60	0	742	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0	4.0	4.0			4.4	4.0			
Lane Util. Factor		0.95	1.00	0.97	1.00			1.00	0.88			
Frt		1.00	0.85	1.00	1.00			1.00	0.85			
Flt Protected		1.00	1.00	0.95	1.00			0.95	1.00			
Satd. Flow (prot)		3539	1583	3433	1863			1770	2787			
Flt Permitted		1.00	1.00	0.95	1.00			0.95	1.00			
Satd. Flow (perm)		3539	1583	3433	1863			1770	2787			
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	417	337	907	71	0	65	0	807	0	0	0
RTOR Reduction (vph)	0	0	242	0	0	0	0	0	371	0	0	0
Lane Group Flow (vph)	0	417	95	907	71	0	0	65	436	0	0	0
Turn Type		NA	Perm	Prot	NA	Perm	Split	NA	pm+ov			
Protected Phases		2		1	6		8	8	1	4	4	
Permitted Phases			2			6			8			
Actuated Green, G (s)		14.1	14.1	22.1	42.2			4.8	26.9			
Effective Green, g (s)		16.1	16.1	24.1	44.2			4.6	30.9			
Actuated g/C Ratio		0.28	0.28	0.42	0.77			0.08	0.54			
Clearance Time (s)		6.0	6.0	6.0	6.0			4.2	6.0			
Vehicle Extension (s)		3.0	3.0	3.0	3.0			3.0	3.0			
Lane Grp Cap (vph)		996	445	1446	1439			142	1700			
v/s Ratio Prot		c0.12		c0.26	0.04			0.04	c0.11			
v/s Ratio Perm			0.06						0.05			
v/c Ratio		0.42	0.21	0.63	0.05			0.46	0.26			
Uniform Delay, d1		16.7	15.7	13.0	1.5			25.1	7.0			
Progression Factor		1.00	1.00	1.00	1.00			1.00	1.00			
Incremental Delay, d2		0.3	0.2	0.9	0.0			2.3	0.1			
Delay (s)		17.0	15.9	13.9	1.6			27.4	7.1			
Level of Service		B	B	B	A			C	A			
Approach Delay (s)		16.5			13.0			8.6			0.0	
Approach LOS		B			B			A			A	

Intersection Summary		
HCM 2000 Control Delay	12.6	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.59	B
Actuated Cycle Length (s)	57.2	Sum of lost time (s)
Intersection Capacity Utilization	49.7%	16.4
Analysis Period (min)	15	ICU Level of Service
		A

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
25: Airway Blvd & I-580 WB Ramps



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↙	↖	↗		↑↑	↗		↑↑↑	
Traffic Volume (vph)	0	0	0	71	27	145	0	698	394	0	591	641
Future Volume (vph)	0	0	0	71	27	145	0	698	394	0	591	641
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0	4.0	4.0		4.0	4.0		4.0	
Lane Util. Factor				0.95	0.95	0.88		0.95	1.00		0.91	
Frt				1.00	1.00	0.85		1.00	0.85		0.92	
Flt Protected				0.95	0.97	1.00		1.00	1.00		1.00	
Satd. Flow (prot)				1681	1722	2787		3539	1583		4688	
Flt Permitted				0.95	0.97	1.00		1.00	1.00		1.00	
Satd. Flow (perm)				1681	1722	2787		3539	1583		4688	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	77	29	158	0	759	428	0	642	697
RTOR Reduction (vph)	0	0	0	0	0	143	0	0	83	0	135	0
Lane Group Flow (vph)	0	0	0	41	65	15	0	759	345	0	1204	0
Turn Type				Split	NA	Perm		NA	Perm		NA	
Protected Phases				8	8			2			6	
Permitted Phases						8			2			
Actuated Green, G (s)				7.5	7.5	7.5		63.2	63.2		63.2	
Effective Green, g (s)				7.5	7.5	7.5		64.5	64.5		64.5	
Actuated g/C Ratio				0.09	0.09	0.09		0.81	0.81		0.81	
Clearance Time (s)				4.0	4.0	4.0		5.3	5.3		5.3	
Vehicle Extension (s)				2.0	2.0	2.0		4.0	4.0		4.0	
Lane Grp Cap (vph)				157	161	261		2853	1276		3779	
v/s Ratio Prot				0.02	c0.04			0.21			c0.26	
v/s Ratio Perm						0.01			0.22			
v/c Ratio				0.26	0.40	0.06		0.27	0.27		0.32	
Uniform Delay, d1				33.7	34.1	33.0		1.9	1.9		2.0	
Progression Factor				1.00	1.00	1.00		0.46	0.91		1.00	
Incremental Delay, d2				0.3	0.6	0.0		0.2	0.5		0.2	
Delay (s)				34.0	34.7	33.1		1.1	2.2		2.2	
Level of Service				C	C	C		A	A		A	
Approach Delay (s)		0.0			33.6			1.5			2.2	
Approach LOS		A			C			A			A	

Intersection Summary

HCM 2000 Control Delay	4.9	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.33		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	35.8%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
26: Airway Blvd & I-580 EB Ramps/Kitty Hawk Rd



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	588	210	305	61	84	137	39	413	154	103	249	292
Future Volume (vph)	588	210	305	61	84	137	39	413	154	103	249	292
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.4	4.4	4.4	4.0	4.0		4.0	4.0	
Lane Util. Factor	0.97	1.00	1.00	1.00	1.00	1.00	1.00	0.95		1.00	0.95	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.96		1.00	0.92	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	3433	1863	1583	1770	1863	1583	1770	3395		1770	3253	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	3433	1863	1583	1770	1863	1583	1770	3395		1770	3253	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	639	228	332	66	91	149	42	449	167	112	271	317
RTOR Reduction (vph)	0	0	225	0	0	118	0	63	0	0	223	0
Lane Group Flow (vph)	639	228	107	66	91	31	42	553	0	112	365	0
Turn Type	Split	NA	Perm	Split	NA	pm+ov	Prot	NA		Prot	NA	
Protected Phases	7	7		8	8	1	5	2		1	6	
Permitted Phases			7			8						
Actuated Green, G (s)	25.7	25.7	25.7	11.2	11.2	17.3	3.9	19.7		6.1	22.4	
Effective Green, g (s)	25.7	25.7	25.7	10.8	10.8	16.5	3.4	21.0		6.1	23.7	
Actuated g/C Ratio	0.32	0.32	0.32	0.14	0.14	0.21	0.04	0.26		0.08	0.30	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	3.5	5.3		4.0	5.3	
Vehicle Extension (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	3.5		2.0	4.0	
Lane Grp Cap (vph)	1102	598	508	238	251	326	75	891		134	963	
v/s Ratio Prot	c0.19	0.12		0.04	c0.05	0.01	0.02	c0.16		c0.06	c0.11	
v/s Ratio Perm			0.07			0.01						
v/c Ratio	0.58	0.38	0.21	0.28	0.36	0.09	0.56	0.62		0.84	0.38	
Uniform Delay, d1	22.6	21.0	19.8	31.1	31.5	25.7	37.6	26.0		36.5	22.3	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.03	0.82	
Incremental Delay, d2	0.5	0.1	0.1	0.2	0.3	0.0	5.6	3.2		31.9	1.1	
Delay (s)	23.1	21.1	19.8	31.3	31.8	25.7	43.2	29.2		69.3	19.4	
Level of Service	C	C	B	C	C	C	D	C		E	B	
Approach Delay (s)		21.8			28.7			30.1			27.4	
Approach LOS		C			C			C			C	

Intersection Summary

HCM 2000 Control Delay	25.8	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.57		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	16.8
Intersection Capacity Utilization	64.2%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 27: Collier Canyon Rd & N Canyons Pkwy/Portola Ave

BART to Livermore Extension Project
 2025 DMU PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↕	↖	↖	↕	↖	↖	↕		↖	↕	↖
Traffic Volume (vph)	297	552	141	89	245	27	51	9	295	124	15	102
Future Volume (vph)	297	552	141	89	245	27	51	9	295	124	15	102
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	5.2	5.2
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.85		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	1770	1592		1770	1863	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	1770	1592		1770	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	323	600	153	97	266	29	55	10	321	135	16	111
RTOR Reduction (vph)	0	0	105	0	0	21	0	248	0	0	0	79
Lane Group Flow (vph)	323	600	48	97	266	8	55	83	0	135	16	32
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA		Prot	NA	Perm
Protected Phases	1	6		5	2		3	8		7		4
Permitted Phases			6			2						4
Actuated Green, G (s)	11.3	22.0	22.0	7.6	18.3	18.3	4.3	15.9		10.1	22.1	22.1
Effective Green, g (s)	11.3	23.3	23.3	7.6	19.6	19.6	4.3	16.9		10.1	21.5	21.5
Actuated g/C Ratio	0.15	0.32	0.32	0.10	0.27	0.27	0.06	0.23		0.14	0.29	0.29
Clearance Time (s)	4.0	5.3	5.3	4.0	5.3	5.3	4.0	5.0		4.0	4.6	4.6
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	524	1115	499	182	938	419	102	364		241	542	460
v/s Ratio Prot	c0.09	c0.17		0.05	0.08		0.03	c0.05		c0.08	0.01	
v/s Ratio Perm			0.03			0.00						0.02
v/c Ratio	0.62	0.54	0.10	0.53	0.28	0.02	0.54	0.23		0.56	0.03	0.07
Uniform Delay, d1	29.3	20.9	17.9	31.5	21.6	20.0	33.8	23.2		29.8	18.7	19.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	2.2	0.5	0.1	3.0	0.2	0.0	5.4	0.3		3.0	0.0	0.1
Delay (s)	31.4	21.4	18.0	34.4	21.7	20.1	39.2	23.5		32.8	18.8	19.0
Level of Service	C	C	B	C	C	C	D	C		C	B	B
Approach Delay (s)		23.9			24.8			25.8			26.1	
Approach LOS		C			C			C			C	

Intersection Summary

HCM 2000 Control Delay	24.7	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.49		
Actuated Cycle Length (s)	73.9	Sum of lost time (s)	17.2
Intersection Capacity Utilization	59.1%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
28: Isabel Ave/Campus Hill Dr & Portola Ave

BART to Livermore Extension Project
2025 DMU PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↘	↑↑	↗↗	↘↘↘	↑↑		↘↘	↑↑	↗	↘	↑↑	↗
Traffic Volume (vph)	4	518	472	262	185	110	228	343	78	118	287	2
Future Volume (vph)	4	518	472	262	185	110	228	343	78	118	287	2
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	5.8	5.8
Lane Util. Factor	1.00	0.95	0.88	0.94	0.95		0.97	0.95	1.00	1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	0.94		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3539	2787	4990	3341		3433	3539	1583	1770	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	3539	2787	4990	3341		3433	3539	1583	1770	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	4	563	513	285	201	120	248	373	85	128	312	2
RTOR Reduction (vph)	0	0	342	0	65	0	0	0	68	0	0	2
Lane Group Flow (vph)	4	563	171	285	256	0	248	373	17	128	312	0
Turn Type	Prot	NA	Perm	Prot	NA		Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4						2			6
Actuated Green, G (s)	1.4	24.4	24.4	9.2	32.2		9.2	14.1	14.1	10.6	15.9	15.9
Effective Green, g (s)	1.4	25.7	25.7	9.2	33.5		9.2	15.4	15.4	10.6	15.0	15.0
Actuated g/C Ratio	0.02	0.33	0.33	0.12	0.44		0.12	0.20	0.20	0.14	0.20	0.20
Clearance Time (s)	4.0	5.3	5.3	4.0	5.3		4.0	5.3	5.3	4.0	4.9	4.9
Vehicle Extension (s)	2.0	3.0	3.0	2.0	3.0		2.0	3.0	3.0	2.0	3.0	3.0
Lane Grp Cap (vph)	32	1182	931	596	1455		410	708	317	243	690	308
v/s Ratio Prot	0.00	c0.16		c0.06	0.08		0.07	c0.11		c0.07	0.09	
v/s Ratio Perm			0.06						0.01			0.00
v/c Ratio	0.12	0.48	0.18	0.48	0.18		0.60	0.53	0.05	0.53	0.45	0.00
Uniform Delay, d1	37.1	20.3	18.2	31.6	13.3		32.1	27.5	24.9	30.8	27.3	24.9
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.6	0.3	0.1	0.2	0.1		1.7	0.7	0.1	1.0	0.5	0.0
Delay (s)	37.8	20.6	18.3	31.8	13.3		33.9	28.2	24.9	31.8	27.8	24.9
Level of Service	D	C	B	C	B		C	C	C	C	C	C
Approach Delay (s)		19.5			22.0			29.8			28.9	
Approach LOS		B			C			C			C	

Intersection Summary

HCM 2000 Control Delay	24.1	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.51		
Actuated Cycle Length (s)	76.9	Sum of lost time (s)	17.8
Intersection Capacity Utilization	54.2%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 29: Isabel Ave & I-580 WB Ramps



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↖↗		↖		↕↕	↖↗		↕↕	↖
Traffic Volume (vph)	0	0	0	689	0	258	0	364	0	0	585	430
Future Volume (vph)	0	0	0	689	0	258	0	364	0	0	585	430
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0		4.0		5.6			5.6	5.6
Lane Util. Factor				0.97		1.00		0.95			0.95	1.00
Frt				1.00		0.85		1.00			1.00	0.85
Flt Protected				0.95		1.00		1.00			1.00	1.00
Satd. Flow (prot)				3433		1583		3539			3539	1583
Flt Permitted				0.95		1.00		1.00			1.00	1.00
Satd. Flow (perm)				3433		1583		3539			3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	749	0	280	0	396	0	0	636	467
RTOR Reduction (vph)	0	0	0	0	0	200	0	0	0	0	0	246
Lane Group Flow (vph)	0	0	0	749	0	81	0	396	0	0	636	221
Turn Type				Prot		Prot		NA	Free		NA	Prot
Protected Phases				8		8		2			6	6
Permitted Phases									Free			
Actuated Green, G (s)				11.5		11.5		19.7			19.7	19.7
Effective Green, g (s)				11.5		11.5		18.9			18.9	18.9
Actuated g/C Ratio				0.29		0.29		0.47			0.47	0.47
Clearance Time (s)				4.0		4.0		4.8			4.8	4.8
Vehicle Extension (s)				2.0		2.0		4.0			4.0	4.0
Lane Grp Cap (vph)				986		455		1672			1672	747
v/s Ratio Prot				c0.22		0.05		0.11			c0.18	0.14
v/s Ratio Perm												
v/c Ratio				0.76		0.18		0.24			0.38	0.30
Uniform Delay, d1				13.0		10.7		6.3			6.8	6.5
Progression Factor				1.00		1.00		0.97			1.00	1.00
Incremental Delay, d2				3.0		0.1		0.3			0.2	0.3
Delay (s)				16.0		10.8		6.4			7.0	6.8
Level of Service				B		B		A			A	A
Approach Delay (s)		0.0			14.6			6.4			6.9	
Approach LOS		A			B			A			A	

Intersection Summary			
HCM 2000 Control Delay	9.9	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.52		
Actuated Cycle Length (s)	40.0	Sum of lost time (s)	9.6
Intersection Capacity Utilization	43.8%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 30: Isabel Ave & I-580 EB Ramps



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↖		↗↗					↕↕	↗		↕↕	↗
Traffic Volume (vph)	178	0	347	0	0	0	0	701	1056	0	911	613
Future Volume (vph)	178	0	347	0	0	0	0	701	1056	0	911	613
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0					4.0	4.0		4.0	4.0
Lane Util. Factor	0.97		0.88					0.95	1.00		0.95	1.00
Frt	1.00		0.85					1.00	0.85		1.00	0.85
Flt Protected	0.95		1.00					1.00	1.00		1.00	1.00
Satd. Flow (prot)	3433		2787					3539	1583		3539	1583
Flt Permitted	0.95		1.00					1.00	1.00		1.00	1.00
Satd. Flow (perm)	3433		2787					3539	1583		3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	193	0	377	0	0	0	0	762	1148	0	990	666
RTOR Reduction (vph)	0	0	210	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	193	0	167	0	0	0	0	762	1148	0	990	666
Turn Type	Prot		Perm					NA	Free		NA	Free
Protected Phases	4							2			6	
Permitted Phases			4						Free			Free
Actuated Green, G (s)	9.5		9.5					61.5	80.0		61.5	80.0
Effective Green, g (s)	9.5		9.5					62.5	80.0		62.5	80.0
Actuated g/C Ratio	0.12		0.12					0.78	1.00		0.78	1.00
Clearance Time (s)	4.0		4.0					5.0			5.0	
Vehicle Extension (s)	2.0		2.0					4.0			4.0	
Lane Grp Cap (vph)	407		330					2764	1583		2764	1583
v/s Ratio Prot	0.06							0.22			0.28	
v/s Ratio Perm			0.06						c0.73			0.42
v/c Ratio	0.47		0.51					0.28	0.73		0.36	0.42
Uniform Delay, d1	32.9		33.1					2.4	0.0		2.7	0.0
Progression Factor	1.00		1.00					1.00	1.00		0.64	1.00
Incremental Delay, d2	0.3		0.4					0.1	2.9		0.3	0.7
Delay (s)	33.2		33.5					2.5	2.9		2.0	0.7
Level of Service	C		C					A	A		A	A
Approach Delay (s)		33.4			0.0			2.8			1.5	
Approach LOS		C			A			A			A	

Intersection Summary			
HCM 2000 Control Delay	6.5	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.81		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	44.0%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
31: Isabel Ave & Airway Blvd




































Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	8	110	507	373	129	602	363	1087	122	358	1352	16
Future Volume (vph)	8	110	507	373	129	602	363	1087	122	358	1352	16
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.2	5.2	5.6	5.2	5.2	5.6	4.0	4.0	4.0	4.0	4.0	5.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.91	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	1863	1583	1770	1863	1583	1770	5085	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	1863	1583	1770	1863	1583	1770	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	9	120	551	405	140	654	395	1182	133	389	1470	17
RTOR Reduction (vph)	0	0	72	0	0	49	0	0	88	0	0	12
Lane Group Flow (vph)	9	120	479	405	140	605	395	1182	45	389	1470	5
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4	5	3	8	1	5	2		1	NA	6
Permitted Phases			4			8			2			6
Actuated Green, G (s)	0.8	14.8	28.8	15.4	29.4	42.4	14.0	30.4	30.4	13.0	29.4	29.4
Effective Green, g (s)	0.2	14.2	27.6	14.8	28.8	41.2	15.0	31.4	31.4	14.0	30.4	29.4
Actuated g/C Ratio	0.00	0.15	0.30	0.16	0.31	0.44	0.16	0.34	0.34	0.15	0.33	0.32
Clearance Time (s)	4.6	4.6	5.0	4.6	4.6	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	5.0	5.0	3.0	5.0	5.0
Lane Grp Cap (vph)	3	285	470	282	578	702	286	1720	535	517	1665	501
v/s Ratio Prot	0.01	0.06	c0.15	c0.23	0.08	0.11	c0.22	0.23		0.11	c0.29	
v/s Ratio Perm			0.16			0.27			0.03			0.00
v/c Ratio	3.00	0.42	1.02	1.44	0.24	0.86	1.38	0.69	0.08	0.75	0.88	0.01
Uniform Delay, d1	46.3	35.6	32.6	39.0	23.9	23.2	38.9	26.5	20.9	37.7	29.5	21.7
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1456.2	1.0	46.6	215.4	0.2	10.6	191.9	1.5	0.1	6.1	6.4	0.0
Delay (s)	1502.5	36.6	79.2	254.4	24.1	33.8	230.8	28.0	21.0	43.9	35.9	21.7
Level of Service	F	D	E	F	C	C	F	C	C	D	D	C
Approach Delay (s)		90.5			107.2			74.3			37.4	
Approach LOS		F			F			E			D	

Intersection Summary

HCM 2000 Control Delay	70.9	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.14		
Actuated Cycle Length (s)	92.8	Sum of lost time (s)	20.0
Intersection Capacity Utilization	90.5%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

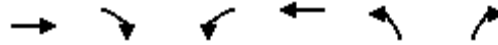
HCM Signalized Intersection Capacity Analysis
32: Isabel Ave & Jack London Blvd

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 	 			 		 	  		 	  	
Traffic Volume (vph)	127	686	242	199	142	306	88	1153	350	545	1409	68
Future Volume (vph)	127	686	242	199	142	306	88	1153	350	545	1409	68
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.97	0.91	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	3433	5085	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	3433	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	138	746	263	216	154	333	96	1253	380	592	1532	74
RTOR Reduction (vph)	0	0	160	0	0	36	0	0	158	0	0	45
Lane Group Flow (vph)	138	746	103	216	154	297	96	1253	222	592	1532	29
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8	1	5	2		1	NA	6
Permitted Phases			4			8			2			6
Actuated Green, G (s)	8.9	29.1	29.1	14.9	35.1	55.8	5.4	30.3	30.3	20.7	45.6	45.6
Effective Green, g (s)	8.9	29.1	29.1	14.9	35.1	55.8	5.4	30.3	30.3	20.7	45.6	45.6
Actuated g/C Ratio	0.08	0.25	0.25	0.13	0.30	0.48	0.05	0.26	0.26	0.18	0.39	0.39
Clearance Time (s)	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	262	886	396	226	1069	832	159	1325	412	611	1995	621
v/s Ratio Prot	0.04	c0.21		c0.12	0.04	0.06	0.03	c0.25		c0.17	0.30	
v/s Ratio Perm			0.06			0.12			0.14			0.02
v/c Ratio	0.53	0.84	0.26	0.96	0.14	0.36	0.60	0.95	0.54	0.97	0.77	0.05
Uniform Delay, d1	51.6	41.4	34.9	50.3	29.6	18.9	54.4	42.1	36.9	47.4	30.7	21.8
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.9	7.3	0.3	47.1	0.1	0.3	6.3	13.7	1.4	28.4	1.8	0.0
Delay (s)	53.5	48.7	35.3	97.4	29.7	19.2	60.7	55.8	38.3	75.8	32.5	21.9
Level of Service	D	D	D	F	C	B	E	E	D	E	C	C
Approach Delay (s)		46.2			45.5			52.3			43.8	
Approach LOS		D			D			D			D	

Intersection Summary		
HCM 2000 Control Delay	47.0	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.92	D
Actuated Cycle Length (s)	116.2	Sum of lost time (s)
Intersection Capacity Utilization	85.5%	21.2
Analysis Period (min)	15	ICU Level of Service
		E

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 33: Isabel Ave Connector & Stanley Blvd



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑	↑	↔	↑↑	↔	↔
Traffic Volume (vph)	1684	454	212	559	173	384
Future Volume (vph)	1684	454	212	559	173	384
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	3.8	4.0	4.0	4.0	2.5
Lane Util. Factor	0.95	1.00	0.97	0.95	0.97	0.88
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	3539	1583	3433	3539	3433	2787
Flt Permitted	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (perm)	3539	1583	3433	3539	3433	2787
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	1830	493	230	608	188	417
RTOR Reduction (vph)	0	2	0	0	0	8
Lane Group Flow (vph)	1830	491	230	608	188	409
Turn Type	NA	pm+ov	Prot	NA	Prot	pm+ov
Protected Phases	2	8	1	6	8	1
Permitted Phases		2				8
Actuated Green, G (s)	43.8	52.7	6.0	53.8	8.9	14.9
Effective Green, g (s)	45.5	56.1	6.0	55.5	10.4	17.9
Actuated g/C Ratio	0.62	0.76	0.08	0.75	0.14	0.24
Clearance Time (s)	5.7	5.5	4.0	5.7	5.5	4.0
Vehicle Extension (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Grp Cap (vph)	2178	1201	278	2657	483	675
v/s Ratio Prot	c0.52	0.06	c0.07	0.17	0.05	c0.06
v/s Ratio Perm		0.25				0.09
v/c Ratio	0.84	0.41	0.83	0.23	0.39	0.61
Uniform Delay, d1	11.3	3.1	33.4	2.8	28.9	24.9
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	3.0	0.1	17.2	0.0	0.2	1.1
Delay (s)	14.3	3.2	50.6	2.8	29.1	25.9
Level of Service	B	A	D	A	C	C
Approach Delay (s)	11.9			15.9	26.9	
Approach LOS	B			B	C	

Intersection Summary

HCM 2000 Control Delay	15.2	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.80		
Actuated Cycle Length (s)	73.9	Sum of lost time (s)	12.0
Intersection Capacity Utilization	69.3%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 34: Murrieta Blvd/Driveway & Portola Ave



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗		↖	↗		↖	↗	↗		↗	
Traffic Volume (vph)	0	1408	136	213	730	1	127	5	332	5	6	0
Future Volume (vph)	0	1408	136	213	730	1	127	5	332	5	6	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.8		4.0	5.8		5.2	5.2	5.2		4.0	
Lane Util. Factor		0.95		1.00	0.95		0.95	0.95	1.00		1.00	
Frt		0.99		1.00	1.00		1.00	1.00	0.85		1.00	
Flt Protected		1.00		0.95	1.00		0.95	0.96	1.00		0.98	
Satd. Flow (prot)		3492		1770	3539		1681	1691	1583		1825	
Flt Permitted		1.00		0.95	1.00		0.95	0.96	1.00		0.98	
Satd. Flow (perm)		3492		1770	3539		1681	1691	1583		1825	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	1530	148	232	793	1	138	5	361	5	7	0
RTOR Reduction (vph)	0	5	0	0	0	0	0	0	207	0	0	0
Lane Group Flow (vph)	0	1673	0	232	794	0	72	71	154	0	12	0
Turn Type	Prot	NA		Prot	NA		Split	NA	Perm		Split	NA
Protected Phases	5	2		1	6		8	8			4	4
Permitted Phases									8			
Actuated Green, G (s)		58.0		16.2	78.2		14.1	14.1	14.1		1.4	
Effective Green, g (s)		57.1		16.2	77.3		13.5	13.5	13.5		1.4	
Actuated g/C Ratio		0.53		0.15	0.72		0.13	0.13	0.13		0.01	
Clearance Time (s)		4.9		4.0	4.9		4.6	4.6	4.6		4.0	
Vehicle Extension (s)		2.0		2.0	2.0		2.0	2.0	2.0		2.0	
Lane Grp Cap (vph)		1860		267	2551		211	212	199		23	
v/s Ratio Prot		c0.48		c0.13	0.22		0.04	0.04			c0.01	
v/s Ratio Perm									c0.10			
v/c Ratio		0.90		0.87	0.31		0.34	0.33	0.77		0.52	
Uniform Delay, d1		22.5		44.5	5.4		42.8	42.8	45.4		52.6	
Progression Factor		1.00		1.00	1.00		1.00	1.00	1.00		1.00	
Incremental Delay, d2		6.1		23.8	0.0		0.4	0.3	15.5		9.5	
Delay (s)		28.6		68.3	5.4		43.1	43.1	60.9		62.1	
Level of Service		C		E	A		D	D	E		E	
Approach Delay (s)		28.6			19.6			55.8			62.1	
Approach LOS		C			B			E			E	

Intersection Summary		
HCM 2000 Control Delay	30.1	HCM 2000 Level of Service C
HCM 2000 Volume to Capacity ratio	0.87	
Actuated Cycle Length (s)	107.2	Sum of lost time (s) 19.0
Intersection Capacity Utilization	79.6%	ICU Level of Service D
Analysis Period (min)	15	

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 35: Murrieta Blvd & Jack London Blvd
































Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	283	848	440	245	280	127
Future Volume (vph)	283	848	440	245	280	127
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00	1.00	0.95	0.91	
Frt	1.00	0.85	1.00	1.00	0.95	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1770	1583	1770	3539	4847	
Flt Permitted	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	1770	1583	1770	3539	4847	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	308	922	478	266	304	138
RTOR Reduction (vph)	0	470	0	0	110	0
Lane Group Flow (vph)	308	452	478	266	332	0
Turn Type	Prot	Perm	Prot	NA	NA	
Protected Phases	4		5	2	6	
Permitted Phases		4				
Actuated Green, G (s)	22.5	22.5	21.8	36.3	10.5	
Effective Green, g (s)	22.5	22.5	21.8	36.3	10.5	
Actuated g/C Ratio	0.34	0.34	0.33	0.54	0.16	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	596	533	577	1923	761	
v/s Ratio Prot	0.17		c0.27	0.08	c0.07	
v/s Ratio Perm		c0.29				
v/c Ratio	0.52	0.85	0.83	0.14	0.44	
Uniform Delay, d1	17.8	20.6	20.8	7.5	25.5	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.8	12.0	9.5	0.0	0.4	
Delay (s)	18.5	32.6	30.3	7.6	25.9	
Level of Service	B	C	C	A	C	
Approach Delay (s)	29.1			22.2	25.9	
Approach LOS	C			C	C	

Intersection Summary

HCM 2000 Control Delay	26.4	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.76		
Actuated Cycle Length (s)	66.8	Sum of lost time (s)	12.0
Intersection Capacity Utilization	67.4%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
36: Murrieta Blvd & Stanley Blvd

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 	 			 		 	 			 	
Traffic Volume (vph)	274	1067	512	42	529	156	229	379	18	251	344	182
Future Volume (vph)	274	1067	512	42	529	156	229	379	18	251	344	182
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.9	4.9	4.0	4.9	4.9	4.9	4.9		4.9	4.9	4.0
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.97	0.95		1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	3433	3515		1770	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	3433	3515		1770	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	298	1160	557	46	575	170	249	412	20	273	374	198
RTOR Reduction (vph)	0	0	313	0	0	69	0	4	0	0	0	150
Lane Group Flow (vph)	298	1160	244	46	575	101	249	428	0	273	374	48
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Prot	NA		Prot	NA	Perm
Protected Phases	7	4		3	8	1	5	2		1	6	
Permitted Phases			4			8						6
Actuated Green, G (s)	10.8	29.1	29.1	2.2	20.5	34.9	9.9	13.6		14.4	18.1	18.1
Effective Green, g (s)	10.8	28.2	28.2	2.2	19.6	33.1	9.0	12.7		13.5	17.2	18.1
Actuated g/C Ratio	0.14	0.37	0.37	0.03	0.26	0.44	0.12	0.17		0.18	0.23	0.24
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	492	1325	592	51	921	798	410	592		317	808	380
v/s Ratio Prot	c0.09	c0.33		0.03	0.16	0.02	0.07	c0.12		c0.15	c0.11	
v/s Ratio Perm			0.15			0.04						0.03
v/c Ratio	0.61	0.88	0.41	0.90	0.62	0.13	0.61	0.72		0.86	0.46	0.13
Uniform Delay, d1	30.3	21.9	17.4	36.4	24.6	12.5	31.5	29.6		30.0	25.1	22.4
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	2.1	6.8	0.5	89.8	1.3	0.1	2.5	4.3		20.6	0.4	0.1
Delay (s)	32.4	28.7	17.9	126.3	25.9	12.6	34.0	34.0		50.6	25.5	22.5
Level of Service	C	C	B	F	C	B	C	C		D	C	C
Approach Delay (s)		26.2			28.9			34.0			32.9	
Approach LOS		C			C			C			C	

Intersection Summary

HCM 2000 Control Delay	29.2	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.83		
Actuated Cycle Length (s)	75.3	Sum of lost time (s)	18.7
Intersection Capacity Utilization	73.4%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
37: Livermore Ave & I-580 WB Ramps



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↖	↔		↗	↑			↕	
Traffic Volume (vph)	0	0	0	323	18	19	783	469	0	0	112	0
Future Volume (vph)	0	0	0	323	18	19	783	469	0	0	112	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)					4.0		4.0	4.0			4.0	
Lane Util. Factor					0.95		0.97	1.00			0.95	
Frt					0.99		1.00	1.00			1.00	
Flt Protected					0.96		0.95	1.00			1.00	
Satd. Flow (prot)					1680		3433	1863			3539	
Flt Permitted					0.96		0.95	1.00			1.00	
Satd. Flow (perm)					1680		3433	1863			3539	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	351	20	21	851	510	0	0	122	0
RTOR Reduction (vph)	0	0	0	0	4	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	0	388	0	851	510	0	0	122	0
Turn Type				Split	NA		Prot	NA			NA	
Protected Phases				8	8		5	2			6	
Permitted Phases												
Actuated Green, G (s)					18.3		14.5	32.0			14.0	
Effective Green, g (s)					18.3		14.0	33.7			15.7	
Actuated g/C Ratio					0.31		0.23	0.56			0.26	
Clearance Time (s)					4.0		3.5	5.7			5.7	
Vehicle Extension (s)					2.0		2.0	2.5			2.5	
Lane Grp Cap (vph)					512		801	1046			926	
v/s Ratio Prot					c0.23		c0.25	c0.27			0.03	
v/s Ratio Perm												
v/c Ratio					0.76		1.06	0.49			0.13	
Uniform Delay, d1					18.8		23.0	7.9			16.9	
Progression Factor					1.00		0.51	0.25			1.00	
Incremental Delay, d2					5.6		31.2	0.1			0.3	
Delay (s)					24.5		42.8	2.1			17.2	
Level of Service					C		D	A			B	
Approach Delay (s)		0.0			24.5			27.6			17.2	
Approach LOS		A			C			C			B	

Intersection Summary

HCM 2000 Control Delay	26.3	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.77		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	104.8%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
38: Livermore Ave & I-580 EB Ramps



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕	↗					↕		↘	↕	
Traffic Volume (vph)	259	13	1253	0	0	0	0	1005	295	75	358	0
Future Volume (vph)	259	13	1253	0	0	0	0	1005	295	75	358	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0					4.0		4.0	4.0	
Lane Util. Factor		0.95	0.95					0.95		1.00	0.95	
Frt		0.90	0.85					0.97		1.00	1.00	
Flt Protected		0.99	1.00					1.00		0.95	1.00	
Satd. Flow (prot)		1563	1504					3419		1770	3539	
Flt Permitted		0.99	1.00					1.00		0.95	1.00	
Satd. Flow (perm)		1563	1504					3419		1770	3539	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	282	14	1362	0	0	0	0	1092	321	82	389	0
RTOR Reduction (vph)	0	135	284	0	0	0	0	42	0	0	0	0
Lane Group Flow (vph)	0	828	411	0	0	0	0	1371	0	82	389	0
Turn Type	Prot	NA	Perm					NA		Prot	NA	
Protected Phases	7	4						2		1	6	
Permitted Phases			4									
Actuated Green, G (s)		20.0	20.0					23.8		4.2	31.0	
Effective Green, g (s)		20.0	20.0					24.8		3.2	32.0	
Actuated g/C Ratio		0.33	0.33					0.41		0.05	0.53	
Clearance Time (s)		4.0	4.0					5.0		3.0	5.0	
Vehicle Extension (s)		2.0	2.0					2.5		2.0	2.5	
Lane Grp Cap (vph)		521	501					1413		94	1887	
v/s Ratio Prot								c0.40		c0.05	0.11	
v/s Ratio Perm		0.53	0.27									
v/c Ratio		1.59	0.82					0.97		0.87	0.21	
Uniform Delay, d1		20.0	18.4					17.2		28.2	7.3	
Progression Factor		1.00	1.00					1.00		0.83	0.28	
Incremental Delay, d2		273.9	9.9					17.8		49.2	0.2	
Delay (s)		293.9	28.2					35.0		72.6	2.3	
Level of Service		F	C					D		E	A	
Approach Delay (s)		182.5			0.0			35.0			14.5	
Approach LOS		F			A			D			B	





























Intersection Summary

HCM 2000 Control Delay	101.4	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.22		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	104.8%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
39: Livermore Ave & Portola Ave

BART to Livermore Extension Project
2025 DMU PM

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations	 	 			 			 			 		
Traffic Volume (vph)	680	629	193	16	333	53	201	493	73	195	878	478	
Future Volume (vph)	680	629	193	16	333	53	201	493	73	195	878	478	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)	4.0	4.0	5.3	4.0	4.0	5.3	4.0	5.8		4.0	5.8	4.9	
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	1.00	0.95		1.00	0.95	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.98		1.00	1.00	0.85	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	1770	3471		1770	3539	1583	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	1770	3471		1770	3539	1583	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	
Adj. Flow (vph)	739	684	210	17	362	58	218	536	79	212	954	520	
RTOR Reduction (vph)	0	0	128	0	0	50	0	8	0	0	0	63	
Lane Group Flow (vph)	739	684	82	17	362	8	218	607	0	212	954	457	
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA		Prot	NA	pm+ov	
Protected Phases	3	8		7	4		1	6		5	2	3	
Permitted Phases			8			4						2	
Actuated Green, G (s)	32.6	48.8	48.8	1.9	18.1	18.1	17.1	37.1		18.7	38.7	71.3	
Effective Green, g (s)	32.6	50.1	48.8	1.9	19.4	18.1	17.1	36.2		18.7	37.8	69.5	
Actuated g/C Ratio	0.26	0.40	0.39	0.02	0.16	0.15	0.14	0.29		0.15	0.30	0.56	
Clearance Time (s)	4.0	5.3	5.3	4.0	5.3	5.3	4.0	4.9		4.0	4.9	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	
Lane Grp Cap (vph)	897	1421	619	26	550	229	242	1007		265	1072	882	
v/s Ratio Prot	c0.22	0.19		0.01	c0.10		c0.12	0.17		0.12	c0.27	0.13	
v/s Ratio Perm			0.05			0.01						0.16	
v/c Ratio	0.82	0.48	0.13	0.65	0.66	0.04	0.90	0.60		0.80	0.89	0.52	
Uniform Delay, d1	43.3	27.7	24.4	61.1	49.5	45.8	53.0	38.1		51.2	41.5	17.2	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	
Incremental Delay, d2	6.2	0.3	0.1	46.4	2.8	0.1	32.7	1.0		15.7	9.2	0.5	
Delay (s)	49.5	27.9	24.5	107.4	52.4	45.9	85.7	39.1		66.9	50.7	17.7	
Level of Service	D	C	C	F	D	D	F	D		E	D	B	
Approach Delay (s)		37.3			53.7			51.3			42.6		
Approach LOS		D			D			D			D		
Intersection Summary													
HCM 2000 Control Delay			43.3									HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio			0.84										
Actuated Cycle Length (s)			124.7									Sum of lost time (s)	18.7
Intersection Capacity Utilization			78.8%									ICU Level of Service	D
Analysis Period (min)			15										
c Critical Lane Group													

HCM Signalized Intersection Capacity Analysis
40: First St/Springtown Blvd & I-580 WB Ramps



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations			↗↗			↗	↗↗	↑			↖↖	↗
Traffic Volume (vph)	0	0	261	0	0	0	388	1545	0	0	422	195
Future Volume (vph)	0	0	261	0	0	0	388	1545	0	0	422	195
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)			4.0				4.0	4.0			5.0	5.0
Lane Util. Factor			0.88				0.97	1.00			0.95	1.00
Frt			0.85				1.00	1.00			1.00	0.85
Flt Protected			1.00				0.95	1.00			1.00	1.00
Satd. Flow (prot)			2787				3433	1863			3539	1583
Flt Permitted			1.00				0.95	1.00			1.00	1.00
Satd. Flow (perm)			2787				3433	1863			3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	284	0	0	0	422	1679	0	0	459	212
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	38
Lane Group Flow (vph)	0	0	284	0	0	0	422	1679	0	0	459	174
Turn Type			Over			Free	Prot	NA			NA	Perm
Protected Phases			5				5	2			6	
Permitted Phases						Free						6
Actuated Green, G (s)			38.5				38.5	80.0			33.5	33.5
Effective Green, g (s)			38.0				38.0	80.0			33.0	33.0
Actuated g/C Ratio			0.48				0.48	1.00			0.41	0.41
Clearance Time (s)			3.5				3.5	4.0			4.5	4.5
Vehicle Extension (s)			2.0				2.0	0.2			4.0	4.0
Lane Grp Cap (vph)			1323				1630	1863			1459	652
v/s Ratio Prot			0.10				0.12	c0.90			0.13	
v/s Ratio Perm												0.11
v/c Ratio			0.21				0.26	0.90			0.31	0.27
Uniform Delay, d1			12.3				12.6	0.0			15.9	15.5
Progression Factor			1.00				0.93	1.00			1.00	1.00
Incremental Delay, d2			0.0				0.0	2.0			0.2	0.3
Delay (s)			12.3				11.7	2.0			16.0	15.8
Level of Service			B				B	A			B	B
Approach Delay (s)		12.3			0.0			3.9			16.0	
Approach LOS		B			A			A			B	

Intersection Summary

HCM 2000 Control Delay	7.4	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	1.02		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	84.6%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
41: First St & I-580 EB Ramps



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕	↗↘					↕↕	↗	↘	↕↕	
Traffic Volume (vph)	551	4	745	0	0	0	0	1409	458	85	881	0
Future Volume (vph)	551	4	745	0	0	0	0	1409	458	85	881	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0					5.0	5.0	4.0	5.0	
Lane Util. Factor		1.00	0.88					0.95	1.00	1.00	0.95	
Frt		1.00	0.85					1.00	0.85	1.00	1.00	
Flt Protected		0.95	1.00					1.00	1.00	0.95	1.00	
Satd. Flow (prot)		1775	2787					3539	1583	1770	3539	
Flt Permitted		0.95	1.00					1.00	1.00	0.95	1.00	
Satd. Flow (perm)		1775	2787					3539	1583	1770	3539	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	599	4	810	0	0	0	0	1532	498	92	958	0
RTOR Reduction (vph)	0	0	127	0	0	0	0	0	280	0	0	0
Lane Group Flow (vph)	0	603	683	0	0	0	0	1532	218	92	958	0
Turn Type	Perm	NA	Perm					NA	Perm	Prot	NA	
Protected Phases		4						2		1	6	
Permitted Phases	4		4						2			
Actuated Green, G (s)		27.5	27.5					35.5	35.5	6.0	44.5	
Effective Green, g (s)		27.0	27.0					35.0	35.0	5.0	44.0	
Actuated g/C Ratio		0.34	0.34					0.44	0.44	0.06	0.55	
Clearance Time (s)		3.5	3.5					4.5	4.5	3.0	4.5	
Vehicle Extension (s)		2.5	2.5					4.0	4.0	2.0	4.0	
Lane Grp Cap (vph)		599	940					1548	692	110	1946	
v/s Ratio Prot								c0.43		c0.05	0.27	
v/s Ratio Perm		0.34	0.25						0.14			
v/c Ratio		1.01	0.73					0.99	0.31	0.84	0.49	
Uniform Delay, d1		26.5	23.3					22.3	14.7	37.1	11.1	
Progression Factor		1.00	1.00					1.00	1.00	0.88	0.60	
Incremental Delay, d2		38.4	2.7					20.5	1.2	38.1	0.9	
Delay (s)		64.9	25.9					42.9	15.9	70.8	7.6	
Level of Service		E	C					D	B	E	A	
Approach Delay (s)		42.6			0.0			36.2			13.1	
Approach LOS		D			A			D			B	

Intersection Summary

HCM 2000 Control Delay	32.8	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.98		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	13.0
Intersection Capacity Utilization	85.2%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
42: 1st St & Mines Rd

BART to Livermore Extension Project
2025 DMU PM






















Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↘	↑	↗	↘↗	↑	↗	↘	↑↑↑	↗	↘↗	↑↑↑	↗
Traffic Volume (vph)	66	241	60	434	286	374	73	1437	900	369	893	48
Future Volume (vph)	66	241	60	434	286	374	73	1437	900	369	893	48
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	0.97	1.00	1.00	1.00	0.91	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	1863	1583	3433	1863	1583	1770	5085	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	1863	1583	3433	1863	1583	1770	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	72	262	65	472	311	407	79	1562	978	401	971	52
RTOR Reduction (vph)	0	0	54	0	0	36	0	0	184	0	0	27
Lane Group Flow (vph)	72	262	11	472	311	371	79	1562	794	401	971	25
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8	1	5	2		1	NA	6
Permitted Phases			4			8			2			6
Actuated Green, G (s)	4.8	16.5	16.5	13.0	24.7	35.7	7.6	44.8	44.8	11.0	48.2	48.2
Effective Green, g (s)	4.8	16.5	16.5	13.0	24.7	35.7	7.6	44.8	44.8	11.0	48.2	48.2
Actuated g/C Ratio	0.05	0.16	0.16	0.13	0.24	0.35	0.08	0.44	0.44	0.11	0.48	0.48
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	83	303	257	440	454	620	132	2248	700	372	2419	753
v/s Ratio Prot	0.04	c0.14		c0.14	0.17	0.06	0.04	0.31		c0.12	c0.19	
v/s Ratio Perm			0.01			0.17			c0.50			0.02
v/c Ratio	0.87	0.86	0.04	1.07	0.69	0.60	0.60	0.69	1.13	1.08	0.40	0.03
Uniform Delay, d1	47.9	41.3	35.7	44.1	34.8	26.9	45.4	22.7	28.2	45.1	17.2	14.1
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	56.5	21.7	0.1	63.7	4.3	1.6	7.1	0.9	77.4	69.1	0.1	0.0
Delay (s)	104.5	63.0	35.8	107.9	39.0	28.5	52.5	23.7	105.6	114.2	17.3	14.2
Level of Service	F	E	D	F	D	C	D	C	F	F	B	B
Approach Delay (s)		66.1			62.7			55.2			44.5	
Approach LOS		E			E			E			D	

Intersection Summary

HCM 2000 Control Delay	54.8	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	1.04		
Actuated Cycle Length (s)	101.3	Sum of lost time (s)	16.0
Intersection Capacity Utilization	88.9%	ICU Level of Service	E
Analysis Period (min)	15		



















c Critical Lane Group

HCM Unsignalized Intersection Capacity Analysis
43: Vasco Rd & I-580 WB Ramps

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations								 				
Traffic Volume (veh/h)	0	0	0	0	0	88	0	1881	0	0	426	0
Future Volume (Veh/h)	0	0	0	0	0	88	0	1881	0	0	426	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	0	0	0	96	0	2045	0	0	463	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage (veh)												
Upstream signal (ft)											487	
pX, platoon unblocked												
vC, conflicting volume	1582	2508	463	2508	2508	1022	463			2045		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1582	2508	463	2508	2508	1022	463			2045		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	100	100	59	100			100		
cM capacity (veh/h)	43	28	546	14	28	233	1095			272		
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	SB 1	SB 2					
Volume Total	0	96	1022	1022	0	463	0					
Volume Left	0	0	0	0	0	0	0					
Volume Right	0	96	0	0	0	0	0					
cSH	1700	233	1700	1700	1700	1700	1700					
Volume to Capacity	0.00	0.41	0.60	0.60	0.00	0.27	0.00					
Queue Length 95th (ft)	0	47	0	0	0	0	0					
Control Delay (s)	0.0	30.8	0.0	0.0	0.0	0.0	0.0					
Lane LOS	A	D										
Approach Delay (s)	0.0	30.8	0.0			0.0						
Approach LOS	A	D										
Intersection Summary												
Average Delay			1.1									
Intersection Capacity Utilization			64.1%	ICU Level of Service	C							
Analysis Period (min)			15									

HCM Unsignalized Intersection Capacity Analysis
44: Vasco Rd & I-580 EB Ramps

BART to Livermore Extension Project
2025 DMU PM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	0	0	0	0	2077	0	64	557	0
Future Volume (Veh/h)	0	0	0	0	0	0	0	2077	0	64	557	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	0	0	0	0	0	2258	0	70	605	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1874	3003	605	3003	3003	1129	605			2258		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1874	3003	605	3003	3003	1129	605			2258		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	100	100	100	100			69		
cM capacity (veh/h)	33	9	441	4	9	198	969			224		
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2						
Volume Total	0	0	1505	753	70	605						
Volume Left	0	0	0	0	70	0						
Volume Right	0	0	0	0	0	0						
cSH	1700	1700	1700	1700	224	1700						
Volume to Capacity	0.00	0.00	0.89	0.44	0.31	0.36						
Queue Length 95th (ft)	0	0	0	0	32	0						
Control Delay (s)	0.0	0.0	0.0	0.0	28.2	0.0						
Lane LOS	A	A			D							
Approach Delay (s)	0.0	0.0	0.0		2.9							
Approach LOS	A	A										
Intersection Summary												
Average Delay			0.7									
Intersection Capacity Utilization			60.7%	ICU Level of Service	B							
Analysis Period (min)			15									

HCM Signalized Intersection Capacity Analysis
45: Vasco Rd & East Ave

BART to Livermore Extension Project
2025 DMU PM

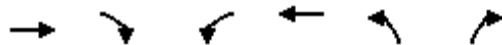


Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	444	26	93	142	355	229	102	339	12	12	348	352
Future Volume (vph)	444	26	93	142	355	229	102	339	12	12	348	352
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	0.95		0.97	1.00	1.00
Frt	1.00	0.88		1.00	0.94		1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	3124		1770	3331		1770	3521		3433	1863	1583
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1770	3124		1770	3331		1770	3521		3433	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	483	28	101	154	386	249	111	368	13	13	378	383
RTOR Reduction (vph)	0	65	0	0	133	0	0	3	0	0	0	283
Lane Group Flow (vph)	483	64	0	154	502	0	111	378	0	13	378	100
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												6
Actuated Green, G (s)	22.6	29.1		9.4	15.9		6.0	26.6		0.8	21.4	21.4
Effective Green, g (s)	22.6	29.1		9.4	15.9		6.0	26.6		0.8	21.4	21.4
Actuated g/C Ratio	0.28	0.36		0.11	0.19		0.07	0.32		0.01	0.26	0.26
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	488	1109		203	646		129	1143		33	486	413
v/s Ratio Prot	c0.27	0.02		0.09	c0.15		c0.06	0.11		0.00	c0.20	
v/s Ratio Perm												0.06
v/c Ratio	0.99	0.06		0.76	0.78		0.86	0.33		0.39	0.78	0.24
Uniform Delay, d1	29.5	17.4		35.1	31.3		37.5	20.9		40.3	28.0	23.9
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	37.6	0.0		14.9	5.9		40.6	0.2		7.6	7.7	0.3
Delay (s)	67.2	17.4		50.1	37.2		78.1	21.1		47.9	35.7	24.2
Level of Service	E	B		D	D		E	C		D	D	C
Approach Delay (s)		56.7			39.7			34.0			30.2	
Approach LOS		E			D			C			C	

Intersection Summary

HCM 2000 Control Delay	39.8	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.86		
Actuated Cycle Length (s)	81.9	Sum of lost time (s)	16.0
Intersection Capacity Utilization	79.1%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	633	35	199	231	6	130
Future Volume (Veh/h)	633	35	199	231	6	130
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	688	38	216	251	7	141
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage (veh)						
Upstream signal (ft)	1007					
pX, platoon unblocked						
vC, conflicting volume			688	1390		707
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			688	1390		707
tC, single (s)			4.1	6.4	6.2	
tC, 2 stage (s)						
tF (s)			2.2	3.5	3.3	
p0 queue free %			76	94	68	
cM capacity (veh/h)			906	119	435	
Direction, Lane #	EB 1	WB 1	NB 1	NB 2		
Volume Total	726	467	7	141		
Volume Left	0	216	7	0		
Volume Right	38	0	0	141		
cSH	1700	906	119	435		
Volume to Capacity	0.43	0.24	0.06	0.32		
Queue Length 95th (ft)	0	23	5	35		
Control Delay (s)	0.0	6.3	37.0	17.2		
Lane LOS	A		E	C		
Approach Delay (s)	0.0	6.3	18.1			
Approach LOS	C					
Intersection Summary						
Average Delay	4.2					
Intersection Capacity Utilization	71.9%		ICU Level of Service		C	
Analysis Period (min)	15					

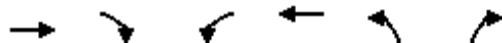
Intersection	
Intersection Delay, s/veh	13.7
Intersection LOS	B

Movement	EBU	EBL	EBT	WBU	WBT	WBR	SBU	SBL	SBR
Lane Configurations		↘	↕↕		↕	↘		↘↘	↘
Traffic Vol, veh/h	0	291	253	0	84	267	0	190	7
Future Vol, veh/h	0	291	253	0	84	267	0	190	7
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	316	275	0	91	290	0	207	8
Number of Lanes	0	1	2	0	1	1	0	2	1

Approach	EB	WB	SB
Opposing Approach	WB	EB	
Opposing Lanes	2	3	0
Conflicting Approach Left	SB		WB
Conflicting Lanes Left	3	0	2
Conflicting Approach Right		SB	EB
Conflicting Lanes Right	0	3	3
HCM Control Delay	14.7	13.3	11.9
HCM LOS	B	B	B

Lane	EBLn1	EBLn2	EBLn3	WBLn1	WBLn2	SBLn1	SBLn2	SBLn3
Vol Left, %	100%	0%	0%	0%	0%	100%	100%	0%
Vol Thru, %	0%	100%	100%	100%	0%	0%	0%	0%
Vol Right, %	0%	0%	0%	0%	100%	0%	0%	100%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	291	127	127	84	267	95	95	7
LT Vol	291	0	0	0	0	95	95	0
Through Vol	0	127	127	84	0	0	0	0
RT Vol	0	0	0	0	267	0	0	7
Lane Flow Rate	316	138	138	91	290	103	103	8
Geometry Grp	8	8	8	8	8	7	7	7
Degree of Util (X)	0.595	0.239	0.173	0.169	0.479	0.211	0.211	0.009
Departure Headway (Hd)	6.775	6.27	4.517	6.651	5.943	7.373	7.373	4.407
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cap	531	572	791	538	604	486	486	807
Service Time	4.526	4.02	2.267	4.409	3.701	5.131	5.131	2.163
HCM Lane V/C Ratio	0.595	0.241	0.174	0.169	0.48	0.212	0.212	0.01
HCM Control Delay	19.1	11	8.2	10.8	14.1	12.1	12.1	7.2
HCM Lane LOS	C	B	A	B	B	B	B	A
HCM 95th-tile Q	3.9	0.9	0.6	0.6	2.6	0.8	0.8	0

HCM Signalized Intersection Capacity Analysis
48: Greenville Rd & Northfront Road/Altamont Pass Road



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↗	↖	↑	↘	↗
Traffic Volume (vph)	612	146	1	51	379	1038
Future Volume (vph)	612	146	1	51	379	1038
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	1863	1583	1770	1863	1770	1583
Flt Permitted	1.00	1.00	0.10	1.00	0.95	1.00
Satd. Flow (perm)	1863	1583	191	1863	1770	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	665	159	1	55	412	1128
RTOR Reduction (vph)	0	65	0	0	0	28
Lane Group Flow (vph)	665	94	1	55	412	1100
Turn Type	NA	Perm	Perm	NA	Prot	Perm
Protected Phases	4			8	2	
Permitted Phases		4	8			2
Actuated Green, G (s)	39.0	39.0	39.0	39.0	73.0	73.0
Effective Green, g (s)	39.0	39.0	39.0	39.0	73.0	73.0
Actuated g/C Ratio	0.32	0.32	0.32	0.32	0.61	0.61
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	605	514	62	605	1076	962
v/s Ratio Prot	c0.36			0.03	0.23	
v/s Ratio Perm		0.06	0.01			c0.69
v/c Ratio	1.10	0.18	0.02	0.09	0.38	1.14
Uniform Delay, d1	40.5	29.1	27.5	28.2	12.0	23.5
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	66.7	0.2	0.1	0.1	0.2	77.1
Delay (s)	107.2	29.2	27.6	28.2	12.2	100.6
Level of Service	F	C	C	C	B	F
Approach Delay (s)	92.2			28.2	77.0	
Approach LOS	F			C	E	

Intersection Summary

HCM 2000 Control Delay	81.0	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.13		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	103.1%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 49: Greenville Rd & Southfront Rd



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	417	111	243	1032	67	80
Future Volume (vph)	417	111	243	1032	67	80
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.2	5.2	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.88	0.97	0.95	0.95	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	3433	2787	3433	3539	3539	1583
Flt Permitted	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (perm)	3433	2787	3433	3539	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	453	121	264	1122	73	87
RTOR Reduction (vph)	0	101	0	0	0	54
Lane Group Flow (vph)	453	20	264	1122	73	33
Turn Type	Prot	Perm	Prot	NA	NA	Perm
Protected Phases	8		1	6	2	
Permitted Phases		8				2
Actuated Green, G (s)	6.5	6.5	3.0	19.0	12.0	12.0
Effective Green, g (s)	5.9	5.9	3.0	20.7	13.7	13.7
Actuated g/C Ratio	0.16	0.16	0.08	0.58	0.38	0.38
Clearance Time (s)	4.6	4.6	4.0	5.7	5.7	5.7
Vehicle Extension (s)	5.0	5.0	6.0	2.5	2.5	2.5
Lane Grp Cap (vph)	565	459	287	2046	1354	605
v/s Ratio Prot	c0.13		c0.08	c0.32	0.02	
v/s Ratio Perm		0.01				0.02
v/c Ratio	0.80	0.04	0.92	0.55	0.05	0.06
Uniform Delay, d1	14.4	12.6	16.3	4.7	7.0	7.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	9.1	0.1	34.7	0.2	0.0	0.0
Delay (s)	23.5	12.7	51.0	4.9	7.0	7.0
Level of Service	C	B	D	A	A	A
Approach Delay (s)	21.2			13.7	7.0	
Approach LOS	C			B	A	

Intersection Summary

HCM 2000 Control Delay	15.2	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.72		
Actuated Cycle Length (s)	35.8	Sum of lost time (s)	13.2
Intersection Capacity Utilization	48.1%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
50: Greenville Rd & Patterson Pass Rd



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	40	520	58	5	12	8	64	415	292	426	207	46
Future Volume (vph)	40	520	58	5	12	8	64	415	292	426	207	46
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.98		1.00	0.94		1.00	0.94		1.00	0.97	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1835		1770	1748		1770	1747		1770	1812	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	1835		1770	1748		1770	1747		1770	1812	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	43	565	63	5	13	9	70	451	317	463	225	50
RTOR Reduction (vph)	0	4	0	0	7	0	0	21	0	0	6	0
Lane Group Flow (vph)	43	624	0	5	15	0	70	747	0	463	269	0
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												
Actuated Green, G (s)	9.2	32.0		0.8	23.6		7.6	43.9		25.0	61.3	
Effective Green, g (s)	9.2	32.0		0.8	23.6		7.6	43.9		25.0	61.3	
Actuated g/C Ratio	0.08	0.27		0.01	0.20		0.06	0.37		0.21	0.52	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	138	498		12	350		114	651		375	943	
v/s Ratio Prot	c0.02	c0.34		0.00	0.01		0.04	c0.43		c0.26	0.15	
v/s Ratio Perm												
v/c Ratio	0.31	1.25		0.42	0.04		0.61	1.15		1.23	0.29	
Uniform Delay, d1	51.3	42.9		58.2	37.9		53.6	36.9		46.4	15.9	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	1.3	129.9		21.8	0.0		9.4	83.6		126.7	0.8	
Delay (s)	52.6	172.7		80.0	38.0		63.1	120.5		173.0	16.6	
Level of Service	D	F		E	D		E	F		F	B	
Approach Delay (s)		165.0			45.8			115.7			114.7	
Approach LOS		F			D			F			F	

Intersection Summary

HCM 2000 Control Delay	129.1	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.20		
Actuated Cycle Length (s)	117.7	Sum of lost time (s)	16.0
Intersection Capacity Utilization	104.2%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
1: Dougherty Rd & Amador Valley Rd

BART to Livermore Extension Project
2025 Express Bus AM



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	85	497	381	710	1758	137
Future Volume (vph)	85	497	381	710	1758	137
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5	5.7	5.7	
Lane Util. Factor	1.00	1.00	0.97	0.91	0.91	
Frt	1.00	0.85	1.00	1.00	0.99	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1770	1583	3433	5085	5030	
Flt Permitted	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	1770	1583	3433	5085	5030	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	92	540	414	772	1911	149
RTOR Reduction (vph)	0	195	0	0	9	0
Lane Group Flow (vph)	92	345	414	772	2051	0
Turn Type	Perm	Perm	Prot	NA	NA	
Protected Phases			5	2	6	
Permitted Phases	4	4				
Actuated Green, G (s)	21.8	21.8	12.2	56.2	39.5	
Effective Green, g (s)	21.8	21.8	12.2	56.2	39.5	
Actuated g/C Ratio	0.25	0.25	0.14	0.64	0.45	
Clearance Time (s)	4.5	4.5	4.5	5.7	5.7	
Vehicle Extension (s)	1.8	1.8	2.0	4.0	4.0	
Lane Grp Cap (vph)	437	391	474	3240	2252	
v/s Ratio Prot			c0.12	0.15	c0.41	
v/s Ratio Perm	0.05	c0.22				
v/c Ratio	0.21	0.88	0.87	0.24	0.91	
Uniform Delay, d1	26.4	32.0	37.2	6.8	22.7	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.1	19.7	15.7	0.1	6.2	
Delay (s)	26.5	51.7	53.0	6.9	28.9	
Level of Service	C	D	D	A	C	
Approach Delay (s)	48.0			23.0	28.9	
Approach LOS	D			C	C	

Intersection Summary

HCM 2000 Control Delay	30.2	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.90		
Actuated Cycle Length (s)	88.2	Sum of lost time (s)	14.7
Intersection Capacity Utilization	76.3%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
2: Dougherty Rd & Dublin Blvd

BART to Livermore Extension Project
2025 Express Bus AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↑↑↑	↖↗	↖↗↘	↑↑↑	↖	↖↗↘	↑↑↑	↖↗	↖↗	↑↑↑	↖↗
Traffic Volume (vph)	40	355	420	273	600	364	606	988	115	658	1739	72
Future Volume (vph)	40	355	420	273	600	364	606	988	115	658	1739	72
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	6.0	5.0	5.0	5.5	5.0	5.0	5.5	5.0	5.0	5.5	
Lane Util. Factor	0.97	0.91	0.88	0.94	0.91	1.00	0.94	0.91	0.88	0.97	0.86	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	3433	5085	2787	4990	5085	1583	4990	5085	2787	3433	6370	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	3433	5085	2787	4990	5085	1583	4990	5085	2787	3433	6370	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	43	386	457	297	652	396	659	1074	125	715	1890	78
RTOR Reduction (vph)	0	0	41	0	0	103	0	0	74	0	4	0
Lane Group Flow (vph)	43	386	416	297	652	293	659	1074	51	715	1964	0
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	
Protected Phases	5	2	3	1	6	7	3	8	1	7	4	
Permitted Phases			2			6			8			
Actuated Green, G (s)	11.8	22.3	39.3	15.0	26.0	52.3	17.0	32.8	47.8	26.3	42.1	
Effective Green, g (s)	11.8	22.3	39.3	15.0	26.0	52.3	17.0	32.8	47.8	26.3	42.1	
Actuated g/C Ratio	0.10	0.19	0.33	0.13	0.22	0.44	0.14	0.28	0.41	0.22	0.36	
Clearance Time (s)	5.0	6.0	5.0	5.0	5.5	5.0	5.0	5.5	5.0	5.0	5.5	
Vehicle Extension (s)	2.0	4.5	2.0	2.0	4.5	2.0	2.0	4.5	2.0	2.0	4.5	
Lane Grp Cap (vph)	343	961	929	634	1121	702	719	1414	1129	765	2274	
v/s Ratio Prot	0.01	0.08	0.06	c0.06	c0.13	0.09	0.13	0.21	0.01	c0.21	c0.31	
v/s Ratio Perm			0.08			0.09			0.01			
v/c Ratio	0.13	0.40	0.45	0.47	0.58	0.42	0.92	0.76	0.04	0.93	0.86	
Uniform Delay, d1	48.3	41.9	30.8	47.8	41.1	22.4	49.8	38.9	21.2	45.0	35.2	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.1	0.5	0.1	0.2	1.1	0.1	16.1	2.7	0.0	18.2	3.9	
Delay (s)	48.4	42.4	30.9	48.0	42.1	22.5	65.9	41.6	21.2	63.1	39.2	
Level of Service	D	D	C	D	D	C	E	D	C	E	D	
Approach Delay (s)		36.8			37.7			48.9			45.5	
Approach LOS		D			D			D			D	

Intersection Summary

HCM 2000 Control Delay	43.7	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.80		
Actuated Cycle Length (s)	117.9	Sum of lost time (s)	21.5
Intersection Capacity Utilization	81.3%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

3: Dougherty Rd & I-580 WB Ramps

BART to Livermore Extension Project
2025 Express Bus AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↔↔		↔↔		↑↑↑			↑↑↑	↔
Traffic Volume (vph)	0	0	0	396	0	637	0	1278	0	0	1656	0
Future Volume (vph)	0	0	0	396	0	637	0	1278	0	0	1656	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0		4.0		4.0			4.0	
Lane Util. Factor				0.97		0.88		0.91			0.86	
Frt				1.00		0.85		1.00			1.00	
Flt Protected				0.95		1.00		1.00			1.00	
Satd. Flow (prot)				3433		2787		5085			4806	
Flt Permitted				0.95		1.00		1.00			1.00	
Satd. Flow (perm)				3433		2787		5085			4806	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	430	0	692	0	1389	0	0	1800	0
RTOR Reduction (vph)	0	0	0	0	0	36	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	430	0	656	0	1389	0	0	1800	0
Turn Type				Prot		Prot		NA			NA	Perm
Protected Phases				4		4		2			6	
Permitted Phases												6
Actuated Green, G (s)				14.0		14.0		25.2			25.2	
Effective Green, g (s)				15.4		15.4		26.6			26.6	
Actuated g/C Ratio				0.31		0.31		0.53			0.53	
Clearance Time (s)				5.4		5.4		5.4			5.4	
Vehicle Extension (s)				3.0		3.0		3.0			3.0	
Lane Grp Cap (vph)				1057		858		2705			2556	
v/s Ratio Prot				0.13		c0.24		0.27			c0.37	
v/s Ratio Perm												
v/c Ratio				0.41		0.76		0.51			0.70	
Uniform Delay, d1				13.7		15.7		7.5			8.8	
Progression Factor				1.00		1.00		0.75			1.00	
Incremental Delay, d2				0.3		4.1		0.6			1.7	
Delay (s)				13.9		19.8		6.3			10.4	
Level of Service				B		B		A			B	
Approach Delay (s)		0.0			17.5			6.3			10.4	
Approach LOS		A			B			A			B	
Intersection Summary												
HCM 2000 Control Delay			10.9								B	
HCM 2000 Volume to Capacity ratio			0.73									
Actuated Cycle Length (s)			50.0								8.0	
Intersection Capacity Utilization			53.6%								A	
Analysis Period (min)			15									

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
4: Hopyard Rd/Dougherty Rd & I-580 EB Ramps



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗		↖↗					↑↑↑	↖		↑↑↑	↖
Traffic Volume (vph)	756	0	1437	0	0	0	0	753	0	0	1521	0
Future Volume (vph)	756	0	1437	0	0	0	0	753	0	0	1521	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0					4.0			4.0	
Lane Util. Factor	0.97		0.88					0.91			0.86	
Frt	1.00		0.85					1.00			1.00	
Flt Protected	0.95		1.00					1.00			1.00	
Satd. Flow (prot)	3433		2787					5085			4806	
Flt Permitted	0.95		1.00					1.00			1.00	
Satd. Flow (perm)	3433		2787					5085			4806	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	822	0	1562	0	0	0	0	818	0	0	1653	0
RTOR Reduction (vph)	0	0	26	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	822	0	1536	0	0	0	0	818	0	0	1653	0
Turn Type	Prot		Prot					NA	Free		NA	Perm
Protected Phases	4		4					2			6	
Permitted Phases									Free			6
Actuated Green, G (s)	23.4		23.4					15.8			15.8	
Effective Green, g (s)	24.8		24.8					17.2			17.2	
Actuated g/C Ratio	0.50		0.50					0.34			0.34	
Clearance Time (s)	5.4		5.4					5.4			5.4	
Vehicle Extension (s)	3.0		3.0					3.0			3.0	
Lane Grp Cap (vph)	1702		1382					1749			1653	
v/s Ratio Prot	0.24		c0.55					0.16			c0.34	
v/s Ratio Perm												
v/c Ratio	0.48		1.11					0.47			1.00	
Uniform Delay, d1	8.4		12.6					12.8			16.4	
Progression Factor	1.00		1.00					1.00			0.71	
Incremental Delay, d2	0.2		60.8					0.9			19.3	
Delay (s)	8.6		73.4					13.7			30.9	
Level of Service	A		E					B			C	
Approach Delay (s)		51.0			0.0			13.7			30.9	
Approach LOS		D			A			B			C	

Intersection Summary			
HCM 2000 Control Delay	37.9	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	1.07		
Actuated Cycle Length (s)	50.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	86.3%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
5: Hopyard Rd & Owens Rd

BART to Livermore Extension Project
2025 Express Bus AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	202	95	52	115	131	199	137	680	138	826	1626	557
Future Volume (vph)	202	95	52	115	131	199	137	680	138	826	1626	557
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	2.7	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	0.91	0.91		1.00	0.95	0.95	1.00	0.91	1.00	0.97	0.91	
Frt	1.00	0.97		1.00	0.95	0.85	1.00	1.00	0.85	1.00	0.96	
Flt Protected	0.95	0.98		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1610	3217		1770	1685	1504	1770	5085	1583	3433	4891	
Flt Permitted	0.95	0.98		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1610	3217		1770	1685	1504	1770	5085	1583	3433	4891	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	220	103	57	125	142	216	149	739	150	898	1767	605
RTOR Reduction (vph)	0	26	0	0	19	49	0	0	112	0	69	0
Lane Group Flow (vph)	121	233	0	125	190	100	149	739	38	898	2303	0
Turn Type	Split	NA		Split	NA	pm+ov	Prot	NA	Perm	Prot	NA	
Protected Phases	8	8		4	4	1	5	2		1	6	
Permitted Phases						4			2			
Actuated Green, G (s)	6.7	6.7		9.9	9.9	41.7	8.0	21.3	21.3	31.8	45.1	
Effective Green, g (s)	8.0	8.0		11.2	11.2	44.3	8.0	23.0	23.0	31.8	46.8	
Actuated g/C Ratio	0.09	0.09		0.12	0.12	0.49	0.09	0.26	0.26	0.35	0.52	
Clearance Time (s)	5.3	5.3		5.3	5.3	4.0	4.0	5.7	5.7	4.0	5.7	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	143	285		220	209	785	157	1299	404	1212	2543	
v/s Ratio Prot	c0.08	0.07		0.07	c0.11	0.05	0.08	0.15		c0.26	c0.47	
v/s Ratio Perm						0.02			0.02			
v/c Ratio	0.85	0.82		0.57	0.91	0.13	0.95	0.57	0.09	0.74	0.91	
Uniform Delay, d1	40.4	40.3		37.1	38.9	12.4	40.8	29.2	25.6	25.5	19.6	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	34.4	16.3		3.3	37.4	0.1	56.0	0.6	0.1	2.5	5.1	
Delay (s)	74.8	56.6		40.5	76.3	12.5	96.8	29.8	25.7	28.0	24.7	
Level of Service	E	E		D	E	B	F	C	C	C	C	
Approach Delay (s)		62.4			47.3			38.8			25.6	
Approach LOS		E			D			D			C	

Intersection Summary

HCM 2000 Control Delay	33.0	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.91		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	82.5%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
6: Hopyard Rd & Stoneridge Dr

BART to Livermore Extension Project
2025 Express Bus AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	145	731	438	84	1008	116	647	722	87	279	971	232
Future Volume (vph)	145	731	438	84	1008	116	647	722	87	279	971	232
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.91	1.00	0.97	0.91	1.00	0.94	0.95	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5085	1583	3433	5085	1583	4990	3539	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5085	1583	3433	5085	1583	4990	3539	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	158	795	476	91	1096	126	703	785	95	303	1055	252
RTOR Reduction (vph)	0	0	222	0	0	91	0	0	68	0	0	121
Lane Group Flow (vph)	158	795	254	91	1096	35	703	785	27	303	1055	131
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8			2			6
Actuated Green, G (s)	4.0	17.6	17.6	3.2	16.8	16.8	8.0	17.0	17.0	7.0	16.0	16.0
Effective Green, g (s)	4.0	17.6	17.6	3.2	16.8	16.8	8.0	17.0	17.0	7.0	16.0	16.0
Actuated g/C Ratio	0.07	0.29	0.29	0.05	0.28	0.28	0.13	0.28	0.28	0.12	0.26	0.26
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	225	1471	458	180	1405	437	656	989	442	395	1338	416
v/s Ratio Prot	c0.05	0.16		0.03	c0.22		c0.14	c0.22		0.09	0.21	
v/s Ratio Perm			0.16			0.02			0.02			0.08
v/c Ratio	0.70	0.54	0.56	0.51	0.78	0.08	1.07	0.79	0.06	0.77	0.79	0.32
Uniform Delay, d1	27.8	18.2	18.3	28.0	20.3	16.3	26.4	20.3	16.0	26.1	20.8	18.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	9.5	0.4	1.5	2.2	2.9	0.1	55.9	4.5	0.1	8.7	3.2	0.4
Delay (s)	37.3	18.6	19.7	30.3	23.2	16.4	82.3	24.7	16.1	34.8	24.0	18.4
Level of Service	D	B	B	C	C	B	F	C	B	C	C	B
Approach Delay (s)		21.1			23.0			49.8			25.1	
Approach LOS		C			C			D			C	


































Intersection Summary

HCM 2000 Control Delay	30.3	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.85		
Actuated Cycle Length (s)	60.8	Sum of lost time (s)	16.0
Intersection Capacity Utilization	68.0%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

































HCM Signalized Intersection Capacity Analysis
7: Hopyard Rd & Las Positas Blvd

BART to Livermore Extension Project
2025 Express Bus AM

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations	 	 		 	 		 	  		 	  		
Traffic Volume (vph)	149	462	373	350	448	56	411	1130	364	111	1010	90	
Future Volume (vph)	149	462	373	350	448	56	411	1130	364	111	1010	90	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	0.97	0.95	1.00	0.97	0.95	1.00	0.97	0.91	1.00	0.97	0.91	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	3433	3539	1583	3433	3539	1583	3433	5085	1583	3433	5085	1583	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	3433	3539	1583	3433	3539	1583	3433	5085	1583	3433	5085	1583	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	
Adj. Flow (vph)	162	502	405	380	487	61	447	1228	396	121	1098	98	
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	72	
Lane Group Flow (vph)	162	502	405	380	487	61	447	1228	396	121	1098	26	
Turn Type	Prot	NA	Free	Prot	NA	Free	Prot	NA	Free	Prot	NA	Perm	
Protected Phases	7	4		3	8		5	2		1	6		
Permitted Phases			Free			Free			Free			6	
Actuated Green, G (s)	4.7	14.6	64.5	8.0	17.9	64.5	9.0	22.7	64.5	3.2	16.9	16.9	
Effective Green, g (s)	4.7	14.6	64.5	8.0	17.9	64.5	9.0	22.7	64.5	3.2	16.9	16.9	
Actuated g/C Ratio	0.07	0.23	1.00	0.12	0.28	1.00	0.14	0.35	1.00	0.05	0.26	0.26	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0	
Lane Grp Cap (vph)	250	801	1583	425	982	1583	479	1789	1583	170	1332	414	
v/s Ratio Prot	0.05	c0.14		c0.11	0.14		c0.13	0.24		0.04	c0.22		
v/s Ratio Perm			c0.26			0.04			0.25			0.02	
v/c Ratio	0.65	0.63	0.26	0.89	0.50	0.04	0.93	0.69	0.25	0.71	0.82	0.06	
Uniform Delay, d1	29.1	22.5	0.0	27.8	19.5	0.0	27.5	17.9	0.0	30.2	22.4	17.9	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	5.7	1.5	0.4	20.6	0.4	0.0	25.3	1.1	0.4	13.2	4.3	0.1	
Delay (s)	34.8	24.0	0.4	48.4	19.9	0.0	52.8	19.0	0.4	43.3	26.7	17.9	
Level of Service	C	C	A	D	B	A	D	B	A	D	C	B	
Approach Delay (s)		16.7			30.3			22.7			27.6		
Approach LOS		B			C			C			C		
Intersection Summary													
HCM 2000 Control Delay			24.0									HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio			0.78										
Actuated Cycle Length (s)			64.5									Sum of lost time (s)	16.0
Intersection Capacity Utilization			67.3%									ICU Level of Service	C
Analysis Period (min)			15										
c Critical Lane Group													

HCM Signalized Intersection Capacity Analysis
8: Willow Rd & Owens Rd

BART to Livermore Extension Project
2025 Express Bus AM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 	  		 	  			 		 	 	
Traffic Volume (vph)	111	377	197	115	325	91	92	94	0	129	102	94
Future Volume (vph)	111	377	197	115	325	91	92	94	0	129	102	94
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	5.3	4.0		5.3	4.0	4.0
Lane Util. Factor	0.97	0.91		0.97	0.91	1.00	1.00	0.95		1.00	1.00	1.00
Frt	1.00	0.95		1.00	1.00	0.85	1.00	1.00		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	4824		3433	5085	1583	1770	3539		1770	1863	1583
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.69	1.00		0.69	1.00	1.00
Satd. Flow (perm)	3433	4824		3433	5085	1583	1277	3539		1281	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	121	410	214	125	353	99	100	102	0	140	111	102
RTOR Reduction (vph)	0	131	0	0	0	60	0	0	0	0	0	78
Lane Group Flow (vph)	121	493	0	125	353	39	100	102	0	140	111	24
Turn Type	Prot	NA		Prot	NA	Perm	Perm	NA	Perm	Perm	NA	Perm
Protected Phases	1	6		5	2			4			8	
Permitted Phases						2	4		4	8		8
Actuated Green, G (s)	3.8	14.6		3.8	14.6	14.6	8.5	8.5		8.5	8.5	8.5
Effective Green, g (s)	3.8	16.3		3.8	16.3	16.3	8.5	9.8		8.5	9.8	9.8
Actuated g/C Ratio	0.09	0.39		0.09	0.39	0.39	0.20	0.23		0.20	0.23	0.23
Clearance Time (s)	4.0	5.7		4.0	5.7	5.7	5.3	5.3		5.3	5.3	5.3
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	311	1876		311	1978	615	259	827		259	435	370
v/s Ratio Prot	0.04	c0.10		c0.04	0.07			0.03			0.06	
v/s Ratio Perm						0.02	0.08			c0.11		0.02
v/c Ratio	0.39	0.26		0.40	0.18	0.06	0.39	0.12		0.54	0.26	0.06
Uniform Delay, d1	18.0	8.7		18.0	8.4	8.0	14.4	12.7		15.0	13.1	12.5
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	0.8	0.1		0.9	0.0	0.0	1.0	0.1		2.3	0.3	0.1
Delay (s)	18.8	8.8		18.8	8.4	8.1	15.4	12.7		17.2	13.4	12.6
Level of Service	B	A		B	A	A	B	B		B	B	B
Approach Delay (s)		10.4			10.6			14.1			14.7	
Approach LOS		B			B			B			B	

Intersection Summary		
HCM 2000 Control Delay	11.7	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.35	B
Actuated Cycle Length (s)	41.9	Sum of lost time (s)
Intersection Capacity Utilization	38.8%	12.0
Analysis Period (min)	15	ICU Level of Service
		A

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 9: Hacienda Dr & Dublin Blvd

BART to Livermore Extension Project
 2025 Express Bus AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↑↑↑	↖↗	↖↗	↑↑↑		↖↗	↑↑	↖↗	↖↗	↑↑↑	↖↗
Traffic Volume (vph)	72	336	93	272	745	80	157	632	115	12	390	132
Future Volume (vph)	72	336	93	272	745	80	157	632	115	12	390	132
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	6.0	5.0	4.5	6.0		5.0	6.0	6.0	4.5	5.5	5.5
Lane Util. Factor	0.97	0.91	0.88	0.97	0.91		0.94	0.95	0.88	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5085	2787	3433	5011		4990	3539	2787	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5085	2787	3433	5011		4990	3539	2787	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	78	365	101	296	810	87	171	687	125	13	424	143
RTOR Reduction (vph)	0	0	71	0	12	0	0	0	86	0	0	117
Lane Group Flow (vph)	78	365	30	296	885	0	171	687	39	13	424	26
Turn Type	Prot	NA	pm+ov	Prot	NA		Prot	NA	Perm	Prot	NA	Perm
Protected Phases	5	2	3	1	6		3	8		7	NA	4
Permitted Phases			2						8			4
Actuated Green, G (s)	4.8	12.1	22.4	17.3	24.6		10.3	23.5	23.5	0.6	13.8	13.8
Effective Green, g (s)	4.8	12.1	22.4	17.3	24.6		10.3	23.5	23.5	0.6	13.8	13.8
Actuated g/C Ratio	0.06	0.16	0.30	0.23	0.33		0.14	0.32	0.32	0.01	0.19	0.19
Clearance Time (s)	4.5	6.0	5.0	4.5	6.0		5.0	6.0	6.0	4.5	5.5	5.5
Vehicle Extension (s)	2.0	3.5	2.0	2.0	3.5		2.0	3.5	3.5	2.0	3.5	3.5
Lane Grp Cap (vph)	221	825	1025	797	1654		689	1116	879	27	941	293
v/s Ratio Prot	0.02	c0.07	0.00	0.09	c0.18		0.03	c0.19		0.00	c0.08	
v/s Ratio Perm			0.01						0.01			0.02
v/c Ratio	0.35	0.44	0.03	0.37	0.54		0.25	0.62	0.04	0.48	0.45	0.09
Uniform Delay, d1	33.4	28.2	18.4	24.0	20.3		28.6	21.7	17.7	36.8	27.0	25.1
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.4	0.4	0.0	0.1	0.4		0.1	1.1	0.0	4.9	0.4	0.2
Delay (s)	33.7	28.6	18.4	24.1	20.7		28.7	22.7	17.7	41.6	27.4	25.3
Level of Service	C	C	B	C	C		C	C	B	D	C	C
Approach Delay (s)		27.4			21.5			23.1			27.2	
Approach LOS		C			C			C			C	

Intersection Summary

HCM 2000 Control Delay	24.0	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.59		
Actuated Cycle Length (s)	74.5	Sum of lost time (s)	21.0
Intersection Capacity Utilization	57.8%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 10: Hacienda Dr & Martinelli Blvd/Hacienda Crossings



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗	↖↗	↖↗	↗		↖↗↘	↖↗↘	↖	↖↗	↖↗↘	
Traffic Volume (vph)	10	8	173	110	12	8	244	867	112	17	727	49
Future Volume (vph)	10	8	173	110	12	8	244	867	112	17	727	49
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	3.0	3.0	5.5	3.0		3.5	3.0	3.0	5.0	3.5	
Lane Util. Factor	1.00	0.91	0.91	0.97	1.00		0.94	0.91	1.00	0.97	0.86	
Frt	1.00	0.90	0.85	1.00	0.94		1.00	1.00	0.85	1.00	0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1770	1523	2882	3433	1748		4990	5085	1583	3433	6347	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1770	1523	2882	3433	1748		4990	5085	1583	3433	6347	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	11	9	188	120	13	9	265	942	122	18	790	53
RTOR Reduction (vph)	0	14	128	0	6	0	0	0	54	0	8	0
Lane Group Flow (vph)	11	14	41	120	16	0	265	942	68	18	835	0
Turn Type	Prot	NA	Perm	Prot	NA		Prot	NA	pm+ov	Prot	NA	
Protected Phases	5	2		1	6		3	8	1	7	4	
Permitted Phases			2						8			
Actuated Green, G (s)	1.7	15.8	15.8	6.9	21.5		8.2	29.7	36.6	1.1	22.6	
Effective Green, g (s)	1.2	17.8	17.8	6.4	23.5		9.2	31.7	40.6	0.6	24.1	
Actuated g/C Ratio	0.02	0.24	0.24	0.09	0.32		0.13	0.43	0.56	0.01	0.33	
Clearance Time (s)	4.5	5.0	5.0	5.0	5.0		4.5	5.0	5.0	4.5	5.0	
Vehicle Extension (s)	3.0	4.0	4.0	2.0	4.0		3.0	4.0	2.0	3.0	4.0	
Lane Grp Cap (vph)	29	371	702	300	562		628	2208	945	28	2095	
v/s Ratio Prot	c0.01	0.01		c0.03	0.01		c0.05	c0.19	0.01	0.01	0.13	
v/s Ratio Perm			c0.01						0.03			
v/c Ratio	0.38	0.04	0.06	0.40	0.03		0.42	0.43	0.07	0.64	0.40	
Uniform Delay, d1	35.5	21.1	21.2	31.5	16.9		29.4	14.3	7.5	36.1	18.9	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	8.1	0.1	0.0	0.3	0.0		0.5	0.2	0.0	40.9	0.2	
Delay (s)	43.6	21.1	21.2	31.8	17.0		29.9	14.5	7.5	77.0	19.0	
Level of Service	D	C	C	C	B		C	B	A	E	B	
Approach Delay (s)		22.4			29.5			16.9			20.2	
Approach LOS		C			C			B			C	

Intersection Summary			
HCM 2000 Control Delay	19.2	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.34		
Actuated Cycle Length (s)	73.0	Sum of lost time (s)	16.5
Intersection Capacity Utilization	42.6%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 11: Hacienda Dr & I-580 WB Ramps

BART to Livermore Extension Project
 2025 Express Bus AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↔↔		↔↔		↑↑↑			↑↑↑	↔
Traffic Volume (vph)	0	0	0	308	0	453	0	1064	183	0	618	416
Future Volume (vph)	0	0	0	308	0	453	0	1064	183	0	618	416
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0		4.0		4.0			4.0	4.0
Lane Util. Factor				0.97		0.88		0.91			0.86	0.86
Frt				1.00		0.85		0.98			0.96	0.85
Flt Protected				0.95		1.00		1.00			1.00	1.00
Satd. Flow (prot)				3433		2787		4973			4624	1362
Flt Permitted				0.95		1.00		1.00			1.00	1.00
Satd. Flow (perm)				3433		2787		4973			4624	1362
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	335	0	492	0	1157	199	0	672	452
RTOR Reduction (vph)	0	0	0	0	0	96	0	45	0	0	92	92
Lane Group Flow (vph)	0	0	0	335	0	396	0	1311	0	0	806	134
Turn Type				Prot		Prot		NA			NA	Perm
Protected Phases				4		4		2			6	
Permitted Phases												6
Actuated Green, G (s)				11.0		11.0		27.7			27.7	27.7
Effective Green, g (s)				12.4		12.4		29.6			29.6	29.6
Actuated g/C Ratio				0.25		0.25		0.59			0.59	0.59
Clearance Time (s)				5.4		5.4		5.9			5.9	5.9
Vehicle Extension (s)				3.0		3.0		3.0			3.0	3.0
Lane Grp Cap (vph)				851		691		2944			2737	806
v/s Ratio Prot				0.10		c0.14		c0.26			0.17	
v/s Ratio Perm												0.10
v/c Ratio				0.39		0.57		0.45			0.29	0.17
Uniform Delay, d1				15.7		16.5		5.7			5.0	4.6
Progression Factor				1.00		1.00		0.45			1.00	1.00
Incremental Delay, d2				0.3		1.2		0.4			0.3	0.4
Delay (s)				16.0		17.6		3.0			5.3	5.1
Level of Service				B		B		A			A	A
Approach Delay (s)		0.0			17.0			3.0			5.3	
Approach LOS		A			B			A			A	

Intersection Summary		
HCM 2000 Control Delay	7.3	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.48	A
Actuated Cycle Length (s)	50.0	Sum of lost time (s)
Intersection Capacity Utilization	47.1%	8.0
Analysis Period (min)	15	ICU Level of Service
		A

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 12: Hacienda Dr & I-580 EB Ramps

BART to Livermore Extension Project
 2025 Express Bus AM



































Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	751	0	1096	0	0	0	0	461	221	0	1033	147
Future Volume (vph)	751	0	1096	0	0	0	0	461	221	0	1033	147
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0					4.0	4.0		4.0	
Lane Util. Factor	0.97		0.88					0.86	0.86		0.91	
Frt	1.00		0.85					0.98	0.85		0.98	
Flt Protected	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (prot)	3433		2787					4713	1362		4990	
Flt Permitted	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (perm)	3433		2787					4713	1362		4990	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	816	0	1191	0	0	0	0	501	240	0	1123	160
RTOR Reduction (vph)	0	0	81	0	0	0	0	41	92	0	46	0
Lane Group Flow (vph)	816	0	1110	0	0	0	0	534	74	0	1237	0
Turn Type	Prot		Prot					NA	Perm		NA	
Protected Phases	4		4					2			6	
Permitted Phases									2			
Actuated Green, G (s)	18.2		18.2					20.5	20.5		20.5	
Effective Green, g (s)	19.6		19.6					22.4	22.4		22.4	
Actuated g/C Ratio	0.39		0.39					0.45	0.45		0.45	
Clearance Time (s)	5.4		5.4					5.9	5.9		5.9	
Vehicle Extension (s)	2.0		2.0					2.0	2.0		2.0	
Lane Grp Cap (vph)	1345		1092					2111	610		2235	
v/s Ratio Prot	0.24		c0.40					0.11			c0.25	
v/s Ratio Perm									0.05			
v/c Ratio	0.61		1.02					0.25	0.12		0.55	
Uniform Delay, d1	12.1		15.2					8.6	8.1		10.1	
Progression Factor	1.00		1.00					1.00	1.00		0.87	
Incremental Delay, d2	0.5		31.5					0.3	0.4		1.0	
Delay (s)	12.7		46.7					8.9	8.5		9.8	
Level of Service	B		D					A	A		A	
Approach Delay (s)		32.8			0.0			8.8			9.8	
Approach LOS		C			A			A			A	

Intersection Summary		
HCM 2000 Control Delay	21.1	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.77	C
Actuated Cycle Length (s)	50.0	Sum of lost time (s)
Intersection Capacity Utilization	68.2%	8.0
Analysis Period (min)	15	ICU Level of Service
		C

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
13: Hacienda Dr & Owens Rd




































BART to Livermore Extension Project
2025 Express Bus AM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 	  		 	  		 	  		 		
Traffic Volume (vph)	143	208	26	95	247	253	24	280	105	539	998	564
Future Volume (vph)	143	208	26	95	247	253	24	280	105	539	998	564
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	2.3	4.0	4.0	2.3	4.0	4.0	2.7	4.0	4.0	2.7
Lane Util. Factor	0.97	0.91	1.00	0.97	0.91	1.00	0.97	0.91	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5085	1583	3433	5085	1583	3433	5085	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5085	1583	3433	5085	1583	3433	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	155	226	28	103	268	275	26	304	114	586	1085	613
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	155	226	28	103	268	275	26	304	114	586	1085	613
Turn Type	Prot	NA	Free	Prot	NA	Free	Prot	NA	Free	Prot	NA	Free
Protected Phases	1	6		5	2		7	4		3	8	
Permitted Phases			Free			Free			Free			Free
Actuated Green, G (s)	4.0	8.7	59.6	4.0	8.7	59.6	1.4	9.1	59.6	18.8	26.5	59.6
Effective Green, g (s)	4.0	10.4	59.6	4.0	10.4	59.6	1.4	10.4	59.6	18.8	27.8	59.6
Actuated g/C Ratio	0.07	0.17	1.00	0.07	0.17	1.00	0.02	0.17	1.00	0.32	0.47	1.00
Clearance Time (s)	4.0	5.7		4.0	5.7		4.0	5.3		4.0	5.3	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	230	887	1583	230	887	1583	80	887	1583	1082	2371	1583
v/s Ratio Prot	0.05	0.04		0.03	0.05		0.01	0.06		c0.17	0.21	
v/s Ratio Perm			0.02			0.17			0.07			c0.39
v/c Ratio	0.67	0.25	0.02	0.45	0.30	0.17	0.33	0.34	0.07	0.54	0.46	0.39
Uniform Delay, d1	27.2	21.3	0.0	26.7	21.4	0.0	28.6	21.6	0.0	16.8	10.8	0.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	7.6	0.2	0.0	1.4	0.2	0.2	2.4	0.2	0.1	0.6	0.1	0.7
Delay (s)	34.7	21.4	0.0	28.1	21.6	0.2	31.0	21.8	0.1	17.4	10.9	0.7
Level of Service	C	C	A	C	C	A	C	C	A	B	B	A
Approach Delay (s)		25.0			13.6			16.8			9.8	
Approach LOS		C			B			B			A	
Intersection Summary												
HCM 2000 Control Delay			12.9	HCM 2000 Level of Service				B				
HCM 2000 Volume to Capacity ratio			0.56									
Actuated Cycle Length (s)			59.6	Sum of lost time (s)				16.0				
Intersection Capacity Utilization			45.9%	ICU Level of Service				A				
Analysis Period (min)			15									

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 14: Tassajara Rd & Dublin Blvd

BART to Livermore Extension Project
 2025 Express Bus AM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 	 	 	  	 		  	  		 	 	
Traffic Volume (vph)	91	148	162	502	605	40	221	512	147	24	1250	221
Future Volume (vph)	91	148	162	502	605	40	221	512	147	24	1250	221
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	6.0	6.0	5.0	6.0		5.0	6.0	6.0	5.0	6.0	6.0
Lane Util. Factor	0.97	0.95	0.88	0.94	0.95		0.94	0.91	1.00	0.97	0.86	0.88
Frt	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	2787	4990	3507		4990	5085	1583	3433	6408	2787
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	2787	4990	3507		4990	5085	1583	3433	6408	2787
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	99	161	176	546	658	43	240	557	160	26	1359	240
RTOR Reduction (vph)	0	0	136	0	4	0	0	0	97	0	0	160
Lane Group Flow (vph)	99	161	40	546	697	0	240	557	63	26	1359	80
Turn Type	Prot	NA	Perm	Prot	NA		Prot	NA	Perm	Prot	NA	Perm
Protected Phases	5	2		1	6		3	8		7	NA	4
Permitted Phases			2						8			4
Actuated Green, G (s)	16.2	29.8	29.8	18.9	32.5		16.2	51.6	51.6	8.4	43.8	43.8
Effective Green, g (s)	16.2	29.8	29.8	18.9	32.5		16.2	51.6	51.6	8.4	43.8	43.8
Actuated g/C Ratio	0.12	0.23	0.23	0.14	0.25		0.12	0.39	0.39	0.06	0.34	0.34
Clearance Time (s)	5.0	6.0	6.0	5.0	6.0		5.0	6.0	6.0	5.0	6.0	6.0
Vehicle Extension (s)	2.0	3.0	3.0	2.0	3.0		2.0	4.0	4.0	2.0	4.0	4.0
Lane Grp Cap (vph)	425	806	635	721	872		618	2007	624	220	2147	933
v/s Ratio Prot	0.03	0.05		c0.11	c0.20		c0.05	0.11		0.01	c0.21	
v/s Ratio Perm			0.01						0.04			0.03
v/c Ratio	0.23	0.20	0.06	0.76	0.80		0.39	0.28	0.10	0.12	0.63	0.09
Uniform Delay, d1	51.6	40.8	39.5	53.7	46.0		52.7	26.9	24.9	57.7	36.7	29.7
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.1	0.1	0.0	4.1	5.2		0.1	0.1	0.1	0.1	0.7	0.1
Delay (s)	51.7	40.9	39.6	57.8	51.2		52.8	27.0	25.0	57.7	37.4	29.8
Level of Service	D	D	D	E	D		D	C	C	E	D	C
Approach Delay (s)		42.8			54.1			33.1			36.6	
Approach LOS		D			D			C			D	
Intersection Summary												
HCM 2000 Control Delay			41.6			HCM 2000 Level of Service			D			
HCM 2000 Volume to Capacity ratio			0.68									
Actuated Cycle Length (s)			130.7			Sum of lost time (s)			22.0			
Intersection Capacity Utilization			81.1%			ICU Level of Service			D			
Analysis Period (min)			15									

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 15: Tassajara Rd & I-580 WB Ramps

BART to Livermore Extension Project
 2025 Express Bus AM
































Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↔		↔		↑↑	↔		↑↑↑	↔
Traffic Volume (vph)	0	0	0	565	0	294	0	1033	469	0	939	935
Future Volume (vph)	0	0	0	565	0	294	0	1033	469	0	939	935
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0		4.0		4.0	4.0		4.0	4.0
Lane Util. Factor				0.97		0.88		0.95	1.00		0.86	0.86
Frt				1.00		0.85		1.00	0.85		0.95	0.85
Flt Protected				0.95		1.00		1.00	1.00		1.00	1.00
Satd. Flow (prot)				3433		2787		3539	1583		4566	1362
Flt Permitted				0.95		1.00		1.00	1.00		1.00	1.00
Satd. Flow (perm)				3433		2787		3539	1583		4566	1362
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	614	0	320	0	1123	510	0	1021	1016
RTOR Reduction (vph)	0	0	0	0	0	28	0	0	284	0	208	283
Lane Group Flow (vph)	0	0	0	614	0	292	0	1123	226	0	1321	225
Turn Type				Perm		Perm		NA	Perm		NA	Perm
Protected Phases								2			6	
Permitted Phases				8		8			2			6
Actuated Green, G (s)				12.2		12.2		16.1	16.1		16.1	16.1
Effective Green, g (s)				12.2		12.2		16.1	16.1		16.1	16.1
Actuated g/C Ratio				0.34		0.34		0.44	0.44		0.44	0.44
Clearance Time (s)				4.0		4.0		4.0	4.0		4.0	4.0
Vehicle Extension (s)				3.0		3.0		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)				1153		936		1569	702		2025	604
v/s Ratio Prot								c0.32			0.29	
v/s Ratio Perm				c0.18		0.10			0.14			0.17
v/c Ratio				0.53		0.31		0.72	0.32		0.65	0.37
Uniform Delay, d1				9.7		8.9		8.2	6.6		7.9	6.7
Progression Factor				1.00		1.00		1.00	1.00		1.00	1.00
Incremental Delay, d2				0.5		0.2		1.6	0.3		0.8	0.4
Delay (s)				10.2		9.1		9.8	6.8		8.7	7.1
Level of Service				B		A		A	A		A	A
Approach Delay (s)		0.0			9.8			8.9			8.3	
Approach LOS		A			A			A			A	

Intersection Summary			
HCM 2000 Control Delay	8.8	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.64		
Actuated Cycle Length (s)	36.3	Sum of lost time (s)	8.0
Intersection Capacity Utilization	51.3%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 16: Santa Rita Rd & I-580 EB Ramps/Pimilco Dr


































BART to Livermore Extension Project
 2025 Express Bus AM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 		 	 		 		  		 	 	
Traffic Volume (vph)	539	118	675	182	0	192	0	731	104	191	1255	0
Future Volume (vph)	539	118	675	182	0	192	0	731	104	191	1255	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0		4.0		4.0		4.0	4.0	
Lane Util. Factor	0.97	1.00	1.00	0.97		0.88		0.86		1.00	0.95	
Frt	1.00	1.00	0.85	1.00		0.85		0.98		1.00	1.00	
Flt Protected	0.95	1.00	1.00	0.95		1.00		1.00		0.95	1.00	
Satd. Flow (prot)	3433	1863	1583	3433		2787		6288		1770	3539	
Flt Permitted	0.95	1.00	1.00	0.95		1.00		1.00		0.95	1.00	
Satd. Flow (perm)	3433	1863	1583	3433		2787		6288		1770	3539	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	586	128	734	198	0	209	0	795	113	208	1364	0
RTOR Reduction (vph)	0	0	0	0	0	72	0	43	0	0	0	0
Lane Group Flow (vph)	586	128	734	198	0	137	0	865	0	208	1364	0
Turn Type	Perm	NA	Free	Prot		pm+ov		NA		Prot	NA	Perm
Protected Phases		4		3		1		2		1	6	
Permitted Phases	4		Free			3						6
Actuated Green, G (s)	14.4	14.4	57.3	4.0		12.1		14.8		8.1	26.9	
Effective Green, g (s)	14.4	14.4	57.3	4.0		12.1		14.8		8.1	26.9	
Actuated g/C Ratio	0.25	0.25	1.00	0.07		0.21		0.26		0.14	0.47	
Clearance Time (s)	4.0	4.0		4.0		4.0		4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0		3.0		3.0		3.0	3.0	
Lane Grp Cap (vph)	862	468	1583	239		588		1624		250	1661	
v/s Ratio Prot		0.07		0.06		0.03		0.14		0.12	c0.39	
v/s Ratio Perm	c0.17		c0.46			0.02						
v/c Ratio	0.68	0.27	0.46	0.83		0.23		0.53		0.83	0.82	
Uniform Delay, d1	19.4	17.2	0.0	26.3		18.8		18.3		23.9	13.1	
Progression Factor	1.00	1.00	1.00	1.00		1.00		1.00		1.00	1.00	
Incremental Delay, d2	2.1	0.3	1.0	20.5		0.2		0.3		20.4	3.4	
Delay (s)	21.5	17.6	1.0	46.8		19.0		18.6		44.4	16.5	
Level of Service	C	B	A	D		B		B		D	B	
Approach Delay (s)		10.8			32.5			18.6			20.2	
Approach LOS		B			C			B			C	
Intersection Summary												
HCM 2000 Control Delay			17.9			HCM 2000 Level of Service				B		
HCM 2000 Volume to Capacity ratio			0.86									
Actuated Cycle Length (s)			57.3			Sum of lost time (s)			16.0			
Intersection Capacity Utilization			56.7%			ICU Level of Service				B		
Analysis Period (min)			15									

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 17: Santa Rita Rd & Valley Ave

BART to Livermore Extension Project
 2025 Express Bus AM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 	 			 		 	 	 	 	 	 
Traffic Volume (vph)	186	223	78	179	331	828	92	471	72	571	913	154
Future Volume (vph)	186	223	78	179	331	828	92	471	72	571	913	154
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.97	0.95		0.97	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.98		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	3433	3469		3433	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	3433	3469		3433	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	202	242	85	195	360	900	100	512	78	621	992	167
RTOR Reduction (vph)	0	0	70	0	0	0	0	17	0	0	0	100
Lane Group Flow (vph)	202	242	15	195	360	900	100	573	0	621	992	67
Turn Type	Prot	NA	Perm	Prot	NA	Free	Prot	NA		Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			Free						6
Actuated Green, G (s)	7.7	11.5	11.5	8.1	11.9	64.8	3.1	16.1		13.1	26.1	26.1
Effective Green, g (s)	7.7	11.5	11.5	8.1	11.9	64.8	3.1	16.1		13.1	26.1	26.1
Actuated g/C Ratio	0.12	0.18	0.18	0.12	0.18	1.00	0.05	0.25		0.20	0.40	0.40
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	407	628	280	221	649	1583	164	861		694	1425	637
v/s Ratio Prot	0.06	0.07		c0.11	0.10		0.03	0.17		c0.18	c0.28	
v/s Ratio Perm			0.01			c0.57						0.04
v/c Ratio	0.50	0.39	0.05	0.88	0.55	0.57	0.61	0.67		0.89	0.70	0.11
Uniform Delay, d1	26.7	23.5	22.1	27.9	24.0	0.0	30.3	21.9		25.2	16.1	12.1
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	1.0	0.4	0.1	31.1	1.0	1.5	6.3	2.0		14.0	1.5	0.1
Delay (s)	27.7	23.9	22.2	59.0	25.1	1.5	36.5	23.9		39.2	17.6	12.1
Level of Service	C	C	C	E	C	A	D	C		D	B	B
Approach Delay (s)		25.1			15.0			25.7			24.6	
Approach LOS		C			B			C			C	
Intersection Summary												
HCM 2000 Control Delay			21.7			HCM 2000 Level of Service			C			
HCM 2000 Volume to Capacity ratio			0.84									
Actuated Cycle Length (s)			64.8			Sum of lost time (s)			16.0			
Intersection Capacity Utilization			61.0%			ICU Level of Service			B			
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis
18: Bernal Ave/Valley Ave & Stanley Blvd

BART to Livermore Extension Project
2025 Express Bus AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	204	202	52	251	895	954	173	476	106	139	344	116
Future Volume (vph)	204	202	52	251	895	954	173	476	106	139	344	116
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.95	1.00	0.97	0.91	0.91	1.00	0.95	1.00	0.97	0.95	0.95
Frt	1.00	1.00	0.85	1.00	0.96	0.85	1.00	1.00	0.85	1.00	0.96	0.96
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	3433	3238	1441	1770	3539	1583	3433	3405	3405
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	3433	3238	1441	1770	3539	1583	3433	3405	3405
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	222	220	57	273	973	1037	188	517	115	151	374	126
RTOR Reduction (vph)	0	0	28	0	46	28	0	0	91	0	38	0
Lane Group Flow (vph)	222	220	29	273	1342	594	188	517	24	151	462	0
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	NA
Protected Phases	7	4	5	3	8	1	5	2		1	6	
Permitted Phases			4			8			2			
Actuated Green, G (s)	6.0	32.1	43.7	11.0	37.1	46.9	11.6	18.2	18.2	9.8	16.4	16.4
Effective Green, g (s)	6.0	32.1	43.7	11.0	37.1	46.9	11.6	18.2	18.2	9.8	16.4	16.4
Actuated g/C Ratio	0.07	0.37	0.50	0.13	0.43	0.54	0.13	0.21	0.21	0.11	0.19	0.19
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	236	1304	866	433	1379	842	235	739	330	386	641	641
v/s Ratio Prot	c0.06	0.06	0.00	0.08	c0.41	0.08	c0.11	c0.15		0.04	0.14	0.14
v/s Ratio Perm			0.01			0.33			0.02			
v/c Ratio	0.94	0.17	0.03	0.63	0.97	0.71	0.80	0.70	0.07	0.39	0.72	0.72
Uniform Delay, d1	40.4	18.5	11.0	36.1	24.5	15.0	36.6	31.9	27.7	35.9	33.2	33.2
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	42.3	0.1	0.0	3.0	18.0	2.7	17.5	2.9	0.1	0.7	4.0	4.0
Delay (s)	82.7	18.6	11.0	39.1	42.5	17.7	54.1	34.8	27.8	36.5	37.2	37.2
Level of Service	F	B	B	D	D	B	D	C	C	D	D	D
Approach Delay (s)		46.2			35.3			38.2			37.0	
Approach LOS		D			D			D			D	

Intersection Summary

HCM 2000 Control Delay	37.4	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.89		
Actuated Cycle Length (s)	87.1	Sum of lost time (s)	16.0
Intersection Capacity Utilization	76.9%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 19: Fallon Rd & Dublin Blvd

BART to Livermore Extension Project
 2025 Express Bus AM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	45	52	83	271	1049	335	739	243	27	55	666	320
Future Volume (vph)	45	52	83	271	1049	335	739	243	27	55	666	320
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.3	5.3	5.3	4.0	4.0	4.0	5.3	4.9	4.9	5.3	4.9	4.9
Lane Util. Factor	0.97	0.91	0.88	0.94	0.91	1.00	0.97	0.91	0.88	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3090	4577	2508	4491	4577	1425	3090	4577	2508	3090	4577	1425
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3090	4577	2508	4491	4577	1425	3090	4577	2508	3090	4577	1425
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	49	57	90	295	1140	364	803	264	29	60	724	348
RTOR Reduction (vph)	0	0	58	0	0	269	0	0	15	0	0	149
Lane Group Flow (vph)	49	57	32	295	1140	95	803	264	14	60	724	199
Turn Type	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	5	2	3	1	6		3	8		7	NA	4
Permitted Phases			2			6			8			4
Actuated Green, G (s)	3.1	9.3	39.2	22.8	29.0	29.0	29.9	54.6	54.6	4.5	29.2	29.2
Effective Green, g (s)	3.1	9.3	39.2	22.8	29.0	29.0	29.9	54.6	54.6	4.5	29.2	29.2
Actuated g/C Ratio	0.03	0.08	0.35	0.21	0.26	0.26	0.27	0.49	0.49	0.04	0.26	0.26
Clearance Time (s)	5.3	5.3	5.3	4.0	4.0	4.0	5.3	4.9	4.9	5.3	4.9	4.9
Vehicle Extension (s)	2.0	4.0	2.0	2.0	2.0	2.0	2.0	4.0	4.0	2.0	4.0	4.0
Lane Grp Cap (vph)	86	384	888	924	1199	373	834	2257	1237	125	1207	375
v/s Ratio Prot	0.02	0.01	0.01	c0.07	c0.25		c0.26	0.06		0.02	c0.16	
v/s Ratio Perm			0.00			0.07			0.01			0.14
v/c Ratio	0.57	0.15	0.04	0.32	0.95	0.26	0.96	0.12	0.01	0.48	0.60	0.53
Uniform Delay, d1	53.1	47.0	23.4	37.4	40.1	32.3	39.9	15.1	14.3	52.0	35.6	34.9
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	5.1	0.2	0.0	0.1	15.5	0.1	22.3	0.0	0.0	1.1	0.9	1.8
Delay (s)	58.2	47.3	23.4	37.4	55.7	32.4	62.1	15.1	14.3	53.0	36.6	36.7
Level of Service	E	D	C	D	E	C	E	B	B	D	D	D
Approach Delay (s)		39.0			48.0			49.5			37.5	
Approach LOS		D			D			D			D	
Intersection Summary												
HCM 2000 Control Delay			45.2			HCM 2000 Level of Service			D			
HCM 2000 Volume to Capacity ratio			0.83									
Actuated Cycle Length (s)			110.7	Sum of lost time (s)					19.5			
Intersection Capacity Utilization			79.5%	ICU Level of Service			D					
Analysis Period (min)			15									

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 20: El Charro Rd/Fallon Rd & I-580 WB Ramps

BART to Livermore Extension Project
 2025 Express Bus AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↖	↖	↖↖		↖	↖		↗↗	↗
Traffic Volume (vph)	0	0	0	159	0	608	0	555	478	0	519	399
Future Volume (vph)	0	0	0	159	0	608	0	555	478	0	519	399
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0	4.0	4.0		4.0	4.0		4.0	4.0
Lane Util. Factor				0.95	0.95	0.88		0.95	0.95		0.95	1.00
Frt				1.00	1.00	0.85		0.99	0.85		1.00	0.85
Flt Protected				0.95	0.95	1.00		1.00	1.00		1.00	1.00
Satd. Flow (prot)				1681	1681	2787		1749	1504		3539	1583
Flt Permitted				0.95	0.95	1.00		1.00	1.00		1.00	1.00
Satd. Flow (perm)				1681	1681	2787		1749	1504		3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	173	0	661	0	603	520	0	564	434
RTOR Reduction (vph)	0	0	0	0	0	371	0	5	175	0	0	162
Lane Group Flow (vph)	0	0	0	88	85	290	0	650	293	0	564	272
Turn Type				Perm	NA	Perm		NA	Perm		NA	Perm
Protected Phases					8			2			6	
Permitted Phases				8		8			2			6
Actuated Green, G (s)				11.2	11.2	11.2		31.3	31.3		31.3	31.3
Effective Green, g (s)				10.7	10.7	10.7		31.3	31.3		31.3	31.3
Actuated g/C Ratio				0.21	0.21	0.21		0.63	0.63		0.63	0.63
Clearance Time (s)				3.5	3.5	3.5		4.0	4.0		4.0	4.0
Vehicle Extension (s)				2.0	2.0	2.0		2.0	2.0		2.0	2.0
Lane Grp Cap (vph)				359	359	596		1094	941		2215	990
v/s Ratio Prot								c0.37			0.16	
v/s Ratio Perm				0.05	0.05	c0.10			0.19			0.17
v/c Ratio				0.25	0.24	0.49		0.59	0.31		0.25	0.27
Uniform Delay, d1				16.3	16.3	17.2		5.6	4.3		4.2	4.2
Progression Factor				1.00	1.00	1.00		0.55	0.36		1.00	1.00
Incremental Delay, d2				0.1	0.1	0.2		2.3	0.8		0.3	0.7
Delay (s)				16.4	16.4	17.5		5.4	2.4		4.4	4.9
Level of Service				B	B	B		A	A		A	A
Approach Delay (s)		0.0			17.2			4.1			4.6	
Approach LOS		A			B			A			A	

Intersection Summary			
HCM 2000 Control Delay	8.0	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.57		
Actuated Cycle Length (s)	50.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	66.8%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 21: El Charro Rd & I-580 EB Ramps

BART to Livermore Extension Project
 2025 Express Bus AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔		↔					↕	↗		↕	↗
Traffic Volume (vph)	245	0	400	0	0	0	0	766	141	0	359	0
Future Volume (vph)	245	0	400	0	0	0	0	766	141	0	359	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0					4.0	4.0		4.0	
Lane Util. Factor	0.97		0.88					0.91	0.91		0.91	
Frt	1.00		0.85					1.00	0.85		1.00	
Flt Protected	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (prot)	3433		2787					3379	1441		3390	
Flt Permitted	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (perm)	3433		2787					3379	1441		3390	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	266	0	435	0	0	0	0	833	153	0	390	0
RTOR Reduction (vph)	0	0	364	0	0	0	0	2	44	0	0	0
Lane Group Flow (vph)	266	0	71	0	0	0	0	849	91	0	390	0
Turn Type	Prot		Perm					NA	Perm		NA	Perm
Protected Phases	4							2			6	
Permitted Phases			4						2			6
Actuated Green, G (s)	8.2		8.2					33.8	33.8		33.8	
Effective Green, g (s)	8.2		8.2					33.8	33.8		33.8	
Actuated g/C Ratio	0.16		0.16					0.68	0.68		0.68	
Clearance Time (s)	4.0		4.0					4.0	4.0		4.0	
Vehicle Extension (s)	2.0		2.0					3.0	3.0		3.0	
Lane Grp Cap (vph)	563		457					2284	974		2291	
v/s Ratio Prot	c0.08							c0.25			0.12	
v/s Ratio Perm			0.03						0.06			
v/c Ratio	0.47		0.16					0.37	0.09		0.17	
Uniform Delay, d1	18.9		17.9					3.5	2.8		3.0	
Progression Factor	1.00		1.00					0.79	0.52		0.88	
Incremental Delay, d2	0.2		0.1					0.4	0.2		0.2	
Delay (s)	19.2		18.0					3.2	1.6		2.8	
Level of Service	B		B					A	A		A	
Approach Delay (s)		18.4			0.0			3.0			2.8	
Approach LOS		B			A			A			A	

Intersection Summary

HCM 2000 Control Delay	8.2	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.39		
Actuated Cycle Length (s)	50.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	36.3%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 22: El Charro Rd & Stoneridge Dr/Jack London Blvd

BART to Livermore Extension Project
 2025 Express Bus AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔↔↔	↑↑	↗	↖	↑↑	↗↖	↖	↑↔		↖↖↖	↑	↗↖
Traffic Volume (vph)	145	100	8	17	593	634	7	96	2	207	89	167
Future Volume (vph)	145	100	8	17	593	634	7	96	2	207	89	167
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	0.94	0.95	1.00	1.00	0.95	0.88	1.00	0.95		0.94	1.00	0.88
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	4491	3185	1425	1593	3185	2508	1593	3176		4491	1676	2508
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	4491	3185	1425	1593	3185	2508	1593	3176		4491	1676	2508
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	158	109	9	18	645	689	8	104	2	225	97	182
RTOR Reduction (vph)	0	0	6	0	0	385	0	1	0	0	0	101
Lane Group Flow (vph)	158	109	3	18	645	304	8	105	0	225	97	81
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Prot	NA		Prot	NA	Perm
Protected Phases	7	4		3	8	1	5	2		1	6	
Permitted Phases			4			8						6
Actuated Green, G (s)	8.9	35.0	35.0	3.2	29.3	44.1	1.5	31.0		14.8	44.3	44.3
Effective Green, g (s)	8.9	35.0	35.0	3.2	29.3	44.1	1.5	31.0		14.8	44.3	44.3
Actuated g/C Ratio	0.09	0.35	0.35	0.03	0.29	0.44	0.02	0.31		0.15	0.44	0.44
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	399	1114	498	50	933	1106	23	984		664	742	1111
v/s Ratio Prot	c0.04	0.03		0.01	c0.20	0.04	c0.01	0.03		c0.05	c0.06	
v/s Ratio Perm			0.00			0.08						0.03
v/c Ratio	0.40	0.10	0.01	0.36	0.69	0.27	0.35	0.11		0.34	0.13	0.07
Uniform Delay, d1	43.0	21.9	21.2	47.4	31.3	17.8	48.8	24.6		38.2	16.5	16.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		0.96	0.94	1.00
Incremental Delay, d2	0.6	0.0	0.0	4.4	2.2	0.1	8.9	0.2		0.3	0.4	0.1
Delay (s)	43.7	21.9	21.2	51.8	33.6	17.9	57.7	24.8		36.8	15.8	16.2
Level of Service	D	C	C	D	C	B	E	C		D	B	B
Approach Delay (s)		34.3			25.8			27.1			25.3	
Approach LOS		C			C			C			C	

Intersection Summary

HCM 2000 Control Delay	26.8	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.39		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	42.6%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 24: Airway Blvd/Driveway & N Canyons Pkwy

BART to Livermore Extension Project
 2025 Express Bus AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑	↑	↑↑	↑	↑		↑	↑↑		↑	
Traffic Volume (vph)	0	53	82	685	437	0	1127	0	890	0	0	0
Future Volume (vph)	0	53	82	685	437	0	1127	0	890	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0	4.0	4.0			4.4	4.0			
Lane Util. Factor		0.95	1.00	0.97	1.00			1.00	0.88			
Frt		1.00	0.85	1.00	1.00			1.00	0.85			
Flt Protected		1.00	1.00	0.95	1.00			0.95	1.00			
Satd. Flow (prot)		3539	1583	3433	1863			1770	2787			
Flt Permitted		1.00	1.00	0.95	1.00			0.95	1.00			
Satd. Flow (perm)		3539	1583	3433	1863			1770	2787			
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	58	89	745	475	0	1225	0	967	0	0	0
RTOR Reduction (vph)	0	0	81	0	0	0	0	0	58	0	0	0
Lane Group Flow (vph)	0	58	8	745	475	0	0	1225	909	0	0	0
Turn Type		NA	Perm	Prot	NA	Perm	Split	NA	pm+ov			
Protected Phases		2		1	6		8	8	1	4	4	
Permitted Phases			2			6			8			
Actuated Green, G (s)		10.2	10.2	36.8	53.0			76.8	113.6			
Effective Green, g (s)		12.2	12.2	38.8	55.0			76.6	117.6			
Actuated g/C Ratio		0.09	0.09	0.28	0.39			0.55	0.84			
Clearance Time (s)		6.0	6.0	6.0	6.0			4.2	6.0			
Vehicle Extension (s)		3.0	3.0	3.0	3.0			3.0	3.0			
Lane Grp Cap (vph)		308	137	951	731			968	2420			
v/s Ratio Prot		0.02		c0.22	c0.26			c0.69	0.10			
v/s Ratio Perm			0.00						0.22			
v/c Ratio		0.19	0.06	0.78	0.65			1.27	0.38			
Uniform Delay, d1		59.3	58.6	46.7	34.6			31.7	2.6			
Progression Factor		1.00	1.00	1.00	1.00			1.00	1.00			
Incremental Delay, d2		1.4	0.8	4.3	4.4			127.8	0.1			
Delay (s)		60.7	59.4	51.0	39.1			159.5	2.7			
Level of Service		E	E	D	D			F	A			
Approach Delay (s)		59.9			46.4			90.3			0.0	
Approach LOS		E			D			F			A	

Intersection Summary

HCM 2000 Control Delay	74.0	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.10		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	16.4
Intersection Capacity Utilization	95.6%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
25: Airway Blvd & I-580 WB Ramps

BART to Livermore Extension Project
2025 Express Bus AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↙	↖	↗		↑↑	↗		↑↑↑	
Traffic Volume (vph)	0	0	0	63	43	812	0	1289	343	0	280	553
Future Volume (vph)	0	0	0	63	43	812	0	1289	343	0	280	553
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0	4.0	4.0		4.0	4.0		4.0	
Lane Util. Factor				0.95	0.95	0.88		0.95	1.00		0.91	
Frt				1.00	1.00	0.85		1.00	0.85		0.90	
Flt Protected				0.95	0.98	1.00		1.00	1.00		1.00	
Satd. Flow (prot)				1681	1734	2787		3539	1583		4579	
Flt Permitted				0.95	0.98	1.00		1.00	1.00		1.00	
Satd. Flow (perm)				1681	1734	2787		3539	1583		4579	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	68	47	883	0	1401	373	0	304	601
RTOR Reduction (vph)	0	0	0	0	0	32	0	0	161	0	259	0
Lane Group Flow (vph)	0	0	0	36	79	851	0	1401	212	0	646	0
Turn Type				Split	NA	Perm		NA	Perm		NA	
Protected Phases				8	8			2			6	
Permitted Phases						8			2			
Actuated Green, G (s)				35.1	35.1	35.1		55.6	55.6		55.6	
Effective Green, g (s)				35.1	35.1	35.1		56.9	56.9		56.9	
Actuated g/C Ratio				0.35	0.35	0.35		0.57	0.57		0.57	
Clearance Time (s)				4.0	4.0	4.0		5.3	5.3		5.3	
Vehicle Extension (s)				2.0	2.0	2.0		4.0	4.0		4.0	
Lane Grp Cap (vph)				590	608	978		2013	900		2605	
v/s Ratio Prot				0.02	0.05			c0.40			0.14	
v/s Ratio Perm						c0.31			0.13			
v/c Ratio				0.06	0.13	0.87		0.70	0.24		0.25	
Uniform Delay, d1				21.5	22.1	30.3		15.4	10.7		10.8	
Progression Factor				1.00	1.00	1.00		1.00	1.00		1.00	
Incremental Delay, d2				0.0	0.0	8.1		2.0	0.6		0.2	
Delay (s)				21.5	22.1	38.4		17.4	11.3		11.0	
Level of Service				C	C	D		B	B		B	
Approach Delay (s)		0.0			36.5			16.1			11.0	
Approach LOS		A			D			B			B	

Intersection Summary

HCM 2000 Control Delay	20.4	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.76		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	70.7%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 26: Airway Blvd & I-580 EB Ramps/Kitty Hawk Rd

BART to Livermore Extension Project
 2025 Express Bus AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↑	↖	↖	↑	↖	↖	↑↕		↖	↑↕	
Traffic Volume (vph)	644	192	162	22	34	101	26	507	158	82	116	151
Future Volume (vph)	644	192	162	22	34	101	26	507	158	82	116	151
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.4	4.4	4.4	4.0	4.0		4.0	4.0	
Lane Util. Factor	0.97	1.00	1.00	1.00	1.00	1.00	1.00	0.95		1.00	0.95	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.96		1.00	0.92	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	3433	1863	1583	1770	1863	1583	1770	3413		1770	3239	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	3433	1863	1583	1770	1863	1583	1770	3413		1770	3239	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	700	209	176	24	37	110	28	551	172	89	126	164
RTOR Reduction (vph)	0	0	135	0	0	87	0	34	0	0	86	0
Lane Group Flow (vph)	700	209	41	24	37	23	28	689	0	89	204	0
Turn Type	Split	NA	Perm	Split	NA	pm+ov	Prot	NA		Prot	NA	
Protected Phases	7	7		8	8	1	5	2		1	6	
Permitted Phases			7			8						
Actuated Green, G (s)	20.9	20.9	20.9	8.4	8.4	19.7	2.5	32.1		11.3	41.4	
Effective Green, g (s)	20.9	20.9	20.9	8.0	8.0	18.9	2.0	33.4		11.3	42.7	
Actuated g/C Ratio	0.23	0.23	0.23	0.09	0.09	0.21	0.02	0.37		0.13	0.47	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	3.5	5.3		4.0	5.3	
Vehicle Extension (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	3.5		2.0	4.0	
Lane Grp Cap (vph)	797	432	367	157	165	409	39	1266		222	1536	
v/s Ratio Prot	c0.20	0.11		0.01	c0.02	0.01	0.02	c0.20		c0.05	0.06	
v/s Ratio Perm			0.03			0.01						
v/c Ratio	0.88	0.48	0.11	0.15	0.22	0.06	0.72	0.54		0.40	0.13	
Uniform Delay, d1	33.3	29.9	27.2	37.9	38.1	28.4	43.7	22.3		36.2	13.3	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	10.5	0.3	0.0	0.2	0.3	0.0	40.9	1.7		0.4	0.2	
Delay (s)	43.8	30.2	27.3	38.0	38.4	28.4	84.6	24.0		36.7	13.4	
Level of Service	D	C	C	D	D	C	F	C		D	B	
Approach Delay (s)		38.5			31.9			26.2			18.9	
Approach LOS		D			C			C			B	

Intersection Summary

HCM 2000 Control Delay	31.1	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.59		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	16.8
Intersection Capacity Utilization	58.6%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 27: Collier Canyon Rd & N Canyons Pkwy/Portola Ave

BART to Livermore Extension Project
 2025 Express Bus AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↕	↖	↖	↕	↖	↖	↕		↖	↕	↖
Traffic Volume (vph)	188	219	103	230	827	59	48	5	114	63	14	124
Future Volume (vph)	188	219	103	230	827	59	48	5	114	63	14	124
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	5.2	5.2
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.86		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	1770	1594		1770	1863	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	1770	1594		1770	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	204	238	112	250	899	64	52	5	124	68	15	135
RTOR Reduction (vph)	0	0	78	0	0	38	0	100	0	0	0	109
Lane Group Flow (vph)	204	238	34	250	899	26	52	29	0	68	15	26
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA		Prot	NA	Perm
Protected Phases	1	6		5	2		3	8		7	4	
Permitted Phases			6			2						4
Actuated Green, G (s)	5.7	17.4	17.4	12.6	24.3	24.3	2.1	11.3		2.9	12.5	12.5
Effective Green, g (s)	5.7	18.7	18.7	12.6	25.6	25.6	2.1	12.3		2.9	11.9	11.9
Actuated g/C Ratio	0.09	0.30	0.30	0.20	0.41	0.41	0.03	0.20		0.05	0.19	0.19
Clearance Time (s)	4.0	5.3	5.3	4.0	5.3	5.3	4.0	5.0		4.0	4.6	4.6
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	313	1058	473	356	1449	648	59	313		82	354	301
v/s Ratio Prot	0.06	0.07		c0.14	c0.25		0.03	c0.02		c0.04	0.01	
v/s Ratio Perm			0.02			0.02						0.02
v/c Ratio	0.65	0.22	0.07	0.70	0.62	0.04	0.88	0.09		0.83	0.04	0.09
Uniform Delay, d1	27.4	16.5	15.7	23.2	14.6	11.1	30.1	20.5		29.6	20.6	20.8
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	4.8	0.1	0.1	6.2	0.8	0.0	75.7	0.1		47.1	0.0	0.1
Delay (s)	32.2	16.6	15.7	29.4	15.4	11.1	105.8	20.7		76.6	20.7	20.9
Level of Service	C	B	B	C	B	B	F	C		E	C	C
Approach Delay (s)		22.2			18.1			45.1			38.3	
Approach LOS		C			B			D			D	
























Intersection Summary

HCM 2000 Control Delay	23.4	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.56		
Actuated Cycle Length (s)	62.5	Sum of lost time (s)	17.2
Intersection Capacity Utilization	49.4%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
28: Isabel Ave/Campus Hill Dr & Portola Ave

BART to Livermore Extension Project
2025 Express Bus AM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	1	190	280	614	594	140	503	301	78	39	154	1
Future Volume (vph)	1	190	280	614	594	140	503	301	78	39	154	1
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	5.8	5.8
Lane Util. Factor	1.00	0.95	0.88	0.94	0.95		0.97	0.95	1.00	1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	0.97		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3539	2787	4990	3438		3433	3539	1583	1770	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	3539	2787	4990	3438		3433	3539	1583	1770	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	1	207	304	667	646	152	547	327	85	42	167	1
RTOR Reduction (vph)	0	0	237	0	14	0	0	0	56	0	0	1
Lane Group Flow (vph)	1	207	67	667	784	0	547	327	29	42	167	0
Turn Type	Prot	NA	Perm	Prot	NA		Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4						2			6
Actuated Green, G (s)	1.5	18.3	18.3	17.1	33.9		21.1	29.3	29.3	5.3	13.9	13.9
Effective Green, g (s)	1.5	19.6	19.6	17.1	35.2		21.1	30.6	30.6	5.3	13.0	13.0
Actuated g/C Ratio	0.02	0.22	0.22	0.19	0.40		0.24	0.35	0.35	0.06	0.15	0.15
Clearance Time (s)	4.0	5.3	5.3	4.0	5.3		4.0	5.3	5.3	4.0	4.9	4.9
Vehicle Extension (s)	2.0	3.0	3.0	2.0	3.0		2.0	3.0	3.0	2.0	3.0	3.0
Lane Grp Cap (vph)	29	782	616	963	1365		817	1222	546	105	519	232
v/s Ratio Prot	0.00	0.06		c0.13	c0.23		c0.16	c0.09		0.02	0.05	
v/s Ratio Perm			0.02						0.02			0.00
v/c Ratio	0.03	0.26	0.11	0.69	0.57		0.67	0.27	0.05	0.40	0.32	0.00
Uniform Delay, d1	42.8	28.5	27.5	33.3	20.9		30.6	20.9	19.3	40.1	33.9	32.3
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.2	0.2	0.1	1.8	0.6		1.6	0.1	0.0	0.9	0.4	0.0
Delay (s)	43.0	28.7	27.6	35.1	21.4		32.2	21.0	19.4	41.0	34.2	32.3
Level of Service	D	C	C	D	C		C	C	B	D	C	C
Approach Delay (s)		28.1			27.6			27.3			35.6	
Approach LOS		C			C			C			D	

Intersection Summary

HCM 2000 Control Delay	28.1	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.61		
Actuated Cycle Length (s)	88.6	Sum of lost time (s)	17.8
Intersection Capacity Utilization	67.6%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 29: Isabel Ave & I-580 WB Ramps

BART to Livermore Extension Project
 2025 Express Bus AM

























Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↖↗		↖		↕	↖↗		↕	↖
Traffic Volume (vph)	0	0	0	652	0	416	0	494	0	0	502	596
Future Volume (vph)	0	0	0	652	0	416	0	494	0	0	502	596
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0		4.0		5.6			5.6	5.6
Lane Util. Factor				0.97		1.00		0.95			0.95	1.00
Frt				1.00		0.85		1.00			1.00	0.85
Flt Protected				0.95		1.00		1.00			1.00	1.00
Satd. Flow (prot)				3433		1583		3539			3539	1583
Flt Permitted				0.95		1.00		1.00			1.00	1.00
Satd. Flow (perm)				3433		1583		3539			3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	709	0	452	0	537	0	0	546	648
RTOR Reduction (vph)	0	0	0	0	0	162	0	0	0	0	0	311
Lane Group Flow (vph)	0	0	0	709	0	290	0	537	0	0	546	337
Turn Type				Prot		Prot		NA	Free		NA	Prot
Protected Phases				8		8		2			6	6
Permitted Phases									Free			
Actuated Green, G (s)				14.4		14.4		26.8			26.8	26.8
Effective Green, g (s)				14.4		14.4		26.0			26.0	26.0
Actuated g/C Ratio				0.29		0.29		0.52			0.52	0.52
Clearance Time (s)				4.0		4.0		4.8			4.8	4.8
Vehicle Extension (s)				2.0		2.0		4.0			4.0	4.0
Lane Grp Cap (vph)				988		455		1840			1840	823
v/s Ratio Prot				c0.21		0.18		0.15			0.15	c0.21
v/s Ratio Perm												
v/c Ratio				0.72		0.64		0.29			0.30	0.41
Uniform Delay, d1				16.0		15.5		6.8			6.8	7.3
Progression Factor				1.00		1.00		0.81			1.00	1.00
Incremental Delay, d2				2.1		2.1		0.4			0.1	0.5
Delay (s)				18.1		17.7		5.9			6.9	7.8
Level of Service				B		B		A			A	A
Approach Delay (s)		0.0			17.9			5.9			7.4	
Approach LOS		A			B			A			A	

Intersection Summary		
HCM 2000 Control Delay	11.3	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.52	B
Actuated Cycle Length (s)	50.0	Sum of lost time (s)
Intersection Capacity Utilization	47.4%	9.6
Analysis Period (min)	15	ICU Level of Service
		A

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
30: Isabel Ave & I-580 EB Ramps

BART to Livermore Extension Project
2025 Express Bus AM

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations	 		 					 			 		
Traffic Volume (vph)	205	0	458	0	0	0	0	721	508	0	942	265	
Future Volume (vph)	205	0	458	0	0	0	0	721	508	0	942	265	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)	4.0		4.0					4.0	4.0		4.0	4.0	
Lane Util. Factor	0.97		0.88					0.95	1.00		0.95	1.00	
Frt	1.00		0.85					1.00	0.85		1.00	0.85	
Flt Protected	0.95		1.00					1.00	1.00		1.00	1.00	
Satd. Flow (prot)	3433		2787					3539	1583		3539	1583	
Flt Permitted	0.95		1.00					1.00	1.00		1.00	1.00	
Satd. Flow (perm)	3433		2787					3539	1583		3539	1583	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	
Adj. Flow (vph)	223	0	498	0	0	0	0	784	552	0	1024	288	
RTOR Reduction (vph)	0	0	177	0	0	0	0	0	0	0	0	0	
Lane Group Flow (vph)	223	0	321	0	0	0	0	784	552	0	1024	288	
Turn Type	Prot		Perm					NA	Free		NA	Free	
Protected Phases	4							2			6		
Permitted Phases			4						Free			Free	
Actuated Green, G (s)	9.2		9.2					31.8	50.0		31.8	50.0	
Effective Green, g (s)	9.2		9.2					32.8	50.0		32.8	50.0	
Actuated g/C Ratio	0.18		0.18					0.66	1.00		0.66	1.00	
Clearance Time (s)	4.0		4.0					5.0			5.0		
Vehicle Extension (s)	2.0		2.0					4.0			4.0		
Lane Grp Cap (vph)	631		512					2321	1583		2321	1583	
v/s Ratio Prot	0.06							0.22			c0.29		
v/s Ratio Perm			c0.12						0.35			0.18	
v/c Ratio	0.35		0.63					0.34	0.35		0.44	0.18	
Uniform Delay, d1	17.8		18.8					3.8	0.0		4.2	0.0	
Progression Factor	1.00		1.00					1.00	1.00		0.41	1.00	
Incremental Delay, d2	0.1		1.7					0.1	0.6		0.6	0.2	
Delay (s)	17.9		20.5					3.9	0.6		2.3	0.2	
Level of Service	B		C					A	A		A	A	
Approach Delay (s)		19.7			0.0			2.6			1.8		
Approach LOS		B			A			A			A		
Intersection Summary													
HCM 2000 Control Delay			5.9									HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio			0.48										
Actuated Cycle Length (s)			50.0									Sum of lost time (s)	8.0
Intersection Capacity Utilization			48.7%									ICU Level of Service	A
Analysis Period (min)			15										
c Critical Lane Group													

HCM Signalized Intersection Capacity Analysis
 31: Isabel Ave & Airway Blvd

BART to Livermore Extension Project
 2025 Express Bus AM


































Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↑	↗	↖	↑	↗	↖	↑↑↑	↗	↖↗	↑↑↑	↗
Traffic Volume (vph)	0	55	180	135	244	110	335	1066	20	257	1330	19
Future Volume (vph)	0	55	180	135	244	110	335	1066	20	257	1330	19
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.2	5.6	5.2	5.2	5.6	4.0	4.0	4.0	4.0	4.0	5.0
Lane Util. Factor		1.00	1.00	1.00	1.00	1.00	1.00	0.91	1.00	0.97	0.91	1.00
Frt		1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1863	1583	1770	1863	1583	1770	5085	1583	3433	5085	1583
Flt Permitted		1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)		1863	1583	1770	1863	1583	1770	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	60	196	147	265	120	364	1159	22	279	1446	21
RTOR Reduction (vph)	0	0	73	0	0	75	0	0	12	0	0	14
Lane Group Flow (vph)	0	60	123	147	265	45	364	1159	10	279	1446	7
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4	5	3	8	1	5	2		1	6	
Permitted Phases			4			8			2			6
Actuated Green, G (s)		6.8	25.9	9.9	21.3	33.0	19.1	37.9	37.9	11.7	30.5	30.5
Effective Green, g (s)		6.2	24.7	9.3	20.7	31.8	20.1	38.9	38.9	12.7	31.5	30.5
Actuated g/C Ratio		0.07	0.29	0.11	0.24	0.37	0.24	0.45	0.45	0.15	0.37	0.36
Clearance Time (s)		4.6	5.0	4.6	4.6	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Extension (s)		3.0	3.0	3.0	3.0	3.0	3.0	5.0	5.0	3.0	5.0	5.0
Lane Grp Cap (vph)		135	457	192	451	588	416	2313	720	509	1873	564
v/s Ratio Prot		0.03	0.06	c0.08	c0.14	0.01	c0.21	0.23		0.08	c0.28	
v/s Ratio Perm			0.02			0.02			0.01			0.00
v/c Ratio		0.44	0.27	0.77	0.59	0.08	0.88	0.50	0.01	0.55	0.77	0.01
Uniform Delay, d1		38.0	23.4	37.0	28.6	17.4	31.5	16.4	12.8	33.7	23.8	17.8
Progression Factor		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2		2.3	0.3	16.5	2.0	0.1	18.1	0.4	0.0	1.2	2.4	0.0
Delay (s)		40.3	23.8	53.6	30.6	17.4	49.6	16.8	12.8	35.0	26.2	17.8
Level of Service		D	C	D	C	B	D	B	B	C	C	B
Approach Delay (s)		27.6			34.0			24.5			27.5	
Approach LOS		C			C			C			C	

Intersection Summary			
HCM 2000 Control Delay	27.2	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.83		
Actuated Cycle Length (s)	85.5	Sum of lost time (s)	20.0
Intersection Capacity Utilization	69.4%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

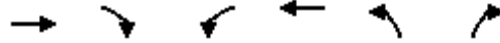
HCM Signalized Intersection Capacity Analysis
32: Isabel Ave & Jack London Blvd

BART to Livermore Extension Project
2025 Express Bus AM

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations	 	 			 		 	  		  			
Traffic Volume (vph)	26	52	53	212	757	306	347	847	96	157	1160	282	
Future Volume (vph)	26	52	53	212	757	306	347	847	96	157	1160	282	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.97	0.91	1.00	0.97	0.91	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	3433	5085	1583	3433	5085	1583	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	3433	5085	1583	3433	5085	1583	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	
Adj. Flow (vph)	28	57	58	230	823	333	377	921	104	171	1261	307	
RTOR Reduction (vph)	0	0	49	0	0	71	0	0	66	0	0	117	
Lane Group Flow (vph)	28	57	9	230	823	262	377	921	38	171	1261	190	
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	Perm	
Protected Phases	7	4		3	8	1	5	2		1	NA	6	
Permitted Phases			4			8			2			6	
Actuated Green, G (s)	3.8	16.0	16.0	18.0	30.2	40.2	14.5	37.7	37.7	10.0	33.2	33.2	
Effective Green, g (s)	3.8	16.0	16.0	18.0	30.2	40.2	14.5	37.7	37.7	10.0	33.2	33.2	
Actuated g/C Ratio	0.04	0.16	0.16	0.17	0.29	0.39	0.14	0.37	0.37	0.10	0.32	0.32	
Clearance Time (s)	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	126	550	246	309	1038	699	483	1863	579	333	1640	510	
v/s Ratio Prot	0.01	0.02		c0.13	c0.23	0.04	c0.11	c0.18		0.05	c0.25		
v/s Ratio Perm			0.01			0.13			0.02			0.12	
v/c Ratio	0.22	0.10	0.04	0.74	0.79	0.38	0.78	0.49	0.07	0.51	0.77	0.37	
Uniform Delay, d1	48.1	37.3	36.9	40.3	33.5	22.4	42.7	25.2	21.2	44.1	31.4	26.8	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.9	0.1	0.1	9.3	4.2	0.3	8.0	0.2	0.0	1.3	2.2	0.5	
Delay (s)	49.0	37.4	37.0	49.6	37.7	22.7	50.7	25.4	21.2	45.5	33.6	27.3	
Level of Service	D	D	D	D	D	C	D	C	C	D	C	C	
Approach Delay (s)		39.5			36.1			31.9			33.7		
Approach LOS		D			D			C			C		
Intersection Summary													
HCM 2000 Control Delay			34.0									HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio			0.80										
Actuated Cycle Length (s)			102.9									Sum of lost time (s)	21.2
Intersection Capacity Utilization			66.5%									ICU Level of Service	C
Analysis Period (min)			15										

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 33: Isabel Ave Connector & Stanley Blvd



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑	↑	↑↑	↑↑	↑↑	↑↑
Traffic Volume (vph)	337	161	317	1961	384	204
Future Volume (vph)	337	161	317	1961	384	204
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	3.8	4.0	4.0	4.0	2.5
Lane Util. Factor	0.95	1.00	0.97	0.95	0.97	0.88
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	3539	1583	3433	3539	3433	2787
Flt Permitted	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (perm)	3539	1583	3433	3539	3433	2787
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	366	175	345	2132	417	222
RTOR Reduction (vph)	0	18	0	0	0	141
Lane Group Flow (vph)	366	157	345	2132	417	81
Turn Type	NA	pm+ov	Prot	NA	Prot	pm+ov
Protected Phases	2	8	1	6	8	1
Permitted Phases		2				8
Actuated Green, G (s)	38.0	51.8	11.9	53.9	13.8	25.7
Effective Green, g (s)	39.7	55.2	11.9	55.6	15.3	28.7
Actuated g/C Ratio	0.50	0.70	0.15	0.70	0.19	0.36
Clearance Time (s)	5.7	5.5	4.0	5.7	5.5	4.0
Vehicle Extension (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Grp Cap (vph)	1780	1107	517	2493	665	1013
v/s Ratio Prot	0.10	0.03	0.10	c0.60	c0.12	0.01
v/s Ratio Perm		0.07				0.02
v/c Ratio	0.21	0.14	0.67	0.86	0.63	0.08
Uniform Delay, d1	10.9	4.0	31.6	8.7	29.2	16.4
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.0	0.0	2.5	3.0	1.3	0.0
Delay (s)	10.9	4.0	34.2	11.6	30.5	16.5
Level of Service	B	A	C	B	C	B
Approach Delay (s)	8.6			14.8	25.6	
Approach LOS	A			B	C	

Intersection Summary

HCM 2000 Control Delay	15.8	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.85		
Actuated Cycle Length (s)	78.9	Sum of lost time (s)	12.0
Intersection Capacity Utilization	71.8%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 34: Murrieta Blvd/Driveway & Portola Ave



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗		↖	↗		↖	↗	↗		↗	
Traffic Volume (vph)	0	385	93	267	1212	1	188	6	148	1	3	0
Future Volume (vph)	0	385	93	267	1212	1	188	6	148	1	3	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.8		4.0	5.8		5.2	5.2	5.2		4.0	
Lane Util. Factor		0.95		1.00	0.95		0.95	0.95	1.00		1.00	
Frt		0.97		1.00	1.00		1.00	1.00	0.85		1.00	
Flt Protected		1.00		0.95	1.00		0.95	0.96	1.00		0.99	
Satd. Flow (prot)		3436		1770	3539		1681	1691	1583		1840	
Flt Permitted		1.00		0.95	1.00		0.95	0.96	1.00		0.99	
Satd. Flow (perm)		3436		1770	3539		1681	1691	1583		1840	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	418	101	290	1317	1	204	7	161	1	3	0
RTOR Reduction (vph)	0	27	0	0	0	0	0	0	138	0	0	0
Lane Group Flow (vph)	0	492	0	290	1318	0	106	105	23	0	4	0
Turn Type	Prot	NA		Prot	NA		Split	NA	Perm		Split	NA
Protected Phases	5	2		1	6		8	8		4	4	
Permitted Phases									8			
Actuated Green, G (s)		12.5		14.5	31.0		8.1	8.1	8.1		0.6	
Effective Green, g (s)		11.6		14.5	30.1		7.5	7.5	7.5		0.6	
Actuated g/C Ratio		0.22		0.27	0.57		0.14	0.14	0.14		0.01	
Clearance Time (s)		4.9		4.0	4.9		4.6	4.6	4.6		4.0	
Vehicle Extension (s)		2.0		2.0	2.0		2.0	2.0	2.0		2.0	
Lane Grp Cap (vph)		749		482	2002		236	238	223		20	
v/s Ratio Prot		0.14		0.16	c0.37		c0.06	0.06			c0.00	
v/s Ratio Perm									0.01			
v/c Ratio		0.66		0.60	0.66		0.45	0.44	0.10		0.20	
Uniform Delay, d1		19.0		16.8	8.0		21.0	20.9	19.9		26.1	
Progression Factor		1.00		1.00	1.00		1.00	1.00	1.00		1.00	
Incremental Delay, d2		1.6		1.5	0.6		0.5	0.5	0.1		1.8	
Delay (s)		20.6		18.3	8.6		21.5	21.4	20.0		27.9	
Level of Service		C		B	A		C	C	B		C	
Approach Delay (s)		20.6			10.3			20.8			27.9	
Approach LOS		C			B			C			C	

Intersection Summary		
HCM 2000 Control Delay	14.1	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.68	B
Actuated Cycle Length (s)	53.2	Sum of lost time (s)
Intersection Capacity Utilization	61.4%	19.0
Analysis Period (min)	15	ICU Level of Service
		B

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 35: Murrieta Blvd & Jack London Blvd



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	76	255	623	206	246	167
Future Volume (vph)	76	255	623	206	246	167
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00	1.00	0.95	0.91	
Frt	1.00	0.85	1.00	1.00	0.94	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1770	1583	1770	3539	4776	
Flt Permitted	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	1770	1583	1770	3539	4776	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	83	277	677	224	267	182
RTOR Reduction (vph)	0	236	0	0	152	0
Lane Group Flow (vph)	83	41	677	224	297	0
Turn Type	Prot	Perm	Prot	NA	NA	
Protected Phases	4		5	2	6	
Permitted Phases		4				
Actuated Green, G (s)	8.5	8.5	27.3	40.8	9.5	
Effective Green, g (s)	8.5	8.5	27.3	40.8	9.5	
Actuated g/C Ratio	0.15	0.15	0.48	0.71	0.17	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	262	234	843	2519	791	
v/s Ratio Prot	c0.05		c0.38	0.06	c0.06	
v/s Ratio Perm		0.03				
v/c Ratio	0.32	0.18	0.80	0.09	0.38	
Uniform Delay, d1	21.8	21.3	12.7	2.5	21.3	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.7	0.4	5.6	0.0	0.3	
Delay (s)	22.5	21.7	18.3	2.6	21.6	
Level of Service	C	C	B	A	C	
Approach Delay (s)	21.9			14.4	21.6	
Approach LOS	C			B	C	

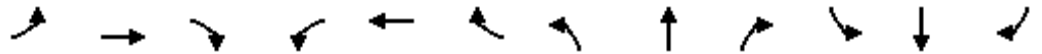
Intersection Summary

HCM 2000 Control Delay	17.8	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.62		
Actuated Cycle Length (s)	57.3	Sum of lost time (s)	12.0
Intersection Capacity Utilization	57.2%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 36: Murrieta Blvd & Stanley Blvd

BART to Livermore Extension Project
 2025 Express Bus AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	210	433	222	17	819	113	433	334	8	153	224	450
Future Volume (vph)	210	433	222	17	819	113	433	334	8	153	224	450
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.9	4.9	4.0	4.9	4.9	4.9	4.9		4.9	4.9	4.0
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.97	0.95		1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	3433	3526		1770	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	3433	3526		1770	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	228	471	241	18	890	123	471	363	9	166	243	489
RTOR Reduction (vph)	0	0	158	0	0	70	0	2	0	0	0	90
Lane Group Flow (vph)	228	471	83	18	890	53	471	370	0	166	243	399
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Prot	NA		Prot	NA	Perm
Protected Phases	7	4		3	8	1	5	2		1	6	
Permitted Phases			4			8						6
Actuated Green, G (s)	6.0	28.9	28.9	1.6	24.5	36.6	12.9	22.6		12.1	21.8	21.8
Effective Green, g (s)	6.0	28.0	28.0	1.6	23.6	34.8	12.0	21.7		11.2	20.9	21.8
Actuated g/C Ratio	0.07	0.34	0.34	0.02	0.29	0.43	0.15	0.27		0.14	0.26	0.27
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	253	1220	545	34	1028	773	507	942		244	910	424
v/s Ratio Prot	c0.07	0.13		0.01	c0.25	0.01	c0.14	0.10		0.09	0.07	
v/s Ratio Perm			0.05			0.02						c0.25
v/c Ratio	0.90	0.39	0.15	0.53	0.87	0.07	0.93	0.39		0.68	0.27	0.94
Uniform Delay, d1	37.3	20.1	18.4	39.4	27.3	13.7	34.2	24.4		33.3	24.0	29.1
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	31.8	0.2	0.1	14.1	7.8	0.0	23.4	0.3		7.6	0.2	29.2
Delay (s)	69.1	20.3	18.5	53.5	35.1	13.7	57.6	24.6		40.9	24.2	58.3
Level of Service	E	C	B	D	D	B	E	C		D	C	E
Approach Delay (s)		31.7			32.8			43.0			45.8	
Approach LOS		C			C			D			D	

Intersection Summary

HCM 2000 Control Delay	38.0	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.92		
Actuated Cycle Length (s)	81.2	Sum of lost time (s)	18.7
Intersection Capacity Utilization	74.4%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
37: Livermore Ave & I-580 WB Ramps



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↖	↔		↗	↑			↕	
Traffic Volume (vph)	0	0	0	344	88	28	444	79	0	0	151	0
Future Volume (vph)	0	0	0	344	88	28	444	79	0	0	151	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)					4.0		4.0	4.0			4.0	
Lane Util. Factor					0.95		0.97	1.00			0.95	
Frt					0.99		1.00	1.00			1.00	
Flt Protected					0.96		0.95	1.00			1.00	
Satd. Flow (prot)					1690		3433	1863			3539	
Flt Permitted					0.96		0.95	1.00			1.00	
Satd. Flow (perm)					1690		3433	1863			3539	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	374	96	30	483	86	0	0	164	0
RTOR Reduction (vph)	0	0	0	0	5	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	0	495	0	483	86	0	0	164	0
Turn Type				Split	NA		Prot	NA			NA	
Protected Phases				8	8		5	2			6	
Permitted Phases												
Actuated Green, G (s)					21.1		12.0	29.2			13.7	
Effective Green, g (s)					21.1		11.5	30.9			15.4	
Actuated g/C Ratio					0.35		0.19	0.51			0.26	
Clearance Time (s)					4.0		3.5	5.7			5.7	
Vehicle Extension (s)					2.0		2.0	2.5			2.5	
Lane Grp Cap (vph)					594		657	959			908	
v/s Ratio Prot					c0.29		c0.14	0.05			c0.05	
v/s Ratio Perm												
v/c Ratio					0.83		0.74	0.09			0.18	
Uniform Delay, d1					17.8		22.8	7.4			17.4	
Progression Factor					1.00		0.73	0.26			1.00	
Incremental Delay, d2					9.4		3.4	0.2			0.4	
Delay (s)					27.2		20.0	2.1			17.8	
Level of Service					C		B	A			B	
Approach Delay (s)		0.0			27.2			17.3			17.8	
Approach LOS		A			C			B			B	

Intersection Summary

HCM 2000 Control Delay	21.4	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.60		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	46.8%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 38: Livermore Ave & I-580 EB Ramps



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕	↗					↕		↘	↕	
Traffic Volume (vph)	15	1	592	0	0	0	0	506	199	17	482	0
Future Volume (vph)	15	1	592	0	0	0	0	506	199	17	482	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0					4.0		4.0	4.0	
Lane Util. Factor		0.95	0.95					0.95		1.00	0.95	
Frt		0.86	0.85					0.96		1.00	1.00	
Flt Protected		1.00	1.00					1.00		0.95	1.00	
Satd. Flow (prot)		1514	1504					3390		1770	3539	
Flt Permitted		1.00	1.00					1.00		0.95	1.00	
Satd. Flow (perm)		1514	1504					3390		1770	3539	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	16	1	643	0	0	0	0	550	216	18	524	0
RTOR Reduction (vph)	0	224	224	0	0	0	0	51	0	0	0	0
Lane Group Flow (vph)	0	108	104	0	0	0	0	715	0	18	524	0
Turn Type	Prot	NA	Perm					NA		Prot	NA	
Protected Phases	7	4						2		1	6	
Permitted Phases			4									
Actuated Green, G (s)		15.9	15.9					30.8		1.3	35.1	
Effective Green, g (s)		15.9	15.9					31.8		0.3	36.1	
Actuated g/C Ratio		0.27	0.27					0.53		0.00	0.60	
Clearance Time (s)		4.0	4.0					5.0		3.0	5.0	
Vehicle Extension (s)		2.0	2.0					2.5		2.0	2.5	
Lane Grp Cap (vph)		401	398					1796		8	2129	
v/s Ratio Prot								c0.21		c0.01	0.15	
v/s Ratio Perm		0.07	0.07									
v/c Ratio		0.27	0.26					0.40		2.25	0.25	
Uniform Delay, d1		17.5	17.4					8.4		29.9	5.6	
Progression Factor		1.00	1.00					1.00		1.10	0.23	
Incremental Delay, d2		0.1	0.1					0.7		803.6	0.2	
Delay (s)		17.6	17.5					9.1		836.3	1.5	
Level of Service		B	B					A		F	A	
Approach Delay (s)		17.6			0.0			9.1			29.2	
Approach LOS		B			A			A			C	

Intersection Summary		
HCM 2000 Control Delay	17.5	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.37	B
Actuated Cycle Length (s)	60.0	Sum of lost time (s)
Intersection Capacity Utilization	46.8%	12.0
Analysis Period (min)	15	ICU Level of Service
		A

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
39: Livermore Ave & Portola Ave

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↖↖	↖	↖	↖↖	↖	↖	↖↖		↖	↖↖	↖
Traffic Volume (vph)	214	263	100	30	729	61	333	431	85	98	548	344
Future Volume (vph)	214	263	100	30	729	61	333	431	85	98	548	344
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	5.3	4.0	4.0	5.3	4.0	5.8		4.0	5.8	4.9
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	1.00	0.95		1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.98		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	1770	3452		1770	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	1770	3452		1770	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	233	286	109	33	792	66	362	468	92	107	596	374
RTOR Reduction (vph)	0	0	72	0	0	48	0	14	0	0	0	90
Lane Group Flow (vph)	233	286	37	33	792	18	362	546	0	107	596	284
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA		Prot	NA	pm+ov
Protected Phases	3	8		7	4		1	6		5	2	3
Permitted Phases			8			4						2
Actuated Green, G (s)	10.9	36.9	36.9	3.3	29.3	29.3	25.1	38.1		11.3	24.3	35.2
Effective Green, g (s)	10.9	38.2	36.9	3.3	30.6	29.3	25.1	37.2		11.3	23.4	33.4
Actuated g/C Ratio	0.10	0.35	0.34	0.03	0.28	0.27	0.23	0.35		0.10	0.22	0.31
Clearance Time (s)	4.0	5.3	5.3	4.0	5.3	5.3	4.0	4.9		4.0	4.9	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	347	1254	541	54	1004	430	412	1191		185	768	490
v/s Ratio Prot	c0.07	0.08		0.02	c0.22		c0.20	0.16		0.06	c0.17	0.05
v/s Ratio Perm			0.02			0.01						0.13
v/c Ratio	0.67	0.23	0.07	0.61	0.79	0.04	0.88	0.46		0.58	0.78	0.58
Uniform Delay, d1	46.7	24.4	23.9	51.6	35.6	28.9	39.9	27.5		46.0	39.7	31.3
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	5.0	0.1	0.1	18.7	4.2	0.0	18.7	0.3		4.3	4.9	1.8
Delay (s)	51.8	24.5	23.9	70.4	39.8	28.9	58.6	27.7		50.3	44.7	33.1
Level of Service	D	C	C	E	D	C	E	C		D	D	C
Approach Delay (s)		34.5			40.1			39.8			41.2	
Approach LOS		C			D			D			D	

Intersection Summary		
HCM 2000 Control Delay	39.4	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.80	D
Actuated Cycle Length (s)	107.8	Sum of lost time (s)
Intersection Capacity Utilization	74.7%	18.7
Analysis Period (min)	15	ICU Level of Service
		D

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
40: First St/Springtown Blvd & I-580 WB Ramps

BART to Livermore Extension Project
2025 Express Bus AM





















Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations			↗↘			↗	↗↘	↑			↗↘	↗
Traffic Volume (vph)	0	0	443	0	0	0	341	375	0	0	875	617
Future Volume (vph)	0	0	443	0	0	0	341	375	0	0	875	617
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)			4.0				4.0	4.0			5.0	5.0
Lane Util. Factor			0.88				0.97	1.00			0.95	1.00
Frt			0.85				1.00	1.00			1.00	0.85
Flt Protected			1.00				0.95	1.00			1.00	1.00
Satd. Flow (prot)			2787				3433	1863			3539	1583
Flt Permitted			1.00				0.95	1.00			1.00	1.00
Satd. Flow (perm)			2787				3433	1863			3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	482	0	0	0	371	408	0	0	951	671
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	62
Lane Group Flow (vph)	0	0	482	0	0	0	371	408	0	0	951	609
Turn Type			Over			Free	Prot	NA			NA	Perm
Protected Phases			5				5	2			6	
Permitted Phases						Free						6
Actuated Green, G (s)			21.7				21.7	100.0			70.3	70.3
Effective Green, g (s)			21.2				21.2	100.0			69.8	69.8
Actuated g/C Ratio			0.21				0.21	1.00			0.70	0.70
Clearance Time (s)			3.5				3.5	4.0			4.5	4.5
Vehicle Extension (s)			2.0				2.0	0.2			4.0	4.0
Lane Grp Cap (vph)			590				727	1863			2470	1104
v/s Ratio Prot			c0.17				0.11	0.22			0.27	
v/s Ratio Perm												c0.38
v/c Ratio			0.82				0.51	0.22			0.39	0.55
Uniform Delay, d1			37.6				34.8	0.0			6.2	7.4
Progression Factor			1.00				1.02	1.00			1.00	1.00
Incremental Delay, d2			8.2				0.2	0.3			0.1	0.7
Delay (s)			45.7				35.8	0.3			6.4	8.2
Level of Service			D				D	A			A	A
Approach Delay (s)		45.7			0.0			17.2			7.1	
Approach LOS		D			A			B			A	

Intersection Summary

HCM 2000 Control Delay	16.3	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.61		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	55.4%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
41: First St & I-580 EB Ramps

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations													
Traffic Volume (vph)	94	1	351	0	0	0	0	629	324	67	1222	0	
Future Volume (vph)	94	1	351	0	0	0	0	629	324	67	1222	0	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)		4.0	4.0					5.0	5.0	4.0	5.0		
Lane Util. Factor		1.00	0.88					0.95	1.00	1.00	0.95		
Frt		1.00	0.85					1.00	0.85	1.00	1.00		
Flt Protected		0.95	1.00					1.00	1.00	0.95	1.00		
Satd. Flow (prot)		1775	2787					3539	1583	1770	3539		
Flt Permitted		0.95	1.00					1.00	1.00	0.95	1.00		
Satd. Flow (perm)		1775	2787					3539	1583	1770	3539		
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	
Adj. Flow (vph)	102	1	382	0	0	0	0	684	352	73	1328	0	
RTOR Reduction (vph)	0	0	108	0	0	0	0	0	174	0	0	0	
Lane Group Flow (vph)	0	103	274	0	0	0	0	684	178	73	1328	0	
Turn Type	Perm	NA	Perm					NA	Perm	Prot	NA		
Protected Phases		4						2		1	6		
Permitted Phases	4		4						2				
Actuated Green, G (s)		9.1	9.1					25.8	25.8	4.1	32.9		
Effective Green, g (s)		8.6	8.6					25.3	25.3	3.1	32.4		
Actuated g/C Ratio		0.17	0.17					0.51	0.51	0.06	0.65		
Clearance Time (s)		3.5	3.5					4.5	4.5	3.0	4.5		
Vehicle Extension (s)		2.5	2.5					4.0	4.0	2.0	4.0		
Lane Grp Cap (vph)		305	479					1790	800	109	2293		
v/s Ratio Prot								0.19		0.04	c0.38		
v/s Ratio Perm		0.06	c0.10						0.11				
v/c Ratio		0.34	0.57					0.38	0.22	0.67	0.58		
Uniform Delay, d1		18.2	19.0					7.6	6.9	22.9	5.0		
Progression Factor		1.00	1.00					1.00	1.00	1.00	1.04		
Incremental Delay, d2		0.5	1.4					0.6	0.6	10.4	1.0		
Delay (s)		18.7	20.4					8.2	7.5	33.3	6.1		
Level of Service		B	C					A	A	C	A		
Approach Delay (s)		20.0			0.0			8.0			7.5		
Approach LOS		C			A			A			A		
Intersection Summary													
HCM 2000 Control Delay			9.8		HCM 2000 Level of Service					A			
HCM 2000 Volume to Capacity ratio			0.64										
Actuated Cycle Length (s)			50.0		Sum of lost time (s)					13.0			
Intersection Capacity Utilization			53.6%		ICU Level of Service					A			
Analysis Period (min)			15										

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
42: 1st St & Mines Rd

BART to Livermore Extension Project
2025 Express Bus AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	33	70	42	539	107	333	18	849	304	211	1244	20
Future Volume (vph)	33	70	42	539	107	333	18	849	304	211	1244	20
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		0.97	1.00	1.00	1.00	0.91		0.97	0.91	
Frt	1.00	0.94		1.00	1.00	0.85	1.00	0.96		1.00	1.00	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1757		3433	1863	1583	1770	4884		3433	5073	
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	1757		3433	1863	1583	1770	4884		3433	5073	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	36	76	46	586	116	362	20	923	330	229	1352	22
RTOR Reduction (vph)	0	35	0	0	0	78	0	85	0	0	2	0
Lane Group Flow (vph)	36	87	0	586	116	284	20	1168	0	229	1372	0
Turn Type	Prot	NA		Prot	NA	pm+ov	Prot	NA		Prot	NA	
Protected Phases	7	4		3	8	1	5	2		1	6	
Permitted Phases						8						
Actuated Green, G (s)	1.8	8.5		12.2	18.9	24.0	0.7	23.4		5.1	27.8	
Effective Green, g (s)	1.8	8.5		12.2	18.9	24.0	0.7	23.4		5.1	27.8	
Actuated g/C Ratio	0.03	0.13		0.19	0.29	0.37	0.01	0.36		0.08	0.43	
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	48	229		642	540	679	19	1752		268	2163	
v/s Ratio Prot	0.02	0.05		c0.17	0.06	c0.03	0.01	0.24		c0.07	c0.27	
v/s Ratio Perm						0.15						
v/c Ratio	0.75	0.38		0.91	0.21	0.42	1.05	0.67		0.85	0.63	
Uniform Delay, d1	31.5	25.9		26.0	17.5	15.4	32.2	17.6		29.7	14.7	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	48.1	1.1		17.4	0.2	0.4	224.0	1.0		22.3	0.6	
Delay (s)	79.6	27.0		43.4	17.7	15.8	256.3	18.6		52.0	15.3	
Level of Service	E	C		D	B	B	F	B		D	B	
Approach Delay (s)		39.0			31.2			22.3			20.6	
Approach LOS		D			C			C			C	



















Intersection Summary

HCM 2000 Control Delay	24.6	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.76		
Actuated Cycle Length (s)	65.2	Sum of lost time (s)	16.0
Intersection Capacity Utilization	61.3%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group




















HCM Unsignalized Intersection Capacity Analysis
43: Vasco Rd & I-580 WB Ramps

BART to Livermore Extension Project
2025 Express Bus AM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	0	0	169	0	826	0	0	1535	0
Future Volume (Veh/h)	0	0	0	0	0	169	0	826	0	0	1535	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	0	0	0	184	0	898	0	0	1668	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage (veh)												
Upstream signal (ft)											487	
pX, platoon unblocked												
vC, conflicting volume	2301	2566	1668	2566	2566	449	1668			898		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	2301	2566	1668	2566	2566	449	1668			898		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	100	100	67	100			100		
cM capacity (veh/h)	14	26	85	13	26	557	381			752		
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	SB 1	SB 2					
Volume Total	0	184	449	449	0	1668	0					
Volume Left	0	0	0	0	0	0	0					
Volume Right	0	184	0	0	0	0	0					
cSH	1700	557	1700	1700	1700	1700	1700					
Volume to Capacity	0.00	0.33	0.26	0.26	0.00	0.98	0.00					
Queue Length 95th (ft)	0	36	0	0	0	0	0					
Control Delay (s)	0.0	14.6	0.0	0.0	0.0	0.0	0.0					
Lane LOS	A	B										
Approach Delay (s)	0.0	14.6	0.0			0.0						
Approach LOS	A	B										
Intersection Summary												
Average Delay			1.0									
Intersection Capacity Utilization			84.1%	ICU Level of Service	E							
Analysis Period (min)			15									

HCM Unsignalized Intersection Capacity Analysis
 44: Vasco Rd & I-580 EB Ramps

BART to Livermore Extension Project
 2025 Express Bus AM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	0	0	0	0	1156	0	73	1761	0
Future Volume (Veh/h)	0	0	0	0	0	0	0	1156	0	73	1761	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	0	0	0	0	0	1257	0	79	1914	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	2700	3329	1914	3329	3329	628	1914			1257		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	2700	3329	1914	3329	3329	628	1914			1257		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	100	100	100	100			86		
cM capacity (veh/h)	9	7	58	3	7	425	306			549		
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2						
Volume Total	0	0	838	419	79	1914						
Volume Left	0	0	0	0	79	0						
Volume Right	0	0	0	0	0	0						
cSH	1700	1700	1700	1700	549	1700						
Volume to Capacity	0.00	0.00	0.49	0.25	0.14	1.13						
Queue Length 95th (ft)	0	0	0	0	12	0						
Control Delay (s)	0.0	0.0	0.0	0.0	12.7	0.0						
Lane LOS	A	A			B							
Approach Delay (s)	0.0	0.0	0.0		0.5							
Approach LOS	A	A										
Intersection Summary												
Average Delay			0.3									
Intersection Capacity Utilization			96.0%	ICU Level of Service	F							
Analysis Period (min)			15									

HCM Signalized Intersection Capacity Analysis
45: Vasco Rd & East Ave

BART to Livermore Extension Project
2025 Express Bus AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	276	323	49	7	17	14	62	251	182	237	287	279
Future Volume (vph)	276	323	49	7	17	14	62	251	182	237	287	279
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	0.95		0.97	1.00	1.00
Frt	1.00	0.98		1.00	0.93		1.00	0.94		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	3470		1770	3298		1770	3316		3433	1863	1583
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1770	3470		1770	3298		1770	3316		3433	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	300	351	53	8	18	15	67	273	198	258	312	303
RTOR Reduction (vph)	0	21	0	0	14	0	0	145	0	0	0	203
Lane Group Flow (vph)	300	383	0	8	19	0	67	326	0	258	312	100
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												6
Actuated Green, G (s)	12.2	14.3		0.6	2.7		2.2	13.2		5.2	16.2	16.2
Effective Green, g (s)	12.2	14.3		0.6	2.7		2.2	13.2		5.2	16.2	16.2
Actuated g/C Ratio	0.25	0.29		0.01	0.05		0.04	0.27		0.11	0.33	0.33
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	438	1006		21	180		78	887		362	612	520
v/s Ratio Prot	c0.17	c0.11		0.00	0.01		0.04	0.10		c0.08	c0.17	
v/s Ratio Perm												0.06
v/c Ratio	0.68	0.38		0.38	0.10		0.86	0.37		0.71	0.51	0.19
Uniform Delay, d1	16.8	14.0		24.2	22.2		23.4	14.7		21.3	13.3	11.9
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	4.4	0.2		11.2	0.3		56.5	0.3		6.5	0.7	0.2
Delay (s)	21.2	14.2		35.3	22.4		79.9	14.9		27.8	14.0	12.0
Level of Service	C	B		D	C		E	B		C	B	B
Approach Delay (s)		17.2			24.9			23.0			17.4	
Approach LOS		B			C			C			B	

Intersection Summary

HCM 2000 Control Delay	18.9	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.64		
Actuated Cycle Length (s)	49.3	Sum of lost time (s)	16.0
Intersection Capacity Utilization	51.5%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Unsignalized Intersection Capacity Analysis
 46: I-580 WB Ramps & Northfront Rd/Northfront Road



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↻			↻	↻	↻
Traffic Volume (veh/h)	116	214	1310	124	64	541
Future Volume (Veh/h)	116	214	1310	124	64	541
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	126	233	1424	135	70	588
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None		None			
Median storage (veh)						
Upstream signal (ft)	1007					
pX, platoon unblocked					0.50	
vC, conflicting volume			126	3226 242		
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			126	4980	242	
tC, single (s)			4.1	6.4	6.2	
tC, 2 stage (s)						
tF (s)			2.2	3.5	3.3	
p0 queue free %			2	0	26	
cM capacity (veh/h)			1460	0	796	
Direction, Lane #	EB 1	WB 1	NB 1	NB 2		
Volume Total	359	1559	70	588		
Volume Left	0	1424	70	0		
Volume Right	233	0	0	588		
cSH	1700	1460	0	796		
Volume to Capacity	0.21	0.98	8131.84	0.74		
Queue Length 95th (ft)	0	524	Err	168		
Control Delay (s)	0.0	35.2	Err	21.1		
Lane LOS	E		F	C		
Approach Delay (s)	0.0	35.2	1082.6			
Approach LOS			F			
Intersection Summary						
Average Delay			297.9			
Intersection Capacity Utilization			111.9%	ICU Level of Service	H	
Analysis Period (min)			15			

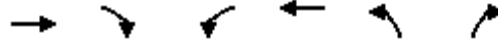
Intersection	
Intersection Delay, s/veh	10
Intersection LOS	A

Movement	EBU	EBL	EBT	WBU	WBT	WBR	SBU	SBL	SBR
Lane Configurations		↘	↕↕		↕	↘		↘↘	↘
Traffic Vol, veh/h	0	43	27	0	165	105	0	307	84
Future Vol, veh/h	0	43	27	0	165	105	0	307	84
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	47	29	0	179	114	0	334	91
Number of Lanes	0	1	2	0	1	1	0	2	1

Approach	EB	WB	SB
Opposing Approach	WB	EB	
Opposing Lanes	2	3	0
Conflicting Approach Left	SB		WB
Conflicting Lanes Left	3	0	2
Conflicting Approach Right		SB	EB
Conflicting Lanes Right	0	3	3
HCM Control Delay	9.5	10.2	9.9
HCM LOS	A	B	A

Lane	EBLn1	EBLn2	EBLn3	WBLn1	WBLn2	SBLn1	SBLn2	SBLn3
Vol Left, %	100%	0%	0%	0%	0%	100%	100%	0%
Vol Thru, %	0%	100%	100%	100%	0%	0%	0%	0%
Vol Right, %	0%	0%	0%	0%	100%	0%	0%	100%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	43	14	14	165	105	154	154	84
LT Vol	43	0	0	0	0	154	154	0
Through Vol	0	14	14	165	0	0	0	0
RT Vol	0	0	0	0	105	0	0	84
Lane Flow Rate	47	15	15	179	114	167	167	91
Geometry Grp	8	8	8	8	8	7	7	7
Degree of Util (X)	0.089	0.026	0.019	0.291	0.163	0.276	0.276	0.076
Departure Headway (Hd)	6.88	6.374	4.621	5.832	5.126	5.952	5.952	3.016
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cap	524	565	779	612	693	599	599	1163
Service Time	4.58	4.074	2.321	3.62	2.913	3.735	3.735	0.799
HCM Lane V/C Ratio	0.09	0.027	0.019	0.292	0.165	0.279	0.279	0.078
HCM Control Delay	10.3	9.2	7.4	11	8.9	11	11	6.1
HCM Lane LOS	B	A	A	B	A	B	B	A
HCM 95th-tile Q	0.3	0.1	0.1	1.2	0.6	1.1	1.1	0.2

HCM Signalized Intersection Capacity Analysis
 48: Greenville Rd & Northfront Road/Altamont Pass Road



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↑	↑	↑	↑	↑
Traffic Volume (vph)	4	652	270	864	586	62
Future Volume (vph)	4	652	270	864	586	62
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	1863	1583	1770	1863	1770	1583
Flt Permitted	1.00	1.00	0.76	1.00	0.95	1.00
Satd. Flow (perm)	1863	1583	1407	1863	1770	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	4	709	293	939	637	67
RTOR Reduction (vph)	0	325	0	0	0	22
Lane Group Flow (vph)	4	384	293	939	637	45
Turn Type	NA	Perm	Perm	NA	Prot	Perm
Protected Phases	4			8	2	
Permitted Phases		4	8			2
Actuated Green, G (s)	60.9	60.9	60.9	60.9	43.5	43.5
Effective Green, g (s)	60.9	60.9	60.9	60.9	43.5	43.5
Actuated g/C Ratio	0.54	0.54	0.54	0.54	0.39	0.39
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	1009	857	762	1009	685	612
v/s Ratio Prot	0.00			c0.50	c0.36	
v/s Ratio Perm		0.24	0.21			0.03
v/c Ratio	0.00	0.45	0.38	0.93	0.93	0.07
Uniform Delay, d1	11.8	15.6	14.9	23.8	33.0	21.7
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.0	0.4	0.3	14.5	19.0	0.1
Delay (s)	11.8	16.0	15.2	38.3	52.0	21.8
Level of Service	B	B	B	D	D	C
Approach Delay (s)	15.9			32.8	49.1	
Approach LOS	B			C	D	

Intersection Summary			
HCM 2000 Control Delay	32.6	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.93		
Actuated Cycle Length (s)	112.4	Sum of lost time (s)	8.0
Intersection Capacity Utilization	84.6%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	115	232	135	527	743	127
Future Volume (vph)	115	232	135	527	743	127
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.2	5.2	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.88	0.97	0.95	0.95	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	3433	2787	3433	3539	3539	1583
Flt Permitted	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (perm)	3433	2787	3433	3539	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	125	252	147	573	808	138
RTOR Reduction (vph)	0	220	0	0	0	73
Lane Group Flow (vph)	125	32	147	573	808	65
Turn Type	Prot	Perm	Prot	NA	NA	Perm
Protected Phases	8		1	6	2	
Permitted Phases		8				2
Actuated Green, G (s)	5.7	5.7	3.1	24.5	17.4	17.4
Effective Green, g (s)	5.1	5.1	3.1	26.2	19.1	19.1
Actuated g/C Ratio	0.13	0.13	0.08	0.65	0.47	0.47
Clearance Time (s)	4.6	4.6	4.0	5.7	5.7	5.7
Vehicle Extension (s)	5.0	5.0	6.0	2.5	2.5	2.5
Lane Grp Cap (vph)	432	350	262	2289	1669	746
v/s Ratio Prot	c0.04		c0.04	0.16	c0.23	
v/s Ratio Perm		0.01				0.04
v/c Ratio	0.29	0.09	0.56	0.25	0.48	0.09
Uniform Delay, d1	16.1	15.6	18.0	3.0	7.3	5.9
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.8	0.2	5.6	0.0	0.2	0.0
Delay (s)	16.8	15.9	23.6	3.1	7.5	5.9
Level of Service	B	B	C	A	A	A
Approach Delay (s)	16.2			7.3	7.3	
Approach LOS	B			A	A	

Intersection Summary

HCM 2000 Control Delay	8.9	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.46		
Actuated Cycle Length (s)	40.5	Sum of lost time (s)	13.2
Intersection Capacity Utilization	38.7%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
50: Greenville Rd & Patterson Pass Rd

BART to Livermore Extension Project
2025 Express Bus AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗		↖	↗		↖	↗		↖	↗	
Traffic Volume (vph)	29	3	26	227	405	563	10	145	1	9	338	53
Future Volume (vph)	29	3	26	227	405	563	10	145	1	9	338	53
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.86		1.00	0.91		1.00	1.00		1.00	0.98	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1610		1770	1700		1770	1861		1770	1825	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	1610		1770	1700		1770	1861		1770	1825	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	32	3	28	247	440	612	11	158	1	10	367	58
RTOR Reduction (vph)	0	21	0	0	39	0	0	0	0	0	5	0
Lane Group Flow (vph)	32	10	0	247	1013	0	11	159	0	10	420	0
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												
Actuated Green, G (s)	2.3	30.0		40.5	68.2		0.7	28.1		0.7	28.1	
Effective Green, g (s)	2.3	30.0		40.5	68.2		0.7	28.1		0.7	28.1	
Actuated g/C Ratio	0.02	0.26		0.35	0.59		0.01	0.24		0.01	0.24	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	35	418		621	1005		10	453		10	444	
v/s Ratio Prot	c0.02	0.01		0.14	c0.60		c0.01	0.09		0.01	c0.23	
v/s Ratio Perm												
v/c Ratio	0.91	0.02		0.40	1.01		1.10	0.35		1.00	0.95	
Uniform Delay, d1	56.4	31.8		28.2	23.5		57.3	36.1		57.3	42.9	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	116.7	0.0		0.4	30.3		321.8	2.1		284.6	31.3	
Delay (s)	173.1	31.8		28.6	53.8		379.1	38.2		341.9	74.2	
Level of Service	F	C		C	D		F	D		F	E	
Approach Delay (s)		103.5			49.0			60.3			80.3	
Approach LOS		F			D			E			F	

Intersection Summary

HCM 2000 Control Delay	58.7	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	0.99		
Actuated Cycle Length (s)	115.3	Sum of lost time (s)	16.0
Intersection Capacity Utilization	83.5%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 1: Dougherty Rd & Amador Valley Rd



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	330	454	602	1931	1080	208
Future Volume (vph)	330	454	602	1931	1080	208
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5	5.7	5.7	
Lane Util. Factor	1.00	1.00	0.97	0.91	0.91	
Frt	1.00	0.85	1.00	1.00	0.98	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1770	1583	3433	5085	4962	
Flt Permitted	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	1770	1583	3433	5085	4962	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	359	493	654	2099	1174	226
RTOR Reduction (vph)	0	228	0	0	29	0
Lane Group Flow (vph)	359	265	654	2099	1371	0
Turn Type	Perm	Perm	Prot	NA	NA	
Protected Phases			5	2	6	
Permitted Phases	4	4				
Actuated Green, G (s)	21.1	21.1	13.6	54.7	36.6	
Effective Green, g (s)	21.1	21.1	13.6	54.7	36.6	
Actuated g/C Ratio	0.25	0.25	0.16	0.64	0.43	
Clearance Time (s)	4.5	4.5	4.5	5.7	5.7	
Vehicle Extension (s)	1.8	1.8	2.0	4.0	4.0	
Lane Grp Cap (vph)	434	388	542	3234	2111	
v/s Ratio Prot			c0.19	c0.41	0.28	
v/s Ratio Perm	c0.20	0.17				
v/c Ratio	0.83	0.68	1.21	0.65	0.65	
Uniform Delay, d1	30.7	29.4	36.2	9.7	19.6	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	11.7	3.9	109.5	0.5	0.8	
Delay (s)	42.4	33.4	145.7	10.2	20.4	
Level of Service	D	C	F	B	C	
Approach Delay (s)	37.2			42.4	20.4	
Approach LOS	D			D	C	

Intersection Summary

HCM 2000 Control Delay	35.3	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.83		
Actuated Cycle Length (s)	86.0	Sum of lost time (s)	14.7
Intersection Capacity Utilization	73.2%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
2: Dougherty Rd & Dublin Blvd

BART to Livermore Extension Project
2025 Express Bus PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↑↑↑	↖↗	↖↗↘	↑↑↑	↖	↖↗↘	↑↑↑	↖↗	↖↗	↑↑↑	↖↗
Traffic Volume (vph)	81	1020	922	536	815	652	865	1864	311	623	1257	36
Future Volume (vph)	81	1020	922	536	815	652	865	1864	311	623	1257	36
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	6.0	5.0	5.0	5.5	5.0	5.0	5.5	5.0	5.0	5.5	
Lane Util. Factor	0.97	0.91	0.88	0.94	0.91	1.00	0.94	0.91	0.88	0.97	0.86	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	3433	5085	2787	4990	5085	1583	4990	5085	2787	3433	6381	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	3433	5085	2787	4990	5085	1583	4990	5085	2787	3433	6381	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	88	1109	1002	583	886	709	940	2026	338	677	1366	39
RTOR Reduction (vph)	0	0	34	0	0	55	0	0	33	0	3	0
Lane Group Flow (vph)	88	1109	968	583	886	654	940	2026	305	677	1402	0
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	
Protected Phases	5	2	3	1	6	7	3	8	1	7	4	
Permitted Phases			2			6			8			
Actuated Green, G (s)	15.0	35.0	57.5	18.4	38.9	56.0	22.5	46.5	64.9	17.1	41.1	
Effective Green, g (s)	15.0	35.0	57.5	18.4	38.9	56.0	22.5	46.5	64.9	17.1	41.1	
Actuated g/C Ratio	0.11	0.25	0.42	0.13	0.28	0.40	0.16	0.34	0.47	0.12	0.30	
Clearance Time (s)	5.0	6.0	5.0	5.0	5.5	5.0	5.0	5.5	5.0	5.0	5.5	
Vehicle Extension (s)	2.0	4.5	2.0	2.0	4.5	2.0	2.0	4.5	2.0	2.0	4.5	
Lane Grp Cap (vph)	371	1285	1157	662	1428	640	810	1707	1305	423	1893	
v/s Ratio Prot	0.03	0.22	0.14	c0.12	0.17	c0.13	c0.19	c0.40	0.03	c0.20	0.22	
v/s Ratio Perm			0.21			0.29			0.08			
v/c Ratio	0.24	0.86	0.84	0.88	0.62	1.02	1.16	1.19	0.23	1.60	0.74	
Uniform Delay, d1	56.5	49.5	36.3	59.0	43.4	41.2	58.0	46.0	22.0	60.7	43.9	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.1	6.6	5.2	12.7	1.1	41.3	85.8	90.3	0.0	281.1	1.8	
Delay (s)	56.6	56.1	41.5	71.7	44.4	82.6	143.8	136.3	22.0	341.8	45.7	
Level of Service	E	E	D	E	D	F	F	F	C	F	D	
Approach Delay (s)		49.4			64.1			126.7			142.0	
Approach LOS		D			E			F			F	

Intersection Summary

HCM 2000 Control Delay	98.6	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.18		
Actuated Cycle Length (s)	138.5	Sum of lost time (s)	21.5
Intersection Capacity Utilization	103.9%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
3: Dougherty Rd & I-580 WB Ramps



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↔↔		↔↔		↑↑↑			↑↑↑	↔
Traffic Volume (vph)	0	0	0	314	0	703	0	2366	0	0	1636	0
Future Volume (vph)	0	0	0	314	0	703	0	2366	0	0	1636	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0		4.0		4.0			4.0	
Lane Util. Factor				0.97		0.88		0.91			0.86	
Frt				1.00		0.85		1.00			1.00	
Flt Protected				0.95		1.00		1.00			1.00	
Satd. Flow (prot)				3433		2787		5085			4806	
Flt Permitted				0.95		1.00		1.00			1.00	
Satd. Flow (perm)				3433		2787		5085			4806	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	341	0	764	0	2572	0	0	1778	0
RTOR Reduction (vph)	0	0	0	0	0	15	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	341	0	749	0	2572	0	0	1778	0
Turn Type				Prot		Prot		NA			NA	Perm
Protected Phases				4		4		2			6	
Permitted Phases												6
Actuated Green, G (s)				36.2		36.2		73.0			73.0	
Effective Green, g (s)				37.6		37.6		74.4			74.4	
Actuated g/C Ratio				0.31		0.31		0.62			0.62	
Clearance Time (s)				5.4		5.4		5.4			5.4	
Vehicle Extension (s)				3.0		3.0		3.0			3.0	
Lane Grp Cap (vph)				1075		873		3152			2979	
v/s Ratio Prot				0.10		c0.27		c0.51			0.37	
v/s Ratio Perm												
v/c Ratio				0.32		0.86		0.82			0.60	
Uniform Delay, d1				31.4		38.7		17.5			13.8	
Progression Factor				1.00		1.00		1.03			1.00	
Incremental Delay, d2				0.2		8.4		0.9			0.9	
Delay (s)				31.6		47.1		18.9			14.6	
Level of Service				C		D		B			B	
Approach Delay (s)		0.0			42.3			18.9			14.6	
Approach LOS		A			D			B			B	

Intersection Summary			
HCM 2000 Control Delay	22.2	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.83		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	77.0%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 4: Hopyard Rd/Dougherty Rd & I-580 EB Ramps



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗		↖↗					↑↑↑	↖		↑↑↑	↖
Traffic Volume (vph)	1116	0	836	0	0	0	0	2456	0	0	1145	0
Future Volume (vph)	1116	0	836	0	0	0	0	2456	0	0	1145	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0					4.0			4.0	
Lane Util. Factor	0.97		0.88					0.91			0.86	
Frt	1.00		0.85					1.00			1.00	
Flt Protected	0.95		1.00					1.00			1.00	
Satd. Flow (prot)	3433		2787					5085			4806	
Flt Permitted	0.95		1.00					1.00			1.00	
Satd. Flow (perm)	3433		2787					5085			4806	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	1213	0	909	0	0	0	0	2670	0	0	1245	0
RTOR Reduction (vph)	0	0	61	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	1213	0	848	0	0	0	0	2670	0	0	1245	0
Turn Type	Prot		Prot					NA	Free		NA	Perm
Protected Phases	4		4					2			6	
Permitted Phases									Free			6
Actuated Green, G (s)	43.6		43.6					65.6			65.6	
Effective Green, g (s)	45.0		45.0					67.0			67.0	
Actuated g/C Ratio	0.38		0.38					0.56			0.56	
Clearance Time (s)	5.4		5.4					5.4			5.4	
Vehicle Extension (s)	3.0		3.0					3.0			3.0	
Lane Grp Cap (vph)	1287		1045					2839			2683	
v/s Ratio Prot	c0.35		0.30					c0.53			0.26	
v/s Ratio Perm												
v/c Ratio	0.94		0.81					0.94			0.46	
Uniform Delay, d1	36.2		33.7					24.6			15.8	
Progression Factor	1.00		1.00					0.50			0.71	
Incremental Delay, d2	13.6		4.9					7.2			0.5	
Delay (s)	49.8		38.6					19.5			11.7	
Level of Service	D		D					B			B	
Approach Delay (s)		45.0			0.0			19.5			11.7	
Approach LOS		D			A			B			B	

Intersection Summary		
HCM 2000 Control Delay	26.8	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.94	C
Actuated Cycle Length (s)	120.0	Sum of lost time (s)
Intersection Capacity Utilization	86.0%	8.0
Analysis Period (min)	15	ICU Level of Service
		E

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
5: Hopyard Rd & Owens Rd

BART to Livermore Extension Project
2025 Express Bus PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	366	244	305	525	284	281	277	891	256	325	1464	239
Future Volume (vph)	366	244	305	525	284	281	277	891	256	325	1464	239
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	2.7	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	0.91	0.91		1.00	0.95	0.95	1.00	0.91	1.00	0.97	0.91	
Frt	1.00	0.94		1.00	0.96	0.85	1.00	1.00	0.85	1.00	0.98	
Flt Protected	0.95	0.99		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1610	3136		1770	1707	1504	1770	5085	1583	3433	4978	
Flt Permitted	0.95	0.99		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1610	3136		1770	1707	1504	1770	5085	1583	3433	4978	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	398	265	332	571	309	305	301	968	278	353	1591	260
RTOR Reduction (vph)	0	106	0	0	9	41	0	0	198	0	19	0
Lane Group Flow (vph)	219	670	0	571	395	169	301	968	80	353	1832	0
Turn Type	Split	NA		Split	NA	pm+ov	Prot	NA	Perm	Prot	NA	
Protected Phases	8	8		4	4	1	5	2		1	6	
Permitted Phases						4			2			
Actuated Green, G (s)	16.7	16.7		27.7	27.7	50.2	15.0	32.8	32.8	22.5	40.3	
Effective Green, g (s)	18.0	18.0		29.0	29.0	52.8	15.0	34.5	34.5	22.5	42.0	
Actuated g/C Ratio	0.15	0.15		0.24	0.24	0.44	0.12	0.29	0.29	0.19	0.35	
Clearance Time (s)	5.3	5.3		5.3	5.3	4.0	4.0	5.7	5.7	4.0	5.7	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	241	470		427	412	695	221	1461	455	643	1742	
v/s Ratio Prot	0.14	c0.21		c0.32	0.23	0.05	c0.17	0.19		0.10	c0.37	
v/s Ratio Perm						0.06			0.05			
v/c Ratio	0.91	1.43		1.34	0.96	0.24	1.36	0.66	0.18	0.55	1.05	
Uniform Delay, d1	50.2	51.0		45.5	44.9	21.1	52.5	37.6	32.1	44.2	39.0	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.04	0.88	
Incremental Delay, d2	34.1	203.3		167.0	33.3	0.2	189.3	2.4	0.8	0.8	34.6	
Delay (s)	84.3	254.3		212.5	78.2	21.3	241.8	40.0	32.9	46.6	69.0	
Level of Service	F	F		F	E	C	F	D	C	D	E	
Approach Delay (s)		216.9			132.8			78.0			65.4	
Approach LOS		F			F			E			E	





































Intersection Summary

HCM 2000 Control Delay	107.6	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.24		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	109.5%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
6: Hopyard Rd & Stoneridge Dr

BART to Livermore Extension Project
2025 Express Bus PM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 	  		 	  		  	 		  	 	
Traffic Volume (vph)	265	1386	704	119	1313	188	593	822	103	290	856	187
Future Volume (vph)	265	1386	704	119	1313	188	593	822	103	290	856	187
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.91	1.00	0.97	0.91	1.00	0.94	0.95	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5085	1583	3433	5085	1583	4990	3539	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5085	1583	3433	5085	1583	4990	3539	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	288	1507	765	129	1427	204	645	893	112	315	930	203
RTOR Reduction (vph)	0	0	193	0	0	136	0	0	80	0	0	156
Lane Group Flow (vph)	288	1507	572	129	1427	68	645	893	32	315	930	47
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8			2			6
Actuated Green, G (s)	9.0	35.0	35.0	4.0	30.0	30.0	13.8	25.5	25.5	9.0	20.7	20.7
Effective Green, g (s)	9.0	35.0	35.0	4.0	30.0	30.0	13.8	25.5	25.5	9.0	20.7	20.7
Actuated g/C Ratio	0.10	0.39	0.39	0.04	0.34	0.34	0.15	0.28	0.28	0.10	0.23	0.23
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	345	1988	619	153	1704	530	769	1008	451	345	1176	366
v/s Ratio Prot	c0.08	0.30		0.04	0.28		c0.13	c0.25		0.09	0.18	
v/s Ratio Perm			c0.36			0.04			0.02			0.03
v/c Ratio	0.83	0.76	0.92	0.84	0.84	0.13	0.84	0.89	0.07	0.91	0.79	0.13
Uniform Delay, d1	39.5	23.6	26.0	42.4	27.5	20.7	36.8	30.6	23.4	39.9	32.4	27.3
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	15.8	1.7	19.6	32.3	3.8	0.1	8.0	9.5	0.1	27.5	3.7	0.2
Delay (s)	55.3	25.3	45.6	74.7	31.3	20.8	44.8	40.1	23.4	67.4	36.1	27.4
Level of Service	E	C	D	E	C	C	D	D	C	E	D	C
Approach Delay (s)		34.7			33.2			40.8			41.7	
Approach LOS		C			C			D			D	

Intersection Summary			
HCM 2000 Control Delay	37.1	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.95		
Actuated Cycle Length (s)	89.5	Sum of lost time (s)	16.0
Intersection Capacity Utilization	77.3%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
7: Hopyard Rd & Las Positas Blvd

BART to Livermore Extension Project
2025 Express Bus PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↖↖	↖	↖↗	↖↖	↖	↖↗	↖↖↖	↖	↖↗	↖↖↖	↖
Traffic Volume (vph)	99	246	421	539	406	51	343	941	244	72	1385	73
Future Volume (vph)	99	246	421	539	406	51	343	941	244	72	1385	73
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.95	1.00	0.97	0.95	1.00	0.97	0.91	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	3433	3539	1583	3433	5085	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	3433	3539	1583	3433	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	108	267	458	586	441	55	373	1023	265	78	1505	79
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	52
Lane Group Flow (vph)	108	267	458	586	441	55	373	1023	265	78	1505	27
Turn Type	Prot	NA	Free	Prot	NA	Free	Prot	NA	Free	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			Free			Free			Free			6
Actuated Green, G (s)	4.0	11.8	76.7	14.0	21.8	76.7	9.0	30.9	76.7	4.0	25.9	25.9
Effective Green, g (s)	4.0	11.8	76.7	14.0	21.8	76.7	9.0	30.9	76.7	4.0	25.9	25.9
Actuated g/C Ratio	0.05	0.15	1.00	0.18	0.28	1.00	0.12	0.40	1.00	0.05	0.34	0.34
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	179	544	1583	626	1005	1583	402	2048	1583	179	1717	534
v/s Ratio Prot	0.03	0.08		c0.17	c0.12		c0.11	0.20		0.02	c0.30	
v/s Ratio Perm			0.29			0.03			0.17			0.02
v/c Ratio	0.60	0.49	0.29	0.94	0.44	0.03	0.93	0.50	0.17	0.44	0.88	0.05
Uniform Delay, d1	35.6	29.7	0.0	30.9	22.4	0.0	33.5	17.1	0.0	35.3	23.9	17.1
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	5.6	0.7	0.5	21.4	0.3	0.0	27.3	0.2	0.2	1.7	5.4	0.0
Delay (s)	41.2	30.4	0.5	52.3	22.8	0.0	60.8	17.3	0.2	37.0	29.3	17.2
Level of Service	D	C	A	D	C	A	E	B	A	D	C	B
Approach Delay (s)		15.3			37.6			24.4			29.1	
Approach LOS		B			D			C			C	

Intersection Summary

HCM 2000 Control Delay	27.2	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.83		
Actuated Cycle Length (s)	76.7	Sum of lost time (s)	16.0
Intersection Capacity Utilization	72.1%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
8: Willow Rd & Owens Rd

BART to Livermore Extension Project
2025 Express Bus PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	79	618	161	120	610	84	161	79	0	176	69	114
Future Volume (vph)	79	618	161	120	610	84	161	79	0	176	69	114
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	5.3	4.0		5.3	4.0	4.0
Lane Util. Factor	0.97	0.91		0.97	0.91	1.00	1.00	0.95		1.00	1.00	1.00
Frt	1.00	0.97		1.00	1.00	0.85	1.00	1.00		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	4928		3433	5085	1583	1770	3539		1770	1863	1583
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.71	1.00		0.70	1.00	1.00
Satd. Flow (perm)	3433	4928		3433	5085	1583	1319	3539		1301	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	86	672	175	130	663	91	175	86	0	191	75	124
RTOR Reduction (vph)	0	61	0	0	0	48	0	0	0	0	0	94
Lane Group Flow (vph)	86	786	0	130	663	43	175	86	0	191	75	30
Turn Type	Prot	NA		Prot	NA	Perm	Perm	NA	Perm	Perm	NA	Perm
Protected Phases	1	6		5	2			4				8
Permitted Phases						2	4		4	8		8
Actuated Green, G (s)	2.5	20.1		4.3	21.9	21.9	10.6	10.6		10.6	10.6	10.6
Effective Green, g (s)	2.5	21.8		4.3	23.6	23.6	10.6	11.9		10.6	11.9	11.9
Actuated g/C Ratio	0.05	0.44		0.09	0.47	0.47	0.21	0.24		0.21	0.24	0.24
Clearance Time (s)	4.0	5.7		4.0	5.7	5.7	5.3	5.3		5.3	5.3	5.3
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	171	2148		295	2400	747	279	842		275	443	376
v/s Ratio Prot	0.03	c0.16		c0.04	0.13			0.02			0.04	
v/s Ratio Perm						0.03	0.13			c0.15		0.02
v/c Ratio	0.50	0.37		0.44	0.28	0.06	0.63	0.10		0.69	0.17	0.08
Uniform Delay, d1	23.1	9.5		21.7	8.0	7.2	17.9	14.9		18.2	15.1	14.8
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	2.3	0.1		1.1	0.1	0.0	4.4	0.1		7.4	0.2	0.1
Delay (s)	25.5	9.6		22.8	8.1	7.2	22.3	14.9		25.6	15.3	14.9
Level of Service	C	A		C	A	A	C	B		C	B	B
Approach Delay (s)		11.0			10.1			19.8			20.2	
Approach LOS		B			B			B			C	

Intersection Summary

HCM 2000 Control Delay	13.1	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.45		
Actuated Cycle Length (s)	50.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	45.4%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

9: Hacienda Dr & Dublin Blvd

BART to Livermore Extension Project
2025 Express Bus PM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	TT	TTT	TT	TT	TTT		TTT	TT	TT	TT	TTT	TT
Traffic Volume (vph)	51	1019	132	230	484	34	224	582	461	42	633	164
Future Volume (vph)	51	1019	132	230	484	34	224	582	461	42	633	164
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	6.0	5.0	4.5	6.0		5.0	6.0	6.0	4.5	5.5	5.5
Lane Util. Factor	0.97	0.91	0.88	0.97	0.91		0.94	0.95	0.88	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5085	2787	3433	5035		4990	3539	2787	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5085	2787	3433	5035		4990	3539	2787	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	55	1108	143	250	526	37	243	633	501	46	688	178
RTOR Reduction (vph)	0	0	64	0	7	0	0	0	233	0	0	137
Lane Group Flow (vph)	55	1108	79	250	556	0	243	633	268	46	688	41
Turn Type	Prot	NA	pm+ov	Prot	NA		Prot	NA	Perm	Prot	NA	Perm
Protected Phases	5	2	3	1	6		3	8		7	NA	4
Permitted Phases			2						8			4
Actuated Green, G (s)	4.2	29.7	40.4	11.0	36.5		10.7	29.7	29.7	2.7	21.7	21.7
Effective Green, g (s)	4.2	29.7	40.4	11.0	36.5		10.7	29.7	29.7	2.7	21.7	21.7
Actuated g/C Ratio	0.04	0.32	0.43	0.12	0.39		0.11	0.32	0.32	0.03	0.23	0.23
Clearance Time (s)	4.5	6.0	5.0	4.5	6.0		5.0	6.0	6.0	4.5	5.5	5.5
Vehicle Extension (s)	2.0	3.5	2.0	2.0	3.5		2.0	3.5	3.5	2.0	3.5	3.5
Lane Grp Cap (vph)	153	1604	1344	401	1953		567	1116	879	98	1172	365
v/s Ratio Prot	0.02	c0.22	0.01	c0.07	0.11		0.05	c0.18		0.01	c0.14	
v/s Ratio Perm			0.02						0.10			0.03
v/c Ratio	0.36	0.69	0.06	0.62	0.28		0.43	0.57	0.31	0.47	0.59	0.11
Uniform Delay, d1	43.6	28.2	15.7	39.6	19.8		38.9	26.8	24.4	45.0	32.2	28.6
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.5	1.4	0.0	2.2	0.1		0.2	0.7	0.2	1.3	0.8	0.2
Delay (s)	44.2	29.5	15.7	41.7	19.9		39.0	27.6	24.6	46.3	33.0	28.8
Level of Service	D	C	B	D	B		D	C	C	D	C	C
Approach Delay (s)		28.6			26.6			28.5			32.9	
Approach LOS		C			C			C			C	

Intersection Summary

HCM 2000 Control Delay	29.1	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.64		
Actuated Cycle Length (s)	94.1	Sum of lost time (s)	21.0
Intersection Capacity Utilization	63.3%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 10: Hacienda Dr & Martinelli Blvd/Hacienda Crossings



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗	↖↗	↖↗	↗		↖↗↘	↖↗↘	↗	↖↗	↖↗↘	
Traffic Volume (vph)	23	50	384	290	37	21	416	1254	467	60	919	72
Future Volume (vph)	23	50	384	290	37	21	416	1254	467	60	919	72
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	3.0	3.0	5.5	3.0		3.5	3.0	3.0	5.0	3.5	
Lane Util. Factor	1.00	0.91	0.91	0.97	1.00		0.94	0.91	1.00	0.97	0.86	
Frt	1.00	0.93	0.85	1.00	0.95		1.00	1.00	0.85	1.00	0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1770	1584	2882	3433	1761		4990	5085	1583	3433	6338	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1770	1584	2882	3433	1761		4990	5085	1583	3433	6338	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	25	54	417	315	40	23	452	1363	508	65	999	78
RTOR Reduction (vph)	0	24	261	0	13	0	0	0	232	0	10	0
Lane Group Flow (vph)	25	72	114	315	50	0	452	1363	276	65	1067	0
Turn Type	Prot	NA	Perm	Prot	NA		Prot	NA	pm+ov	Prot	NA	
Protected Phases	5	2		1	6		3	8	1	7	4	
Permitted Phases			2						8			
Actuated Green, G (s)	3.6	34.4	34.4	19.8	51.1		16.3	41.4	61.2	4.9	30.0	
Effective Green, g (s)	3.1	36.4	36.4	19.3	53.1		17.3	43.4	65.2	4.4	31.5	
Actuated g/C Ratio	0.03	0.30	0.30	0.16	0.44		0.14	0.36	0.54	0.04	0.26	
Clearance Time (s)	4.5	5.0	5.0	5.0	5.0		4.5	5.0	5.0	4.5	5.0	
Vehicle Extension (s)	3.0	4.0	4.0	2.0	4.0		3.0	4.0	2.0	3.0	4.0	
Lane Grp Cap (vph)	45	480	874	552	779		719	1839	860	125	1663	
v/s Ratio Prot	c0.01	c0.05		c0.09	0.03		0.09	c0.27	0.06	0.02	c0.17	
v/s Ratio Perm			0.04						0.12			
v/c Ratio	0.56	0.15	0.13	0.57	0.06		0.63	0.74	0.32	0.52	0.64	
Uniform Delay, d1	57.8	30.5	30.3	46.5	19.2		48.3	33.4	15.2	56.8	39.2	
Progression Factor	1.00	1.00	1.00	1.00	1.00		0.92	0.87	1.17	1.00	1.00	
Incremental Delay, d2	14.0	0.7	0.3	0.9	0.2		1.3	1.4	0.1	3.9	1.0	
Delay (s)	71.8	31.2	30.6	47.4	19.4		45.7	30.6	17.8	60.6	40.2	
Level of Service	E	C	C	D	B		D	C	B	E	D	
Approach Delay (s)		32.8			42.7			30.7			41.4	
Approach LOS		C			D			C			D	

Intersection Summary

HCM 2000 Control Delay	34.8	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.52		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	16.5
Intersection Capacity Utilization	62.6%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 11: Hacienda Dr & I-580 WB Ramps

BART to Livermore Extension Project
 2025 Express Bus PM





















Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↔↔		↔↔		↑↑↑			↑↑↑	↔
Traffic Volume (vph)	0	0	0	354	0	359	0	1514	758	0	802	755
Future Volume (vph)	0	0	0	354	0	359	0	1514	758	0	802	755
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0		4.0		4.0			4.0	4.0
Lane Util. Factor				0.97		0.88		0.91			0.86	0.86
Frt				1.00		0.85		0.95			0.95	0.85
Flt Protected				0.95		1.00		1.00			1.00	1.00
Satd. Flow (prot)				3433		2787		4831			4575	1362
Flt Permitted				0.95		1.00		1.00			1.00	1.00
Satd. Flow (perm)				3433		2787		4831			4575	1362
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	385	0	390	0	1646	824	0	872	821
RTOR Reduction (vph)	0	0	0	0	0	45	0	142	0	0	134	142
Lane Group Flow (vph)	0	0	0	385	0	345	0	2328	0	0	1149	268
Turn Type				Prot		Prot		NA			NA	Perm
Protected Phases				4		4		2			6	
Permitted Phases												6
Actuated Green, G (s)				11.4		11.4		37.3			37.3	37.3
Effective Green, g (s)				12.8		12.8		39.2			39.2	39.2
Actuated g/C Ratio				0.21		0.21		0.65			0.65	0.65
Clearance Time (s)				5.4		5.4		5.9			5.9	5.9
Vehicle Extension (s)				3.0		3.0		3.0			3.0	3.0
Lane Grp Cap (vph)				732		594		3156			2989	889
v/s Ratio Prot				0.11		c0.12		c0.48			0.25	
v/s Ratio Perm												0.20
v/c Ratio				0.53		0.58		0.74			0.38	0.30
Uniform Delay, d1				20.9		21.2		7.0			4.8	4.5
Progression Factor				1.00		1.00		1.17			0.63	3.63
Incremental Delay, d2				0.7		1.5		1.1			0.3	0.8
Delay (s)				21.6		22.6		9.2			3.4	17.0
Level of Service				C		C		A			A	B
Approach Delay (s)		0.0			22.1			9.2			6.7	
Approach LOS		A			C			A			A	

Intersection Summary			
HCM 2000 Control Delay	10.4	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.70		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	65.4%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 12: Hacienda Dr & I-580 EB Ramps

BART to Livermore Extension Project
 2025 Express Bus PM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	885	0	436	0	0	0	0	1559	881	0	741	313
Future Volume (vph)	885	0	436	0	0	0	0	1559	881	0	741	313
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0					4.0	4.0		4.0	
Lane Util. Factor	0.97		0.88					0.86	0.86		0.91	
Frt	1.00		0.85					0.98	0.85		0.96	
Flt Protected	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (prot)	3433		2787					4698	1362		4859	
Flt Permitted	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (perm)	3433		2787					4698	1362		4859	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	962	0	474	0	0	0	0	1695	958	0	805	340
RTOR Reduction (vph)	0	0	186	0	0	0	0	17	267	0	57	0
Lane Group Flow (vph)	962	0	288	0	0	0	0	1975	394	0	1088	0
Turn Type	Prot		Prot					NA	Perm		NA	
Protected Phases	4		4					2			6	
Permitted Phases									2			
Actuated Green, G (s)	39.0		39.0					69.7	69.7		69.7	
Effective Green, g (s)	40.4		40.4					71.6	71.6		71.6	
Actuated g/C Ratio	0.34		0.34					0.60	0.60		0.60	
Clearance Time (s)	5.4		5.4					5.9	5.9		5.9	
Vehicle Extension (s)	2.0		2.0					2.0	2.0		2.0	
Lane Grp Cap (vph)	1155		938					2803	812		2899	
v/s Ratio Prot	c0.28		0.10					c0.42			0.22	
v/s Ratio Perm									0.29			
v/c Ratio	0.83		0.31					0.70	0.49		0.38	
Uniform Delay, d1	36.7		29.4					16.8	13.7		12.6	
Progression Factor	1.00		1.00					1.30	6.61		0.73	
Incremental Delay, d2	5.1		0.1					1.2	1.6		0.3	
Delay (s)	41.7		29.5					23.1	92.5		9.5	
Level of Service	D		C					C	F		A	
Approach Delay (s)		37.7			0.0			40.4			9.5	
Approach LOS		D			A			D			A	
Intersection Summary												
HCM 2000 Control Delay			32.9					HCM 2000 Level of Service			C	
HCM 2000 Volume to Capacity ratio			0.75									
Actuated Cycle Length (s)			120.0					Sum of lost time (s)			8.0	
Intersection Capacity Utilization			68.6%					ICU Level of Service			C	
Analysis Period (min)			15									

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
13: Hacienda Dr & Owens Rd



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	688	723	52	117	301	747	36	989	269	437	465	260
Future Volume (vph)	688	723	52	117	301	747	36	989	269	437	465	260
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	2.3	4.0	4.0	2.3	4.0	4.0	2.7	4.0	4.0	2.7
Lane Util. Factor	0.97	0.91	1.00	0.97	0.91	1.00	0.97	0.91	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5085	1583	3433	5085	1583	3433	5085	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5085	1583	3433	5085	1583	3433	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	748	786	57	127	327	812	39	1075	292	475	505	283
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	748	786	57	127	327	812	39	1075	292	475	505	283
Turn Type	Prot	NA	Free	Prot	NA	Free	Prot	NA	Free	Prot	NA	Free
Protected Phases	1	6		5	2		7	4		3	8	
Permitted Phases			Free			Free			Free			Free
Actuated Green, G (s)	39.6	43.2	120.0	7.8	11.4	120.0	3.7	33.0	120.0	17.0	46.3	120.0
Effective Green, g (s)	39.6	44.9	120.0	7.8	13.1	120.0	3.7	34.3	120.0	17.0	47.6	120.0
Actuated g/C Ratio	0.33	0.37	1.00	0.06	0.11	1.00	0.03	0.29	1.00	0.14	0.40	1.00
Clearance Time (s)	4.0	5.7		4.0	5.7		4.0	5.3		4.0	5.3	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	1132	1902	1583	223	555	1583	105	1453	1583	486	2017	1583
v/s Ratio Prot	c0.22	0.15		0.04	0.06		0.01	c0.21		c0.14	0.10	
v/s Ratio Perm			0.04			c0.51			0.18			0.18
v/c Ratio	0.66	0.41	0.04	0.57	0.59	0.51	0.37	0.74	0.18	0.98	0.25	0.18
Uniform Delay, d1	34.4	27.8	0.0	54.5	50.9	0.0	57.0	38.8	0.0	51.3	24.2	0.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.88	0.76	1.00
Incremental Delay, d2	1.5	0.7	0.0	3.3	4.5	1.2	2.2	2.0	0.3	33.4	0.1	0.2
Delay (s)	35.9	28.5	0.0	57.8	55.4	1.2	59.2	40.8	0.3	78.8	18.5	0.2
Level of Service	D	C	A	E	E	A	E	D	A	E	B	A
Approach Delay (s)		30.9			20.9			32.9			37.1	
Approach LOS		C			C			C			D	

Intersection Summary

HCM 2000 Control Delay	30.5	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.74		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	70.4%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↗↗	↖↗	↖↗↖	↖↗		↖↗↖	↖↗↖	↖	↖↗	↘↘↘	↖↗
Traffic Volume (vph)	247	772	445	245	292	20	380	875	482	29	790	138
Future Volume (vph)	247	772	445	245	292	20	380	875	482	29	790	138
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	6.0	6.0	5.0	6.0		5.0	6.0	6.0	5.0	6.0	6.0
Lane Util. Factor	0.97	0.95	0.88	0.94	0.95		0.94	0.91	1.00	0.97	0.86	0.88
Frt	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	2787	4990	3505		4990	5085	1583	3433	6408	2787
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	2787	4990	3505		4990	5085	1583	3433	6408	2787
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	268	839	484	266	317	22	413	951	524	32	859	150
RTOR Reduction (vph)	0	0	287	0	3	0	0	0	253	0	0	108
Lane Group Flow (vph)	268	839	197	266	336	0	413	951	271	32	859	42
Turn Type	Prot	NA	Perm	Prot	NA		Prot	NA	Perm	Prot	NA	Perm
Protected Phases	5	2		1	6		3	8		7	NA	4
Permitted Phases			2						8			4
Actuated Green, G (s)	17.0	40.6	40.6	16.4	40.0		17.1	45.9	45.9	8.1	36.9	36.9
Effective Green, g (s)	17.0	40.6	40.6	16.4	40.0		17.1	45.9	45.9	8.1	36.9	36.9
Actuated g/C Ratio	0.13	0.31	0.31	0.12	0.30		0.13	0.35	0.35	0.06	0.28	0.28
Clearance Time (s)	5.0	6.0	6.0	5.0	6.0		5.0	6.0	6.0	5.0	6.0	6.0
Vehicle Extension (s)	2.0	3.0	3.0	2.0	3.0		2.0	4.0	4.0	2.0	4.0	4.0
Lane Grp Cap (vph)	438	1080	850	615	1054		641	1754	546	209	1777	773
v/s Ratio Prot	c0.08	c0.24		0.05	0.10		c0.08	c0.19		0.01	0.13	
v/s Ratio Perm			0.07						0.17			0.01
v/c Ratio	0.61	0.78	0.23	0.43	0.32		0.64	0.54	0.50	0.15	0.48	0.05
Uniform Delay, d1	54.9	42.1	34.5	54.0	36.0		55.1	35.1	34.4	59.2	40.1	35.2
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.8	3.6	0.1	0.2	0.2		1.7	0.4	1.0	0.1	0.3	0.0
Delay (s)	56.7	45.6	34.7	54.2	36.1		56.7	35.5	35.4	59.3	40.4	35.3
Level of Service	E	D	C	D	D		E	D	D	E	D	D
Approach Delay (s)		44.2			44.1			40.1			40.2	
Approach LOS		D			D			D			D	

Intersection Summary

HCM 2000 Control Delay	41.9	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.67		
Actuated Cycle Length (s)	133.0	Sum of lost time (s)	22.0
Intersection Capacity Utilization	82.4%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 15: Tassajara Rd & I-580 WB Ramps

BART to Livermore Extension Project
 2025 Express Bus PM
































Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↔↔		↔↔		↑↑	↔		↑↑↔	↔
Traffic Volume (vph)	0	0	0	487	0	226	0	1343	644	0	1166	614
Future Volume (vph)	0	0	0	487	0	226	0	1343	644	0	1166	614
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0		4.0		4.0	4.0		4.0	4.0
Lane Util. Factor				0.97		0.88		0.95	1.00		0.86	0.86
Frt				1.00		0.85		1.00	0.85		0.98	0.85
Flt Protected				0.95		1.00		1.00	1.00		1.00	1.00
Satd. Flow (prot)				3433		2787		3539	1583		4694	1362
Flt Permitted				0.95		1.00		1.00	1.00		1.00	1.00
Satd. Flow (perm)				3433		2787		3539	1583		4694	1362
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	529	0	246	0	1460	700	0	1267	667
RTOR Reduction (vph)	0	0	0	0	0	56	0	0	258	0	37	160
Lane Group Flow (vph)	0	0	0	529	0	190	0	1460	442	0	1463	274
Turn Type				Perm		Perm		NA	Perm		NA	Perm
Protected Phases								2			6	
Permitted Phases				8		8			2			6
Actuated Green, G (s)				14.1		14.1		37.9	37.9		37.9	37.9
Effective Green, g (s)				14.1		14.1		37.9	37.9		37.9	37.9
Actuated g/C Ratio				0.23		0.23		0.63	0.63		0.63	0.63
Clearance Time (s)				4.0		4.0		4.0	4.0		4.0	4.0
Vehicle Extension (s)				3.0		3.0		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)				806		654		2235	999		2965	860
v/s Ratio Prot								c0.41			0.31	
v/s Ratio Perm				c0.15		0.07			0.28			0.20
v/c Ratio				0.66		0.29		0.65	0.44		0.49	0.32
Uniform Delay, d1				20.8		18.8		6.9	5.6		5.9	5.1
Progression Factor				1.00		1.00		1.00	1.00		1.00	1.00
Incremental Delay, d2				1.9		0.2		1.5	1.4		0.6	1.0
Delay (s)				22.7		19.1		8.4	7.1		6.5	6.1
Level of Service				C		B		A	A		A	A
Approach Delay (s)		0.0			21.6			8.0			6.4	
Approach LOS		A			C			A			A	

Intersection Summary			
HCM 2000 Control Delay	9.5	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.65		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	57.7%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 16: Santa Rita Rd & I-580 EB Ramps/Pimilco Dr

BART to Livermore Extension Project
 2025 Express Bus PM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 		 	 		 		  		 	 	
Traffic Volume (vph)	390	89	234	143	0	315	0	1182	176	317	953	0
Future Volume (vph)	390	89	234	143	0	315	0	1182	176	317	953	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0		4.0		4.0		4.0	4.0	
Lane Util. Factor	0.97	1.00	1.00	0.97		0.88		0.86		1.00	0.95	
Frt	1.00	1.00	0.85	1.00		0.85		0.98		1.00	1.00	
Flt Protected	0.95	1.00	1.00	0.95		1.00		1.00		0.95	1.00	
Satd. Flow (prot)	3433	1863	1583	3433		2787		6283		1770	3539	
Flt Permitted	0.95	1.00	1.00	0.95		1.00		1.00		0.95	1.00	
Satd. Flow (perm)	3433	1863	1583	3433		2787		6283		1770	3539	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	424	97	254	155	0	342	0	1285	191	345	1036	0
RTOR Reduction (vph)	0	0	92	0	0	38	0	19	0	0	0	0
Lane Group Flow (vph)	424	97	162	155	0	304	0	1457	0	345	1036	0
Turn Type	Perm	NA	Perm	Prot		pm+ov		NA		Prot	NA	Perm
Protected Phases		4		3		1		2		1	6	
Permitted Phases	4		4			3						6
Actuated Green, G (s)	21.5	21.5	21.5	9.5		37.8		44.7		28.3	77.0	
Effective Green, g (s)	21.5	21.5	21.5	9.5		37.8		44.7		28.3	77.0	
Actuated g/C Ratio	0.18	0.18	0.18	0.08		0.31		0.37		0.24	0.64	
Clearance Time (s)	4.0	4.0	4.0	4.0		4.0		4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0		3.0		3.0		3.0	3.0	
Lane Grp Cap (vph)	615	333	283	271		877		2340		417	2270	
v/s Ratio Prot		0.05		c0.05		0.08		c0.23		c0.19	0.29	
v/s Ratio Perm	c0.12		0.10			0.03						
v/c Ratio	0.69	0.29	0.57	0.57		0.35		0.62		0.83	0.46	
Uniform Delay, d1	46.1	42.7	45.0	53.3		31.6		30.8		43.5	10.9	
Progression Factor	1.00	1.00	1.00	1.00		1.00		1.00		1.00	1.00	
Incremental Delay, d2	3.2	0.5	2.8	2.9		0.2		1.3		12.7	0.7	
Delay (s)	49.3	43.1	47.8	56.2		31.8		32.0		56.2	11.6	
Level of Service	D	D	D	E		C		C		E	B	
Approach Delay (s)		48.1			39.4			32.0			22.7	
Approach LOS		D			D			C			C	

Intersection Summary		
HCM 2000 Control Delay	32.8	HCM 2000 Level of Service C
HCM 2000 Volume to Capacity ratio	0.69	
Actuated Cycle Length (s)	120.0	Sum of lost time (s) 16.0
Intersection Capacity Utilization	59.7%	ICU Level of Service B
Analysis Period (min)	15	

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 17: Santa Rita Rd & Valley Ave

BART to Livermore Extension Project
 2025 Express Bus PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	363	487	117	129	315	774	149	750	128	997	1089	245
Future Volume (vph)	363	487	117	129	315	774	149	750	128	997	1089	245
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.97	0.95		0.97	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.98		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	3433	3462		3433	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	3433	3462		3433	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	395	529	127	140	342	841	162	815	139	1084	1184	266
RTOR Reduction (vph)	0	0	105	0	0	0	0	13	0	0	0	136
Lane Group Flow (vph)	395	529	22	140	342	841	162	941	0	1084	1184	130
Turn Type	Prot	NA	Perm	Prot	NA	Free	Prot	NA		Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1		6
Permitted Phases			4			Free						6
Actuated Green, G (s)	12.0	17.4	17.4	9.8	15.2	99.2	8.6	25.0		31.0	47.4	47.4
Effective Green, g (s)	12.0	17.4	17.4	9.8	15.2	99.2	8.6	25.0		31.0	47.4	47.4
Actuated g/C Ratio	0.12	0.18	0.18	0.10	0.15	1.00	0.09	0.25		0.31	0.48	0.48
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	415	620	277	174	542	1583	297	872		1072	1691	756
v/s Ratio Prot	c0.12	c0.15		0.08	0.10		0.05	c0.27		c0.32	0.33	
v/s Ratio Perm			0.01			c0.53						0.08
v/c Ratio	0.95	0.85	0.08	0.80	0.63	0.53	0.55	1.08		1.01	0.70	0.17
Uniform Delay, d1	43.3	39.7	34.2	43.8	39.4	0.0	43.4	37.1		34.1	20.3	14.7
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	31.9	11.0	0.1	23.0	2.4	1.3	2.0	53.9		30.3	1.3	0.1
Delay (s)	75.2	50.7	34.3	66.7	41.8	1.3	45.5	91.0		64.4	21.7	14.8
Level of Service	E	D	C	E	D	A	D	F		E	C	B
Approach Delay (s)		57.9			18.7			84.4			39.2	
Approach LOS		E			B			F			D	

Intersection Summary

HCM 2000 Control Delay	46.3	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	1.02		
Actuated Cycle Length (s)	99.2	Sum of lost time (s)	16.0
Intersection Capacity Utilization	87.2%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
18: Bernal Ave/Valley Ave & Stanley Blvd

BART to Livermore Extension Project
2025 Express Bus PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	203	836	59	103	233	343	86	327	304	822	555	119
Future Volume (vph)	203	836	59	103	233	343	86	327	304	822	555	119
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.95	1.00	0.97	0.91	0.91	1.00	0.95	1.00	0.97	0.95	
Frt	1.00	1.00	0.85	1.00	0.94	0.85	1.00	1.00	0.85	1.00	0.97	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	3433	3539	1583	3433	3182	1441	1770	3539	1583	3433	3446	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	3433	3539	1583	3433	3182	1441	1770	3539	1583	3433	3446	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	221	909	64	112	253	373	93	355	330	893	603	129
RTOR Reduction (vph)	0	0	40	0	115	52	0	0	168	0	20	0
Lane Group Flow (vph)	221	909	24	112	313	146	93	355	162	893	712	0
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	
Protected Phases	7	4	5	3	8	1	5	2		1	6	
Permitted Phases			4			8			2			
Actuated Green, G (s)	9.4	25.2	32.6	4.0	19.8	44.9	7.4	15.7	15.7	25.1	33.4	
Effective Green, g (s)	9.4	25.2	32.6	4.0	19.8	44.9	7.4	15.7	15.7	25.1	33.4	
Actuated g/C Ratio	0.11	0.29	0.38	0.05	0.23	0.52	0.09	0.18	0.18	0.29	0.39	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	375	1037	673	159	732	819	152	646	288	1001	1338	
v/s Ratio Prot	c0.06	c0.26	0.00	0.03	0.10	0.05	0.05	0.10		c0.26	c0.21	
v/s Ratio Perm			0.01			0.05			0.10			
v/c Ratio	0.59	0.88	0.04	0.70	0.43	0.18	0.61	0.55	0.56	0.89	0.53	
Uniform Delay, d1	36.5	28.9	16.8	40.4	28.3	10.8	37.9	31.9	32.0	29.2	20.3	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	2.4	8.5	0.0	13.2	0.4	0.1	7.1	1.0	2.5	10.1	0.4	
Delay (s)	38.8	37.4	16.8	53.7	28.7	10.9	45.0	32.9	34.5	39.3	20.7	
Level of Service	D	D	B	D	C	B	D	C	C	D	C	
Approach Delay (s)		36.6			27.7			35.0			30.9	
Approach LOS		D			C			D			C	

Intersection Summary		
HCM 2000 Control Delay	32.7	HCM 2000 Level of Service C
HCM 2000 Volume to Capacity ratio	0.82	
Actuated Cycle Length (s)	86.0	Sum of lost time (s) 16.0
Intersection Capacity Utilization	75.4%	ICU Level of Service D
Analysis Period (min)	15	

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
19: Fallon Rd & Dublin Blvd

BART to Livermore Extension Project
2025 Express Bus PM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	209	574	416	48	17	55	193	622	163	107	591	27
Future Volume (vph)	209	574	416	48	17	55	193	622	163	107	591	27
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.3	5.3	5.3	4.0	4.0	4.0	5.3	4.9	4.9	5.3	4.9	4.9
Lane Util. Factor	0.97	0.91	0.88	0.94	0.91	1.00	0.97	0.91	0.88	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3090	4577	2508	4491	4577	1425	3090	4577	2508	3090	4577	1425
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3090	4577	2508	4491	4577	1425	3090	4577	2508	3090	4577	1425
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	227	624	452	52	18	60	210	676	177	116	642	29
RTOR Reduction (vph)	0	0	118	0	0	57	0	0	116	0	0	21
Lane Group Flow (vph)	227	624	334	52	18	3	210	676	61	116	642	8
Turn Type	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	5	2	3	1	6		3	8		7	4	
Permitted Phases			2			6			8			4
Actuated Green, G (s)	17.3	18.4	28.1	2.6	3.7	3.7	9.7	24.4	24.4	6.0	20.7	20.7
Effective Green, g (s)	17.3	18.4	28.1	2.6	3.7	3.7	9.7	24.4	24.4	6.0	20.7	20.7
Actuated g/C Ratio	0.24	0.26	0.40	0.04	0.05	0.05	0.14	0.34	0.34	0.08	0.29	0.29
Clearance Time (s)	5.3	5.3	5.3	4.0	4.0	4.0	5.3	4.9	4.9	5.3	4.9	4.9
Vehicle Extension (s)	2.0	4.0	2.0	2.0	2.0	2.0	2.0	4.0	4.0	2.0	4.0	4.0
Lane Grp Cap (vph)	753	1187	994	164	238	74	422	1575	863	261	1336	416
v/s Ratio Prot	c0.07	c0.14	0.05	0.01	0.00		c0.07	c0.15		0.04	0.14	
v/s Ratio Perm			0.09			0.00			0.02			0.01
v/c Ratio	0.30	0.53	0.34	0.32	0.08	0.04	0.50	0.43	0.07	0.44	0.48	0.02
Uniform Delay, d1	21.9	22.5	14.9	33.3	32.0	31.9	28.3	17.9	15.6	30.9	20.7	17.9
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.1	0.5	0.1	0.4	0.0	0.1	0.3	0.3	0.0	0.4	0.4	0.0
Delay (s)	22.0	23.1	15.0	33.7	32.0	32.0	28.7	18.1	15.7	31.3	21.0	17.9
Level of Service	C	C	B	C	C	C	C	B	B	C	C	B
Approach Delay (s)		20.1			32.7			19.8			22.4	
Approach LOS		C			C			B			C	
Intersection Summary												
HCM 2000 Control Delay			21.1			HCM 2000 Level of Service			C			
HCM 2000 Volume to Capacity ratio			0.50									
Actuated Cycle Length (s)			70.9	Sum of lost time (s)					19.5			
Intersection Capacity Utilization			45.9%	ICU Level of Service			A					
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis
 20: El Charro Rd/Fallon Rd & I-580 WB Ramps

BART to Livermore Extension Project
 2025 Express Bus PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↖	↖	↖↖		↖	↖		↗↗	↗
Traffic Volume (vph)	0	0	0	266	0	444	0	661	245	0	857	376
Future Volume (vph)	0	0	0	266	0	444	0	661	245	0	857	376
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0	4.0	4.0		4.0	4.0		4.0	4.0
Lane Util. Factor				0.95	0.95	0.88		0.95	0.95		0.95	1.00
Frt				1.00	1.00	0.85		0.99	0.85		1.00	0.85
Flt Protected				0.95	0.95	1.00		1.00	1.00		1.00	1.00
Satd. Flow (prot)				1681	1681	2787		1760	1504		3539	1583
Flt Permitted				0.95	0.95	1.00		1.00	1.00		1.00	1.00
Satd. Flow (perm)				1681	1681	2787		1760	1504		3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	289	0	483	0	718	266	0	932	409
RTOR Reduction (vph)	0	0	0	0	0	374	0	2	74	0	0	127
Lane Group Flow (vph)	0	0	0	147	142	109	0	743	165	0	932	282
Turn Type				Perm	NA	Perm		NA	Perm		NA	Perm
Protected Phases					8			2			6	
Permitted Phases				8		8			2			6
Actuated Green, G (s)				11.2	11.2	11.2		41.3	41.3		41.3	41.3
Effective Green, g (s)				10.7	10.7	10.7		41.3	41.3		41.3	41.3
Actuated g/C Ratio				0.18	0.18	0.18		0.69	0.69		0.69	0.69
Clearance Time (s)				3.5	3.5	3.5		4.0	4.0		4.0	4.0
Vehicle Extension (s)				2.0	2.0	2.0		2.0	2.0		2.0	2.0
Lane Grp Cap (vph)				299	299	497		1211	1035		2436	1089
v/s Ratio Prot								c0.42			0.26	
v/s Ratio Perm				c0.09	0.08	0.04			0.11			0.18
v/c Ratio				0.49	0.47	0.22		0.61	0.16		0.38	0.26
Uniform Delay, d1				22.2	22.1	21.1		5.0	3.3		4.0	3.5
Progression Factor				1.00	1.00	1.00		0.82	1.33		1.00	1.00
Incremental Delay, d2				0.5	0.4	0.1		2.2	0.3		0.5	0.6
Delay (s)				22.7	22.6	21.2		6.3	4.7		4.4	4.1
Level of Service				C	C	C		A	A		A	A
Approach Delay (s)		0.0			21.7			5.9			4.3	
Approach LOS		A			C			A			A	

Intersection Summary			
HCM 2000 Control Delay	9.2	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.59		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	61.9%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
21: El Charro Rd & I-580 EB Ramps

BART to Livermore Extension Project
2025 Express Bus PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗		↖↗					↕↔	↖		↕↔	↖
Traffic Volume (vph)	321	0	357	0	0	0	0	907	281	0	875	0
Future Volume (vph)	321	0	357	0	0	0	0	907	281	0	875	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0					4.0	4.0		4.0	
Lane Util. Factor	0.97		0.88					0.91	0.91		0.91	
Frt	1.00		0.85					0.99	0.85		1.00	
Flt Protected	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (prot)	3433		2787					3372	1441		3390	
Flt Permitted	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (perm)	3433		2787					3372	1441		3390	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	349	0	388	0	0	0	0	986	305	0	951	0
RTOR Reduction (vph)	0	0	197	0	0	0	0	3	82	0	0	0
Lane Group Flow (vph)	349	0	191	0	0	0	0	1020	186	0	951	0
Turn Type	Prot		Perm					NA	Perm		NA	Perm
Protected Phases	4							2			6	
Permitted Phases			4						2			6
Actuated Green, G (s)	10.4		10.4					41.6	41.6		41.6	
Effective Green, g (s)	10.4		10.4					41.6	41.6		41.6	
Actuated g/C Ratio	0.17		0.17					0.69	0.69		0.69	
Clearance Time (s)	4.0		4.0					4.0	4.0		4.0	
Vehicle Extension (s)	2.0		2.0					3.0	3.0		3.0	
Lane Grp Cap (vph)	595		483					2337	999		2350	
v/s Ratio Prot	c0.10							c0.30			0.28	
v/s Ratio Perm			0.07						0.13			
v/c Ratio	0.59		0.40					0.44	0.19		0.40	
Uniform Delay, d1	22.8		22.0					4.0	3.2		3.9	
Progression Factor	1.00		1.00					0.70	0.23		0.80	
Incremental Delay, d2	1.0		0.2					0.6	0.4		0.5	
Delay (s)	23.8		22.2					3.4	1.2		3.6	
Level of Service	C		C					A	A		A	
Approach Delay (s)		23.0			0.0			3.0			3.6	
Approach LOS		C			A			A			A	

Intersection Summary

HCM 2000 Control Delay	8.1	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.47		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	43.9%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 22: El Charro Rd & Stoneridge Dr/Jack London Blvd

BART to Livermore Extension Project
 2025 Express Bus PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔↔↔	↑↑	↗	↖	↑↑	↗↗	↖	↑↑		↗↗↗	↑	↗↗
Traffic Volume (vph)	260	560	4	3	307	468	2	34	3	746	25	136
Future Volume (vph)	260	560	4	3	307	468	2	34	3	746	25	136
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	0.94	0.95	1.00	1.00	0.95	0.88	1.00	0.95		0.94	1.00	0.88
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	4491	3185	1425	1593	3185	2508	1593	3149		4491	1676	2508
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	4491	3185	1425	1593	3185	2508	1593	3149		4491	1676	2508
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	283	609	4	3	334	509	2	37	3	811	27	148
RTOR Reduction (vph)	0	0	2	0	0	238	0	3	0	0	0	103
Lane Group Flow (vph)	283	609	2	3	334	271	2	37	0	811	27	45
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Prot	NA		Prot	NA	Perm
Protected Phases	7	4		3	8	1	5	2		1	NA	6
Permitted Phases			4			8						6
Actuated Green, G (s)	9.0	23.0	23.0	1.2	15.2	32.0	1.4	3.0		16.8	18.4	18.4
Effective Green, g (s)	9.0	23.0	23.0	1.2	15.2	32.0	1.4	3.0		16.8	18.4	18.4
Actuated g/C Ratio	0.15	0.38	0.38	0.02	0.25	0.53	0.02	0.05		0.28	0.31	0.31
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	673	1220	546	31	806	1504	37	157		1257	513	769
v/s Ratio Prot	0.06	c0.19		0.00	c0.10	0.05	0.00	c0.01		c0.18	0.02	
v/s Ratio Perm			0.00			0.06						0.02
v/c Ratio	0.42	0.50	0.00	0.10	0.41	0.18	0.05	0.24		0.65	0.05	0.06
Uniform Delay, d1	23.1	14.1	11.4	28.9	18.7	7.2	28.7	27.4		19.0	14.7	14.7
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		0.93	0.89	1.56
Incremental Delay, d2	0.4	0.3	0.0	1.4	0.3	0.1	0.6	3.5		1.1	0.2	0.1
Delay (s)	23.6	14.4	11.4	30.2	19.0	7.3	29.3	30.9		18.7	13.2	23.1
Level of Service	C	B	B	C	B	A	C	C		B	B	C
Approach Delay (s)		17.3			12.0			30.8			19.2	
Approach LOS		B			B			C			B	

Intersection Summary

HCM 2000 Control Delay	16.6	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.56		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	53.0%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
24: Airway Blvd/Driveway & N Canyons Pkwy

BART to Livermore Extension Project
2025 Express Bus PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑	↑	↑↑	↑	↑		↑	↑↑		↑	
Traffic Volume (vph)	0	485	309	822	67	0	49	0	742	0	0	0
Future Volume (vph)	0	485	309	822	67	0	49	0	742	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0	4.0	4.0			4.4	4.0			
Lane Util. Factor		0.95	1.00	0.97	1.00			1.00	0.88			
Frt		1.00	0.85	1.00	1.00			1.00	0.85			
Flt Protected		1.00	1.00	0.95	1.00			0.95	1.00			
Satd. Flow (prot)		3539	1583	3433	1863			1770	2787			
Flt Permitted		1.00	1.00	0.95	1.00			0.95	1.00			
Satd. Flow (perm)		3539	1583	3433	1863			1770	2787			
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	527	336	893	73	0	53	0	807	0	0	0
RTOR Reduction (vph)	0	0	232	0	0	0	0	0	388	0	0	0
Lane Group Flow (vph)	0	527	104	893	73	0	0	53	419	0	0	0
Turn Type		NA	Perm	Prot	NA	Perm	Split	NA	pm+ov			
Protected Phases		2		1	6		8	8	1	4	4	
Permitted Phases			2			6			8			
Actuated Green, G (s)		16.6	16.6	23.1	45.7			4.0	27.1			
Effective Green, g (s)		18.6	18.6	25.1	47.7			3.8	31.1			
Actuated g/C Ratio		0.31	0.31	0.42	0.80			0.06	0.52			
Clearance Time (s)		6.0	6.0	6.0	6.0			4.2	6.0			
Vehicle Extension (s)		3.0	3.0	3.0	3.0			3.0	3.0			
Lane Grp Cap (vph)		1098	491	1438	1483			112	1633			
v/s Ratio Prot		c0.15		c0.26	0.04			0.03	c0.11			
v/s Ratio Perm			0.07						0.04			
v/c Ratio		0.48	0.21	0.62	0.05			0.47	0.26			
Uniform Delay, d1		16.7	15.2	13.7	1.3			27.1	8.0			
Progression Factor		1.00	1.00	1.00	1.00			1.00	1.00			
Incremental Delay, d2		0.3	0.2	0.8	0.0			3.1	0.1			
Delay (s)		17.1	15.5	14.5	1.3			30.2	8.1			
Level of Service		B	B	B	A			C	A			
Approach Delay (s)		16.4			13.5			9.4			0.0	
Approach LOS		B			B			A			A	

Intersection Summary

HCM 2000 Control Delay	13.1	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.61		
Actuated Cycle Length (s)	59.9	Sum of lost time (s)	16.4
Intersection Capacity Utilization	50.5%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
25: Airway Blvd & I-580 WB Ramps

BART to Livermore Extension Project
2025 Express Bus PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↙	↖	↗		↑↑	↗		↑↑↑	
Traffic Volume (vph)	0	0	0	71	28	157	0	693	304	0	568	640
Future Volume (vph)	0	0	0	71	28	157	0	693	304	0	568	640
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0	4.0	4.0		4.0	4.0		4.0	
Lane Util. Factor				0.95	0.95	0.88		0.95	1.00		0.91	
Frt				1.00	1.00	0.85		1.00	0.85		0.92	
Flt Protected				0.95	0.97	1.00		1.00	1.00		1.00	
Satd. Flow (prot)				1681	1723	2787		3539	1583		4681	
Flt Permitted				0.95	0.97	1.00		1.00	1.00		1.00	
Satd. Flow (perm)				1681	1723	2787		3539	1583		4681	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	77	30	171	0	753	330	0	617	696
RTOR Reduction (vph)	0	0	0	0	0	146	0	0	126	0	266	0
Lane Group Flow (vph)	0	0	0	41	66	25	0	753	204	0	1047	0
Turn Type				Split	NA	Perm		NA	Perm		NA	
Protected Phases				8	8			2			6	
Permitted Phases						8			2			
Actuated Green, G (s)				4.9	4.9	4.9		19.5	19.5		19.5	
Effective Green, g (s)				4.9	4.9	4.9		20.8	20.8		20.8	
Actuated g/C Ratio				0.15	0.15	0.15		0.62	0.62		0.62	
Clearance Time (s)				4.0	4.0	4.0		5.3	5.3		5.3	
Vehicle Extension (s)				2.0	2.0	2.0		4.0	4.0		4.0	
Lane Grp Cap (vph)				244	250	405		2184	977		2889	
v/s Ratio Prot				0.02	c0.04			0.21			c0.22	
v/s Ratio Perm						0.01			0.13			
v/c Ratio				0.17	0.26	0.06		0.34	0.21		0.36	
Uniform Delay, d1				12.6	12.8	12.4		3.1	2.8		3.2	
Progression Factor				1.00	1.00	1.00		1.00	1.00		1.00	
Incremental Delay, d2				0.1	0.2	0.0		0.1	0.1		0.1	
Delay (s)				12.7	13.0	12.4		3.3	3.0		3.3	
Level of Service				B	B	B		A	A		A	
Approach Delay (s)		0.0			12.6			3.2			3.3	
Approach LOS		A			B			A			A	

Intersection Summary

HCM 2000 Control Delay	4.2	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.34		
Actuated Cycle Length (s)	33.7	Sum of lost time (s)	8.0
Intersection Capacity Utilization	35.4%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 26: Airway Blvd & I-580 EB Ramps/Kitty Hawk Rd

BART to Livermore Extension Project
 2025 Express Bus PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↑	↖	↖	↑	↖	↖	↕↗		↖	↕↗	
Traffic Volume (vph)	571	226	306	65	76	141	26	318	132	109	247	245
Future Volume (vph)	571	226	306	65	76	141	26	318	132	109	247	245
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.4	4.4	4.4	4.0	4.0		4.0	4.0	
Lane Util. Factor	0.97	1.00	1.00	1.00	1.00	1.00	1.00	0.95		1.00	0.95	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.96		1.00	0.93	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	3433	1863	1583	1770	1863	1583	1770	3384		1770	3275	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	3433	1863	1583	1770	1863	1583	1770	3384		1770	3275	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	621	246	333	71	83	153	28	346	143	118	268	266
RTOR Reduction (vph)	0	0	251	0	0	115	0	60	0	0	177	0
Lane Group Flow (vph)	621	246	82	71	83	38	28	429	0	118	357	0
Turn Type	Split	NA	Perm	Split	NA	pm+ov	Prot	NA		Prot	NA	
Protected Phases	7	7		8	8	1	5	2		1	6	
Permitted Phases			7			8						
Actuated Green, G (s)	17.0	17.0	17.0	10.2	10.2	18.0	3.4	17.0		7.8	21.9	
Effective Green, g (s)	17.0	17.0	17.0	9.8	9.8	17.2	2.9	18.3		7.8	23.2	
Actuated g/C Ratio	0.25	0.25	0.25	0.14	0.14	0.25	0.04	0.26		0.11	0.33	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	3.5	5.3		4.0	5.3	
Vehicle Extension (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	3.5		2.0	4.0	
Lane Grp Cap (vph)	842	457	388	250	263	493	74	893		199	1096	
v/s Ratio Prot	c0.18	0.13		0.04	c0.04	0.01	0.02	c0.13		c0.07	0.11	
v/s Ratio Perm			0.05			0.02						
v/c Ratio	0.74	0.54	0.21	0.28	0.32	0.08	0.38	0.48		0.59	0.33	
Uniform Delay, d1	24.1	22.7	20.8	26.6	26.7	20.0	32.3	21.5		29.2	17.2	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	2.9	0.6	0.1	0.2	0.3	0.0	1.2	0.5		3.1	0.2	
Delay (s)	27.0	23.4	20.9	26.8	27.0	20.0	33.5	22.0		32.4	17.4	
Level of Service	C	C	C	C	C	B	C	C		C	B	
Approach Delay (s)		24.6			23.5			22.6			20.1	
Approach LOS		C			C			C			C	

Intersection Summary

HCM 2000 Control Delay	23.0	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.55		
Actuated Cycle Length (s)	69.3	Sum of lost time (s)	16.8
Intersection Capacity Utilization	60.7%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 27: Collier Canyon Rd & N Canyons Pkwy/Portola Ave

BART to Livermore Extension Project
 2025 Express Bus PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↖↖	↖↗	↖↗	↖↖	↖↗	↖↗	↖↖		↖↗	↖↖	↖↗
Traffic Volume (vph)	297	655	146	84	249	24	50	8	304	128	13	99
Future Volume (vph)	297	655	146	84	249	24	50	8	304	128	13	99
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	5.2	5.2
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.85		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	1770	1591		1770	1863	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	1770	1591		1770	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	323	712	159	91	271	26	54	9	330	139	14	108
RTOR Reduction (vph)	0	0	105	0	0	17	0	132	0	0	0	77
Lane Group Flow (vph)	323	712	54	91	271	9	54	207	0	139	14	31
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA		Prot	NA	Perm
Protected Phases	1	6		5	2		3	8		7	NA	4
Permitted Phases			6			2						4
Actuated Green, G (s)	4.2	21.5	21.5	5.4	22.7	22.7	2.2	17.4		4.2	19.8	19.8
Effective Green, g (s)	4.2	22.8	22.8	5.4	24.0	24.0	2.2	18.4		4.2	19.2	19.2
Actuated g/C Ratio	0.06	0.34	0.34	0.08	0.36	0.36	0.03	0.28		0.06	0.29	0.29
Clearance Time (s)	4.0	5.3	5.3	4.0	5.3	5.3	4.0	5.0		4.0	4.6	4.6
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	215	1207	540	143	1271	568	58	438		111	535	454
v/s Ratio Prot	c0.09	c0.20		0.05	0.08		0.03	c0.13		c0.08	0.01	
v/s Ratio Perm			0.03			0.01						0.02
v/c Ratio	1.50	0.59	0.10	0.64	0.21	0.02	0.93	0.47		1.25	0.03	0.07
Uniform Delay, d1	31.3	18.1	15.0	29.7	14.8	13.8	32.2	20.2		31.3	17.1	17.3
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	248.8	0.7	0.1	8.9	0.1	0.0	93.1	0.8		167.9	0.0	0.1
Delay (s)	280.1	18.9	15.1	38.7	14.9	13.8	125.3	21.0		199.2	17.1	17.4
Level of Service	F	B	B	D	B	B	F	C		F	B	B
Approach Delay (s)		89.0			20.4			35.3			114.2	
Approach LOS		F			C			D			F	

Intersection Summary		
HCM 2000 Control Delay	70.6	HCM 2000 Level of Service E
HCM 2000 Volume to Capacity ratio	0.67	
Actuated Cycle Length (s)	66.8	Sum of lost time (s) 17.2
Intersection Capacity Utilization	62.4%	ICU Level of Service B
Analysis Period (min)	15	

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
28: Isabel Ave/Campus Hill Dr & Portola Ave

BART to Livermore Extension Project
2025 Express Bus PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↘	↑↑	↗↗	↘↘↘	↑↑		↘↘	↑↑	↗	↘	↑↑	↗
Traffic Volume (vph)	4	593	514	235	173	99	238	345	82	121	280	2
Future Volume (vph)	4	593	514	235	173	99	238	345	82	121	280	2
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	5.8	5.8
Lane Util. Factor	1.00	0.95	0.88	0.94	0.95		0.97	0.95	1.00	1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	0.95		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3539	2787	4990	3346		3433	3539	1583	1770	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	3539	2787	4990	3346		3433	3539	1583	1770	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	4	645	559	255	188	108	259	375	89	132	304	2
RTOR Reduction (vph)	0	0	362	0	58	0	0	0	71	0	0	2
Lane Group Flow (vph)	4	645	197	255	238	0	259	375	18	132	304	0
Turn Type	Prot	NA	Perm	Prot	NA		Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4						2			6
Actuated Green, G (s)	1.4	26.7	26.7	9.2	34.5		9.2	14.4	14.4	10.7	16.3	16.3
Effective Green, g (s)	1.4	28.0	28.0	9.2	35.8		9.2	15.7	15.7	10.7	15.4	15.4
Actuated g/C Ratio	0.02	0.35	0.35	0.12	0.45		0.12	0.20	0.20	0.13	0.19	0.19
Clearance Time (s)	4.0	5.3	5.3	4.0	5.3		4.0	5.3	5.3	4.0	4.9	4.9
Vehicle Extension (s)	2.0	3.0	3.0	2.0	3.0		2.0	3.0	3.0	2.0	3.0	3.0
Lane Grp Cap (vph)	31	1244	980	576	1504		396	698	312	237	684	306
v/s Ratio Prot	0.00	c0.18		c0.05	0.07		c0.08	c0.11		0.07	0.09	
v/s Ratio Perm			0.07						0.01			0.00
v/c Ratio	0.13	0.52	0.20	0.44	0.16		0.65	0.54	0.06	0.56	0.44	0.00
Uniform Delay, d1	38.5	20.5	18.0	32.8	13.0		33.7	28.7	25.9	32.2	28.3	25.9
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.7	0.4	0.1	0.2	0.0		3.0	0.8	0.1	1.6	0.5	0.0
Delay (s)	39.2	20.8	18.1	33.0	13.0		36.6	29.5	26.0	33.8	28.8	25.9
Level of Service	D	C	B	C	B		D	C	C	C	C	C
Approach Delay (s)		19.6			22.3			31.6			30.3	
Approach LOS		B			C			C			C	

Intersection Summary

HCM 2000 Control Delay	24.7	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.53		
Actuated Cycle Length (s)	79.6	Sum of lost time (s)	17.8
Intersection Capacity Utilization	56.2%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 29: Isabel Ave & I-580 WB Ramps

BART to Livermore Extension Project
 2025 Express Bus PM

























Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↖↗		↖		↕↕	↖↗		↕↕	↖
Traffic Volume (vph)	0	0	0	680	0	278	0	364	0	0	617	409
Future Volume (vph)	0	0	0	680	0	278	0	364	0	0	617	409
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0		4.0		5.6			5.6	5.6
Lane Util. Factor				0.97		1.00		0.95			0.95	1.00
Frt				1.00		0.85		1.00			1.00	0.85
Flt Protected				0.95		1.00		1.00			1.00	1.00
Satd. Flow (prot)				3433		1583		3539			3539	1583
Flt Permitted				0.95		1.00		1.00			1.00	1.00
Satd. Flow (perm)				3433		1583		3539			3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	739	0	302	0	396	0	0	671	445
RTOR Reduction (vph)	0	0	0	0	0	216	0	0	0	0	0	198
Lane Group Flow (vph)	0	0	0	739	0	86	0	396	0	0	671	247
Turn Type				Prot		Prot		NA	Free		NA	Prot
Protected Phases				8		8		2			6	6
Permitted Phases									Free			
Actuated Green, G (s)				17.1		17.1		34.1			34.1	34.1
Effective Green, g (s)				17.1		17.1		33.3			33.3	33.3
Actuated g/C Ratio				0.29		0.29		0.55			0.55	0.55
Clearance Time (s)				4.0		4.0		4.8			4.8	4.8
Vehicle Extension (s)				2.0		2.0		4.0			4.0	4.0
Lane Grp Cap (vph)				978		451		1964			1964	878
v/s Ratio Prot				c0.22		0.05		0.11			c0.19	0.16
v/s Ratio Perm												
v/c Ratio				0.76		0.19		0.20			0.34	0.28
Uniform Delay, d1				19.5		16.2		6.7			7.3	7.0
Progression Factor				1.00		1.00		1.22			1.00	1.00
Incremental Delay, d2				3.0		0.1		0.2			0.1	0.2
Delay (s)				22.5		16.3		8.4			7.5	7.3
Level of Service				C		B		A			A	A
Approach Delay (s)		0.0			20.7			8.4			7.4	
Approach LOS		A			C			A			A	

Intersection Summary		
HCM 2000 Control Delay	13.0	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.48	B
Actuated Cycle Length (s)	60.0	Sum of lost time (s)
Intersection Capacity Utilization	44.5%	9.6
Analysis Period (min)	15	ICU Level of Service
		A

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
30: Isabel Ave & I-580 EB Ramps

BART to Livermore Extension Project
2025 Express Bus PM

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations	 		 					 			 		
Traffic Volume (vph)	188	0	350	0	0	0	0	691	683	0	891	634	
Future Volume (vph)	188	0	350	0	0	0	0	691	683	0	891	634	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)	4.0		4.0					4.0	4.0		4.0	4.0	
Lane Util. Factor	0.97		0.88					0.95	1.00		0.95	1.00	
Frt	1.00		0.85					1.00	0.85		1.00	0.85	
Flt Protected	0.95		1.00					1.00	1.00		1.00	1.00	
Satd. Flow (prot)	3433		2787					3539	1583		3539	1583	
Flt Permitted	0.95		1.00					1.00	1.00		1.00	1.00	
Satd. Flow (perm)	3433		2787					3539	1583		3539	1583	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	
Adj. Flow (vph)	204	0	380	0	0	0	0	751	742	0	968	689	
RTOR Reduction (vph)	0	0	234	0	0	0	0	0	0	0	0	0	
Lane Group Flow (vph)	204	0	146	0	0	0	0	751	742	0	968	689	
Turn Type	Prot		Perm					NA	Free		NA	Free	
Protected Phases	4							2			6		
Permitted Phases			4						Free			Free	
Actuated Green, G (s)	8.2		8.2					42.8	60.0		42.8	60.0	
Effective Green, g (s)	8.2		8.2					43.8	60.0		43.8	60.0	
Actuated g/C Ratio	0.14		0.14					0.73	1.00		0.73	1.00	
Clearance Time (s)	4.0		4.0					5.0			5.0		
Vehicle Extension (s)	2.0		2.0					4.0			4.0		
Lane Grp Cap (vph)	469		380					2583	1583		2583	1583	
v/s Ratio Prot	0.06							0.21			0.27		
v/s Ratio Perm			0.05						c0.47			0.44	
v/c Ratio	0.43		0.38					0.29	0.47		0.37	0.44	
Uniform Delay, d1	23.8		23.6					2.8	0.0		3.0	0.0	
Progression Factor	1.00		1.00					1.00	1.00		0.45	1.00	
Incremental Delay, d2	0.2		0.2					0.1	1.0		0.4	0.8	
Delay (s)	24.0		23.8					2.9	1.0		1.7	0.8	
Level of Service	C		C					A	A		A	A	
Approach Delay (s)		23.9			0.0			1.9			1.4		
Approach LOS		C			A			A			A		
Intersection Summary													
HCM 2000 Control Delay			5.1									HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio			0.54										
Actuated Cycle Length (s)			60.0									Sum of lost time (s)	8.0
Intersection Capacity Utilization			43.5%									ICU Level of Service	A
Analysis Period (min)			15										
c Critical Lane Group													



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↑	↗	↖	↑	↗	↖	↑↑↑	↗	↖↗	↑↑↑	↗
Traffic Volume (vph)	0	168	462	105	114	75	246	1158	29	305	1335	12
Future Volume (vph)	0	168	462	105	114	75	246	1158	29	305	1335	12
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.2	5.6	5.2	5.2	5.6	4.0	4.0	4.0	4.0	4.0	5.0
Lane Util. Factor		1.00	1.00	1.00	1.00	1.00	1.00	0.91	1.00	0.97	0.91	1.00
Frt		1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1863	1583	1770	1863	1583	1770	5085	1583	3433	5085	1583
Flt Permitted		1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)		1863	1583	1770	1863	1583	1770	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	183	502	114	124	82	267	1259	32	332	1451	13
RTOR Reduction (vph)	0	0	69	0	0	47	0	0	19	0	0	8
Lane Group Flow (vph)	0	183	433	114	124	35	267	1259	13	332	1451	5
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4	5	3	8	1	5	2		1	NA	6
Permitted Phases			4			8			2			6
Actuated Green, G (s)		14.2	31.2	8.8	27.6	40.2	17.0	37.5	37.5	12.6	33.1	33.1
Effective Green, g (s)		13.6	30.0	8.2	27.0	39.0	18.0	38.5	38.5	13.6	34.1	33.1
Actuated g/C Ratio		0.15	0.33	0.09	0.29	0.42	0.20	0.42	0.42	0.15	0.37	0.36
Clearance Time (s)		4.6	5.0	4.6	4.6	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Extension (s)		3.0	3.0	3.0	3.0	3.0	3.0	5.0	5.0	3.0	5.0	5.0
Lane Grp Cap (vph)		274	514	157	544	668	345	2121	660	505	1878	567
v/s Ratio Prot		0.10	c0.15	c0.06	0.07	0.01	c0.15	0.25		0.10	c0.29	
v/s Ratio Perm			0.12			0.02			0.01			0.00
v/c Ratio		0.67	0.84	0.73	0.23	0.05	0.77	0.59	0.02	0.66	0.77	0.01
Uniform Delay, d1		37.2	29.0	41.0	24.7	15.7	35.2	20.8	15.8	37.2	25.7	19.0
Progression Factor		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2		6.0	11.9	15.4	0.2	0.0	10.3	0.7	0.0	3.1	2.4	0.0
Delay (s)		43.3	40.9	56.3	25.0	15.8	45.6	21.5	15.8	40.2	28.1	19.1
Level of Service		D	D	E	C	B	D	C	B	D	C	B
Approach Delay (s)		41.5			33.8			25.5			30.3	
Approach LOS		D			C			C			C	


































Intersection Summary

HCM 2000 Control Delay	30.6	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.81		
Actuated Cycle Length (s)	92.3	Sum of lost time (s)	20.0
Intersection Capacity Utilization	72.6%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
32: Isabel Ave & Jack London Blvd

BART to Livermore Extension Project
2025 Express Bus PM

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations	 	 			 		 	  		 	  		
Traffic Volume (vph)	129	671	255	200	145	297	87	1073	314	440	1226	60	
Future Volume (vph)	129	671	255	200	145	297	87	1073	314	440	1226	60	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.97	0.91	1.00	0.97	0.91	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	3433	5085	1583	3433	5085	1583	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	3433	5085	1583	3433	5085	1583	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	
Adj. Flow (vph)	140	729	277	217	158	323	95	1166	341	478	1333	65	
RTOR Reduction (vph)	0	0	134	0	0	43	0	0	157	0	0	40	
Lane Group Flow (vph)	140	729	143	217	158	280	95	1166	184	478	1333	25	
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	Perm	
Protected Phases	7	4		3	8	1	5	2		1	NA	6	
Permitted Phases			4			8			2			6	
Actuated Green, G (s)	8.4	26.8	26.8	12.7	31.1	44.8	4.0	30.2	30.2	13.7	39.9	39.9	
Effective Green, g (s)	8.4	26.8	26.8	12.7	31.1	44.8	4.0	30.2	30.2	13.7	39.9	39.9	
Actuated g/C Ratio	0.08	0.26	0.26	0.12	0.30	0.43	0.04	0.29	0.29	0.13	0.38	0.38	
Clearance Time (s)	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	275	906	405	214	1052	758	131	1468	457	449	1939	603	
v/s Ratio Prot	0.04	c0.21		c0.12	0.04	c0.05	0.03	c0.23		c0.14	0.26		
v/s Ratio Perm			0.09			0.13			0.12			0.02	
v/c Ratio	0.51	0.80	0.35	1.01	0.15	0.37	0.73	0.79	0.40	1.06	0.69	0.04	
Uniform Delay, d1	46.1	36.4	31.8	45.9	27.0	20.3	49.8	34.3	29.9	45.4	27.1	20.3	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	1.5	5.3	0.5	65.2	0.1	0.3	18.0	3.1	0.6	60.7	1.0	0.0	
Delay (s)	47.6	41.7	32.3	111.1	27.1	20.6	67.7	37.4	30.5	106.2	28.2	20.4	
Level of Service	D	D	C	F	C	C	E	D	C	F	C	C	
Approach Delay (s)		40.2			50.2			37.7			47.8		
Approach LOS		D			D			D			D		
Intersection Summary													
HCM 2000 Control Delay			43.4									HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio			0.86										
Actuated Cycle Length (s)			104.6									Sum of lost time (s)	21.2
Intersection Capacity Utilization			80.6%									ICU Level of Service	D
Analysis Period (min)			15										
c Critical Lane Group													

HCM Signalized Intersection Capacity Analysis
 33: Isabel Ave Connector & Stanley Blvd



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑	↑	↑↓	↑↑	↑↓	↑↓
Traffic Volume (vph)	1691	454	215	547	159	369
Future Volume (vph)	1691	454	215	547	159	369
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	3.8	4.0	4.0	4.0	2.5
Lane Util. Factor	0.95	1.00	0.97	0.95	0.97	0.88
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	3539	1583	3433	3539	3433	2787
Flt Permitted	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (perm)	3539	1583	3433	3539	3433	2787
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	1838	493	234	595	173	401
RTOR Reduction (vph)	0	1	0	0	0	7
Lane Group Flow (vph)	1838	492	234	595	173	394
Turn Type	NA	pm+ov	Prot	NA	Prot	pm+ov
Protected Phases	2	8	1	6	8	1
Permitted Phases		2				8
Actuated Green, G (s)	43.8	52.5	6.0	53.8	8.7	14.7
Effective Green, g (s)	45.5	55.9	6.0	55.5	10.2	17.7
Actuated g/C Ratio	0.62	0.76	0.08	0.75	0.14	0.24
Clearance Time (s)	5.7	5.5	4.0	5.7	5.5	4.0
Vehicle Extension (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Grp Cap (vph)	2184	1200	279	2665	475	669
v/s Ratio Prot	c0.52	0.06	c0.07	0.17	0.05	c0.06
v/s Ratio Perm		0.25				0.08
v/c Ratio	0.84	0.41	0.84	0.22	0.36	0.59
Uniform Delay, d1	11.2	3.1	33.4	2.7	28.8	24.8
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	3.0	0.1	18.5	0.0	0.2	0.9
Delay (s)	14.2	3.2	51.9	2.7	29.0	25.6
Level of Service	B	A	D	A	C	C
Approach Delay (s)	11.9			16.6	26.6	
Approach LOS	B			B	C	

Intersection Summary

HCM 2000 Control Delay	15.2	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.80		
Actuated Cycle Length (s)	73.7	Sum of lost time (s)	12.0
Intersection Capacity Utilization	69.5%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 34: Murrieta Blvd/Driveway & Portola Ave

BART to Livermore Extension Project
 2025 Express Bus PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗		↖	↗		↖	↗	↗		↗	
Traffic Volume (vph)	0	910	121	222	585	1	128	5	317	4	7	0
Future Volume (vph)	0	910	121	222	585	1	128	5	317	4	7	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.8		4.0	5.8		5.2	5.2	5.2		4.0	
Lane Util. Factor		0.95		1.00	0.95		0.95	0.95	1.00		1.00	
Frt		0.98		1.00	1.00		1.00	1.00	0.85		1.00	
Flt Protected		1.00		0.95	1.00		0.95	0.96	1.00		0.98	
Satd. Flow (prot)		3477		1770	3538		1681	1691	1583		1832	
Flt Permitted		1.00		0.95	1.00		0.95	0.96	1.00		0.98	
Satd. Flow (perm)		3477		1770	3538		1681	1691	1583		1832	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	989	132	241	636	1	139	5	345	4	8	0
RTOR Reduction (vph)	0	10	0	0	0	0	0	0	291	0	0	0
Lane Group Flow (vph)	0	1111	0	241	637	0	72	72	54	0	12	0
Turn Type	Prot	NA		Prot	NA		Split	NA	Perm		Split	NA
Protected Phases	5	2		1	6		8	8		4	4	
Permitted Phases									8			
Actuated Green, G (s)		27.9		13.0	44.9		8.2	8.2	8.2		0.6	
Effective Green, g (s)		27.0		13.0	44.0		7.6	7.6	7.6		0.6	
Actuated g/C Ratio		0.40		0.19	0.65		0.11	0.11	0.11		0.01	
Clearance Time (s)		4.9		4.0	4.9		4.6	4.6	4.6		4.0	
Vehicle Extension (s)		2.0		2.0	2.0		2.0	2.0	2.0		2.0	
Lane Grp Cap (vph)		1397		342	2316		190	191	179		16	
v/s Ratio Prot		c0.32		c0.14	0.18		c0.04	0.04			c0.01	
v/s Ratio Perm									0.03			
v/c Ratio		0.80		0.70	0.28		0.38	0.38	0.30		0.75	
Uniform Delay, d1		17.7		25.3	4.9		27.6	27.6	27.4		33.2	
Progression Factor		1.00		1.00	1.00		1.00	1.00	1.00		1.00	
Incremental Delay, d2		3.0		5.3	0.0		0.5	0.5	0.3		97.6	
Delay (s)		20.7		30.6	4.9		28.1	28.1	27.7		130.8	
Level of Service		C		C	A		C	C	C		F	
Approach Delay (s)		20.7			12.0			27.8			130.8	
Approach LOS		C			B			C			F	

Intersection Summary

HCM 2000 Control Delay	19.5	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.70		
Actuated Cycle Length (s)	67.2	Sum of lost time (s)	19.0
Intersection Capacity Utilization	64.5%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
35: Murrieta Blvd & Jack London Blvd



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	253	723	428	245	278	129
Future Volume (vph)	253	723	428	245	278	129
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00	1.00	0.95	0.91	
Frt	1.00	0.85	1.00	1.00	0.95	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1770	1583	1770	3539	4844	
Flt Permitted	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	1770	1583	1770	3539	4844	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	275	786	465	266	302	140
RTOR Reduction (vph)	0	494	0	0	115	0
Lane Group Flow (vph)	275	292	465	266	327	0
Turn Type	Prot	Perm	Prot	NA	NA	
Protected Phases	4		5	2	6	
Permitted Phases		4				
Actuated Green, G (s)	13.3	13.3	16.2	29.3	9.1	
Effective Green, g (s)	13.3	13.3	16.2	29.3	9.1	
Actuated g/C Ratio	0.26	0.26	0.32	0.58	0.18	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	465	416	566	2049	871	
v/s Ratio Prot	0.16		c0.26	0.08	c0.07	
v/s Ratio Perm		c0.18				
v/c Ratio	0.59	0.70	0.82	0.13	0.38	
Uniform Delay, d1	16.3	16.9	15.9	4.8	18.3	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	2.0	5.3	9.3	0.0	0.3	
Delay (s)	18.3	22.2	25.2	4.9	18.5	
Level of Service	B	C	C	A	B	
Approach Delay (s)	21.2			17.8	18.5	
Approach LOS	C			B	B	































Intersection Summary

HCM 2000 Control Delay	19.5	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.67		
Actuated Cycle Length (s)	50.6	Sum of lost time (s)	12.0
Intersection Capacity Utilization	59.7%	ICU Level of Service	B
Analysis Period (min)	15		



















c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 36: Murrieta Blvd & Stanley Blvd

BART to Livermore Extension Project
 2025 Express Bus PM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 	 			 		 	 			 	
Traffic Volume (vph)	277	1066	530	43	525	153	229	376	18	242	344	180
Future Volume (vph)	277	1066	530	43	525	153	229	376	18	242	344	180
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.9	4.9	4.0	4.9	4.9	4.9	4.9		4.9	4.9	4.0
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.97	0.95		1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	3433	3514		1770	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	3433	3514		1770	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	301	1159	576	47	571	166	249	409	20	263	374	196
RTOR Reduction (vph)	0	0	305	0	0	70	0	4	0	0	0	149
Lane Group Flow (vph)	301	1159	271	47	571	96	249	425	0	263	374	47
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Prot	NA		Prot	NA	Perm
Protected Phases	7	4		3	8	1	5	2		1	6	
Permitted Phases			4			8						6
Actuated Green, G (s)	10.8	29.0	29.0	2.2	20.4	34.2	9.9	13.9		13.8	17.8	17.8
Effective Green, g (s)	10.8	28.1	28.1	2.2	19.5	32.4	9.0	13.0		12.9	16.9	17.8
Actuated g/C Ratio	0.14	0.38	0.38	0.03	0.26	0.43	0.12	0.17		0.17	0.23	0.24
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	495	1327	593	51	921	788	412	609		304	798	376
v/s Ratio Prot	c0.09	c0.33		0.03	0.16	0.02	0.07	c0.12		c0.15	c0.11	
v/s Ratio Perm			0.17			0.04						0.03
v/c Ratio	0.61	0.87	0.46	0.92	0.62	0.12	0.60	0.70		0.87	0.47	0.12
Uniform Delay, d1	30.1	21.7	17.6	36.3	24.4	12.7	31.3	29.1		30.2	25.1	22.4
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	2.1	6.6	0.6	96.7	1.3	0.1	2.5	3.5		21.7	0.4	0.1
Delay (s)	32.2	28.4	18.2	133.0	25.7	12.8	33.8	32.6		51.9	25.5	22.6
Level of Service	C	C	B	F	C	B	C	C		D	C	C
Approach Delay (s)		26.1			29.4			33.0			33.2	
Approach LOS		C			C			C			C	
Intersection Summary												
HCM 2000 Control Delay			29.1	HCM 2000 Level of Service				C				
HCM 2000 Volume to Capacity ratio			0.82									
Actuated Cycle Length (s)			74.9	Sum of lost time (s)				18.7				
Intersection Capacity Utilization			72.8%	ICU Level of Service				C				
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis
 37: Livermore Ave & I-580 WB Ramps

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations													
Traffic Volume (vph)	0	0	0	264	17	17	821	460	0	0	111	0	
Future Volume (vph)	0	0	0	264	17	17	821	460	0	0	111	0	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)					4.0		4.0	4.0			4.0		
Lane Util. Factor					0.95		0.97	1.00			0.95		
Frt					0.99		1.00	1.00			1.00		
Flt Protected					0.96		0.95	1.00			1.00		
Satd. Flow (prot)					1680		3433	1863			3539		
Flt Permitted					0.96		0.95	1.00			1.00		
Satd. Flow (perm)					1680		3433	1863			3539		
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	
Adj. Flow (vph)	0	0	0	287	18	18	892	500	0	0	121	0	
RTOR Reduction (vph)	0	0	0	0	4	0	0	0	0	0	0	0	
Lane Group Flow (vph)	0	0	0	0	319	0	892	500	0	0	121	0	
Turn Type				Split	NA		Prot	NA			NA		
Protected Phases				8	8		5	2			6		
Permitted Phases													
Actuated Green, G (s)					14.5		19.3	35.8			13.0		
Effective Green, g (s)					14.5		18.8	37.5			14.7		
Actuated g/C Ratio					0.24		0.31	0.62			0.24		
Clearance Time (s)					4.0		3.5	5.7			5.7		
Vehicle Extension (s)					2.0		2.0	2.5			2.5		
Lane Grp Cap (vph)					406		1075	1164			867		
v/s Ratio Prot					c0.19		c0.26	c0.27			0.03		
v/s Ratio Perm													
v/c Ratio					0.79		0.83	0.43			0.14		
Uniform Delay, d1					21.3		19.1	5.8			17.7		
Progression Factor					1.00		0.46	0.20			1.00		
Incremental Delay, d2					9.0		0.5	0.1			0.3		
Delay (s)					30.2		9.2	1.3			18.0		
Level of Service					C		A	A			B		
Approach Delay (s)		0.0			30.2			6.4			18.0		
Approach LOS		A			C			A			B		
Intersection Summary													
HCM 2000 Control Delay			11.3		HCM 2000 Level of Service						B		
HCM 2000 Volume to Capacity ratio			0.71										
Actuated Cycle Length (s)			60.0		Sum of lost time (s)						12.0		
Intersection Capacity Utilization			102.9%		ICU Level of Service						G		
Analysis Period (min)			15										
c Critical Lane Group													

HCM Signalized Intersection Capacity Analysis
 38: Livermore Ave & I-580 EB Ramps

































Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕	↗					↕		↘	↕	
Traffic Volume (vph)	282	11	1250	0	0	0	0	1018	231	57	319	0
Future Volume (vph)	282	11	1250	0	0	0	0	1018	231	57	319	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0					4.0		4.0	4.0	
Lane Util. Factor		0.95	0.95					0.95		1.00	0.95	
Frt		0.90	0.85					0.97		1.00	1.00	
Flt Protected		0.98	1.00					1.00		0.95	1.00	
Satd. Flow (prot)		1566	1504					3441		1770	3539	
Flt Permitted		0.98	1.00					1.00		0.95	1.00	
Satd. Flow (perm)		1566	1504					3441		1770	3539	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	307	12	1359	0	0	0	0	1107	251	62	347	0
RTOR Reduction (vph)	0	122	324	0	0	0	0	32	0	0	0	0
Lane Group Flow (vph)	0	863	369	0	0	0	0	1326	0	62	347	0
Turn Type	Prot	NA	Perm					NA		Prot	NA	
Protected Phases	7	4						2		1	6	
Permitted Phases			4									
Actuated Green, G (s)		19.9	19.9					24.9		3.2	31.1	
Effective Green, g (s)		19.9	19.9					25.9		2.2	32.1	
Actuated g/C Ratio		0.33	0.33					0.43		0.04	0.54	
Clearance Time (s)		4.0	4.0					5.0		3.0	5.0	
Vehicle Extension (s)		2.0	2.0					2.5		2.0	2.5	
Lane Grp Cap (vph)		519	498					1485		64	1893	
v/s Ratio Prot								c0.39		c0.04	0.10	
v/s Ratio Perm		0.55	0.25									
v/c Ratio		1.66	0.74					0.89		0.97	0.18	
Uniform Delay, d1		20.1	17.8					15.8		28.9	7.2	
Progression Factor		1.00	1.00					1.00		1.15	0.20	
Incremental Delay, d2		306.5	5.1					8.6		91.9	0.2	
Delay (s)		326.5	22.9					24.3		125.3	1.6	
Level of Service		F	C					C		F	A	
Approach Delay (s)		201.1			0.0			24.3			20.4	
Approach LOS		F			A			C			C	

Intersection Summary		
HCM 2000 Control Delay	110.0	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	1.21	F
Actuated Cycle Length (s)	60.0	Sum of lost time (s)
Intersection Capacity Utilization	102.9%	12.0
Analysis Period (min)	15	ICU Level of Service
		G

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 39: Livermore Ave & Portola Ave

BART to Livermore Extension Project
 2025 Express Bus PM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 	 		 	 		 	 		 	 	 
Traffic Volume (vph)	487	481	129	16	314	59	171	496	79	212	838	412
Future Volume (vph)	487	481	129	16	314	59	171	496	79	212	838	412
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	5.8		4.0	5.8	4.9
Lane Util. Factor	0.97	0.95		1.00	0.95		1.00	0.95		1.00	0.95	1.00
Frt	1.00	0.97		1.00	0.98		1.00	0.98		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3427		1770	3455		1770	3466		1770	3539	1583
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3427		1770	3455		1770	3466		1770	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	529	523	140	17	341	64	186	539	86	230	911	448
RTOR Reduction (vph)	0	23	0	0	16	0	0	11	0	0	0	110
Lane Group Flow (vph)	529	640	0	17	389	0	186	614	0	230	911	338
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	pm+ov
Protected Phases	3	8		7	4		1	6		5	2	3
Permitted Phases												2
Actuated Green, G (s)	18.6	32.8		1.9	16.1		13.0	29.7		14.1	30.8	49.4
Effective Green, g (s)	18.6	34.1		1.9	17.4		13.0	28.8		14.1	29.9	47.6
Actuated g/C Ratio	0.19	0.35		0.02	0.18		0.13	0.30		0.15	0.31	0.49
Clearance Time (s)	4.0	5.3		4.0	5.3		4.0	4.9		4.0	4.9	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	660	1208		34	621		237	1032		258	1094	779
v/s Ratio Prot	c0.15	0.19		0.01	c0.11		0.11	0.18		c0.13	c0.26	0.08
v/s Ratio Perm												0.13
v/c Ratio	0.80	0.53		0.50	0.63		0.78	0.60		0.89	0.83	0.43
Uniform Delay, d1	37.3	24.9		46.9	36.7		40.5	29.0		40.5	31.1	15.8
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	6.9	0.4		11.1	2.0		15.6	0.9		29.5	5.6	0.4
Delay (s)	44.2	25.4		58.0	38.6		56.1	29.9		70.0	36.6	16.2
Level of Service	D	C		E	D		E	C		E	D	B
Approach Delay (s)		33.7			39.4			35.9			35.7	
Approach LOS		C			D			D			D	

Intersection Summary

HCM 2000 Control Delay	35.6	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.81		
Actuated Cycle Length (s)	96.7	Sum of lost time (s)	18.7
Intersection Capacity Utilization	71.9%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
40: First St/Springtown Blvd & I-580 WB Ramps

BART to Livermore Extension Project
2025 Express Bus PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations			↗↗			↗	↗↗	↑			↖↖	↖
Traffic Volume (vph)	0	0	262	0	0	0	387	1492	0	0	421	190
Future Volume (vph)	0	0	262	0	0	0	387	1492	0	0	421	190
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)			4.0				4.0	4.0			5.0	5.0
Lane Util. Factor			0.88				0.97	1.00			0.95	1.00
Frt			0.85				1.00	1.00			1.00	0.85
Flt Protected			1.00				0.95	1.00			1.00	1.00
Satd. Flow (prot)			2787				3433	1863			3539	1583
Flt Permitted			1.00				0.95	1.00			1.00	1.00
Satd. Flow (perm)			2787				3433	1863			3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	285	0	0	0	421	1622	0	0	458	207
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	44
Lane Group Flow (vph)	0	0	285	0	0	0	421	1622	0	0	458	163
Turn Type			Over			Free	Prot	NA			NA	Perm
Protected Phases			5				5	2			6	
Permitted Phases						Free						6
Actuated Green, G (s)			25.4				25.4	60.0			26.6	26.6
Effective Green, g (s)			24.9				24.9	60.0			26.1	26.1
Actuated g/C Ratio			0.41				0.41	1.00			0.44	0.44
Clearance Time (s)			3.5				3.5	4.0			4.5	4.5
Vehicle Extension (s)			2.0				2.0	0.2			4.0	4.0
Lane Grp Cap (vph)			1156				1424	1863			1539	688
v/s Ratio Prot			0.10				0.12	c0.87			0.13	
v/s Ratio Perm												0.10
v/c Ratio			0.25				0.30	0.87			0.30	0.24
Uniform Delay, d1			11.4				11.7	0.0			11.0	10.7
Progression Factor			1.00				0.79	1.00			1.00	1.00
Incremental Delay, d2			0.0				0.0	0.6			0.1	0.2
Delay (s)			11.5				9.3	0.6			11.1	10.9
Level of Service			B				A	A			B	B
Approach Delay (s)		11.5			0.0			2.4			11.1	
Approach LOS		B			A			A			B	

Intersection Summary

HCM 2000 Control Delay	5.2	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	1.02		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	81.9%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
41: First St & I-580 EB Ramps



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕	↗↘					↕↕	↗	↘	↕↕	
Traffic Volume (vph)	551	5	754	0	0	0	0	1333	458	85	849	0
Future Volume (vph)	551	5	754	0	0	0	0	1333	458	85	849	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0					5.0	5.0	4.0	5.0	
Lane Util. Factor		1.00	0.88					0.95	1.00	1.00	0.95	
Frt		1.00	0.85					1.00	0.85	1.00	1.00	
Flt Protected		0.95	1.00					1.00	1.00	0.95	1.00	
Satd. Flow (prot)		1775	2787					3539	1583	1770	3539	
Flt Permitted		0.95	1.00					1.00	1.00	0.95	1.00	
Satd. Flow (perm)		1775	2787					3539	1583	1770	3539	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	599	5	820	0	0	0	0	1449	498	92	923	0
RTOR Reduction (vph)	0	0	128	0	0	0	0	0	294	0	0	0
Lane Group Flow (vph)	0	604	692	0	0	0	0	1449	204	92	923	0
Turn Type	Perm	NA	Perm					NA	Perm	Prot	NA	
Protected Phases		4						2		1	6	
Permitted Phases	4		4						2			
Actuated Green, G (s)		19.9	19.9					25.1	25.1	4.0	32.1	
Effective Green, g (s)		19.4	19.4					24.6	24.6	3.0	31.6	
Actuated g/C Ratio		0.32	0.32					0.41	0.41	0.05	0.53	
Clearance Time (s)		3.5	3.5					4.5	4.5	3.0	4.5	
Vehicle Extension (s)		2.5	2.5					4.0	4.0	2.0	4.0	
Lane Grp Cap (vph)		573	901					1450	649	88	1863	
v/s Ratio Prot								c0.41		c0.05	0.26	
v/s Ratio Perm		0.34	0.25						0.13			
v/c Ratio		1.05	0.77					1.00	0.31	1.05	0.50	
Uniform Delay, d1		20.3	18.3					17.7	12.0	28.5	9.1	
Progression Factor		1.00	1.00					1.00	1.00	0.90	0.78	
Incremental Delay, d2		52.6	3.8					23.5	1.3	108.6	0.9	
Delay (s)		72.9	22.1					41.2	13.3	134.3	8.0	
Level of Service		E	C					D	B	F	A	
Approach Delay (s)		43.7			0.0			34.0			19.4	
Approach LOS		D			A			C			B	

Intersection Summary		
HCM 2000 Control Delay	33.8	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	1.02	C
Actuated Cycle Length (s)	60.0	Sum of lost time (s)
Intersection Capacity Utilization	83.2%	13.0
Analysis Period (min)	15	ICU Level of Service
		E

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
42: 1st St & Mines Rd

BART to Livermore Extension Project
2025 Express Bus PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↘	↑	↗	↘↗	↑	↗	↘	↑↑↑	↗	↘↗	↑↑↑	↗
Traffic Volume (vph)	73	237	57	402	296	401	71	1449	813	369	860	52
Future Volume (vph)	73	237	57	402	296	401	71	1449	813	369	860	52
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	0.97	1.00	1.00	1.00	0.91	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	1863	1583	3433	1863	1583	1770	5085	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	1863	1583	3433	1863	1583	1770	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	79	258	62	437	322	436	77	1575	884	401	935	57
RTOR Reduction (vph)	0	0	52	0	0	36	0	0	164	0	0	30
Lane Group Flow (vph)	79	258	10	437	322	400	77	1575	720	401	935	27
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8	1	5	2		1	6	
Permitted Phases			4			8			2			6
Actuated Green, G (s)	5.6	16.4	16.4	13.0	23.8	35.8	7.0	43.8	43.8	12.0	48.8	48.8
Effective Green, g (s)	5.6	16.4	16.4	13.0	23.8	35.8	7.0	43.8	43.8	12.0	48.8	48.8
Actuated g/C Ratio	0.06	0.16	0.16	0.13	0.24	0.35	0.07	0.43	0.43	0.12	0.48	0.48
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	97	301	256	440	438	622	122	2200	685	407	2452	763
v/s Ratio Prot	0.04	c0.14		c0.13	0.17	0.08	0.04	0.31		c0.12	0.18	
v/s Ratio Perm			0.01			0.18			c0.45			0.02
v/c Ratio	0.81	0.86	0.04	0.99	0.74	0.64	0.63	0.72	1.05	0.99	0.38	0.04
Uniform Delay, d1	47.3	41.3	35.8	44.1	35.8	27.4	45.8	23.6	28.7	44.5	16.6	13.8
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	38.7	20.6	0.1	40.9	6.3	2.3	10.2	1.1	48.4	40.4	0.1	0.0
Delay (s)	86.0	61.9	35.8	85.0	42.1	29.7	56.0	24.7	77.1	84.9	16.7	13.8
Level of Service	F	E	D	F	D	C	E	C	E	F	B	B
Approach Delay (s)		62.6			53.2			43.9			36.2	
Approach LOS		E			D			D			D	



















Intersection Summary

HCM 2000 Control Delay	45.3	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.99		
Actuated Cycle Length (s)	101.2	Sum of lost time (s)	16.0
Intersection Capacity Utilization	83.3%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group



















HCM Unsignalized Intersection Capacity Analysis
43: Vasco Rd & I-580 WB Ramps

BART to Livermore Extension Project
2025 Express Bus PM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	0	0	88	0	1818	0	0	430	0
Future Volume (Veh/h)	0	0	0	0	0	88	0	1818	0	0	430	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	0	0	0	96	0	1976	0	0	467	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage (veh)												
Upstream signal (ft)											487	
pX, platoon unblocked												
vC, conflicting volume	1551	2443	467	2443	2443	988	467			1976		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1551	2443	467	2443	2443	988	467			1976		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	100	100	61	100			100		
cM capacity (veh/h)	47	31	542	16	31	246	1091			289		
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	SB 1	SB 2					
Volume Total	0	96	988	988	0	467	0					
Volume Left	0	0	0	0	0	0	0					
Volume Right	0	96	0	0	0	0	0					
cSH	1700	246	1700	1700	1700	1700	1700					
Volume to Capacity	0.00	0.39	0.58	0.58	0.00	0.27	0.00					
Queue Length 95th (ft)	0	44	0	0	0	0	0					
Control Delay (s)	0.0	28.7	0.0	0.0	0.0	0.0	0.0					
Lane LOS	A	D										
Approach Delay (s)	0.0	28.7	0.0			0.0						
Approach LOS	A	D										
Intersection Summary												
Average Delay			1.1									
Intersection Capacity Utilization			62.4%	ICU Level of Service	B							
Analysis Period (min)			15									


























HCM Unsignalized Intersection Capacity Analysis
44: Vasco Rd & I-580 EB Ramps

BART to Livermore Extension Project
2025 Express Bus PM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	0	0	0	0	2077	0	64	560	0
Future Volume (Veh/h)	0	0	0	0	0	0	0	2077	0	64	560	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	0	0	0	0	0	2258	0	70	609	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1878	3007	609	3007	3007	1129	609			2258		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1878	3007	609	3007	3007	1129	609			2258		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	100	100	100	100			69		
cM capacity (veh/h)	33	9	438	4	9	198	966			224		
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2						
Volume Total	0	0	1505	753	70	609						
Volume Left	0	0	0	0	70	0						
Volume Right	0	0	0	0	0	0						
cSH	1700	1700	1700	1700	224	1700						
Volume to Capacity	0.00	0.00	0.89	0.44	0.31	0.36						
Queue Length 95th (ft)	0	0	0	0	32	0						
Control Delay (s)	0.0	0.0	0.0	0.0	28.2	0.0						
Lane LOS	A	A			D							
Approach Delay (s)	0.0	0.0	0.0		2.9							
Approach LOS	A	A										
Intersection Summary												
Average Delay			0.7									
Intersection Capacity Utilization			60.7%	ICU Level of Service	B							
Analysis Period (min)			15									

HCM Signalized Intersection Capacity Analysis
45: Vasco Rd & East Ave

BART to Livermore Extension Project
2025 Express Bus PM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		 			 			 		 		
Traffic Volume (vph)	519	28	102	139	360	239	100	341	12	12	337	355
Future Volume (vph)	519	28	102	139	360	239	100	341	12	12	337	355
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	0.95		0.97	1.00	1.00
Frt	1.00	0.88		1.00	0.94		1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	3121		1770	3327		1770	3521		3433	1863	1583
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1770	3121		1770	3327		1770	3521		3433	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	564	30	111	151	391	260	109	371	13	13	366	386
RTOR Reduction (vph)	0	79	0	0	125	0	0	3	0	0	0	288
Lane Group Flow (vph)	564	62	0	151	526	0	109	381	0	13	366	98
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												6
Actuated Green, G (s)	29.7	26.0		20.2	16.5		6.0	28.3		0.8	23.1	23.1
Effective Green, g (s)	29.7	26.0		20.2	16.5		6.0	28.3		0.8	23.1	23.1
Actuated g/C Ratio	0.33	0.28		0.22	0.18		0.07	0.31		0.01	0.25	0.25
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	575	888		391	601		116	1091		30	471	400
v/s Ratio Prot	c0.32	0.02		0.09	c0.16		c0.06	0.11		0.00	c0.20	
v/s Ratio Perm												0.06
v/c Ratio	0.98	0.07		0.39	0.88		0.94	0.35		0.43	0.78	0.24
Uniform Delay, d1	30.5	23.8		30.3	36.4		42.5	24.4		45.0	31.7	27.1
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	32.5	0.0		0.6	13.5		64.0	0.2		9.7	7.9	0.3
Delay (s)	63.0	23.9		30.9	49.9		106.4	24.6		54.7	39.6	27.5
Level of Service	E	C		C	D		F	C		D	D	C
Approach Delay (s)		55.2			46.3			42.7			33.7	
Approach LOS		E			D			D			C	
Intersection Summary												
HCM 2000 Control Delay			44.5			HCM 2000 Level of Service				D		
HCM 2000 Volume to Capacity ratio			0.89									
Actuated Cycle Length (s)			91.3			Sum of lost time (s)			16.0			
Intersection Capacity Utilization			83.0%			ICU Level of Service				E		
Analysis Period (min)			15									
c Critical Lane Group												

HCM Unsignalized Intersection Capacity Analysis
 46: I-580 WB Ramps & Northfront Rd/Northfront Road



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	→			←	↔	↔
Traffic Volume (veh/h)	628	37	240	186	4	132
Future Volume (Veh/h)	628	37	240	186	4	132
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	683	40	261	202	4	143
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None		None			
Median storage (veh)						
Upstream signal (ft)	1007					
pX, platoon unblocked						
vC, conflicting volume			683		1427	703
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			683		1427	703
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			71		96	67
cM capacity (veh/h)			910		106	438
Direction, Lane #	EB 1	WB 1	NB 1	NB 2		
Volume Total	723	463	4	143		
Volume Left	0	261	4	0		
Volume Right	40	0	0	143		
cSH	1700	910	106	438		
Volume to Capacity	0.43	0.29	0.04	0.33		
Queue Length 95th (ft)	0	30	3	35		
Control Delay (s)	0.0	7.4	40.2	17.2		
Lane LOS		A	E	C		
Approach Delay (s)	0.0	7.4	17.8			
Approach LOS			C			
Intersection Summary						
Average Delay			4.5			
Intersection Capacity Utilization			71.7%	ICU Level of Service		C
Analysis Period (min)	15					

Intersection	
Intersection Delay, s/veh	14.3
Intersection LOS	B

Movement	EBU	EBL	EBT	WBU	WBT	WBR	SBU	SBL	SBR
Lane Configurations		↘	↗↗		↗	↘		↘↘	↗
Traffic Vol, veh/h	0	309	251	0	86	265	0	192	8
Future Vol, veh/h	0	309	251	0	86	265	0	192	8
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	336	273	0	93	288	0	209	9
Number of Lanes	0	1	2	0	1	1	0	2	1

Approach	EB	WB	SB
Opposing Approach	WB	EB	
Opposing Lanes	2	3	0
Conflicting Approach Left	SB		WB
Conflicting Lanes Left	3	0	2
Conflicting Approach Right		SB	EB
Conflicting Lanes Right	0	3	3
HCM Control Delay	15.7	13.4	12
HCM LOS	C	B	B

Lane	EBLn1	EBLn2	EBLn3	WBLn1	WBLn2	SBLn1	SBLn2	SBLn3
Vol Left, %	100%	0%	0%	0%	0%	100%	100%	0%
Vol Thru, %	0%	100%	100%	100%	0%	0%	0%	0%
Vol Right, %	0%	0%	0%	0%	100%	0%	0%	100%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	309	126	126	86	265	96	96	8
LT Vol	309	0	0	0	0	96	96	0
Through Vol	0	126	126	86	0	0	0	0
RT Vol	0	0	0	0	265	0	0	8
Lane Flow Rate	336	136	136	93	288	104	104	9
Geometry Grp	8	8	8	8	8	7	7	7
Degree of Util (X)	0.634	0.238	0.172	0.174	0.48	0.215	0.215	0.011
Departure Headway (Hd)	6.799	6.293	4.54	6.711	6.003	7.421	7.421	4.454
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cap	531	569	786	533	599	483	483	798
Service Time	4.551	4.045	2.292	4.473	3.765	5.181	5.181	2.212
HCM Lane V/C Ratio	0.633	0.239	0.173	0.174	0.481	0.215	0.215	0.011
HCM Control Delay	20.7	11	8.2	10.9	14.2	12.2	12.2	7.3
HCM Lane LOS	C	B	A	B	B	B	B	A
HCM 95th-tile Q	4.4	0.9	0.6	0.6	2.6	0.8	0.8	0

HCM Signalized Intersection Capacity Analysis
48: Greenville Rd & Northfront Road/Altamont Pass Road



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↗	↖	↑	↘	↗
Traffic Volume (vph)	609	146	1	52	391	1039
Future Volume (vph)	609	146	1	52	391	1039
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	1863	1583	1770	1863	1770	1583
Flt Permitted	1.00	1.00	0.10	1.00	0.95	1.00
Satd. Flow (perm)	1863	1583	191	1863	1770	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	662	159	1	57	425	1129
RTOR Reduction (vph)	0	65	0	0	0	28
Lane Group Flow (vph)	662	94	1	57	425	1101
Turn Type	NA	Perm	Perm	NA	Prot	Perm
Protected Phases	4			8	2	
Permitted Phases		4	8			2
Actuated Green, G (s)	39.0	39.0	39.0	39.0	73.0	73.0
Effective Green, g (s)	39.0	39.0	39.0	39.0	73.0	73.0
Actuated g/C Ratio	0.32	0.32	0.32	0.32	0.61	0.61
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	605	514	62	605	1076	962
v/s Ratio Prot	c0.36			0.03	0.24	
v/s Ratio Perm		0.06	0.01			c0.70
v/c Ratio	1.09	0.18	0.02	0.09	0.39	1.14
Uniform Delay, d1	40.5	29.1	27.5	28.2	12.1	23.5
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	65.0	0.2	0.1	0.1	0.2	77.4
Delay (s)	105.5	29.2	27.6	28.3	12.4	100.9
Level of Service	F	C	C	C	B	F
Approach Delay (s)	90.7			28.3	76.7	
Approach LOS	F			C	E	

Intersection Summary

HCM 2000 Control Delay	80.2	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.13		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	103.1%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
49: Greenville Rd & Southfront Rd



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	417	117	243	996	68	79
Future Volume (vph)	417	117	243	996	68	79
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.2	5.2	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.88	0.97	0.95	0.95	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	3433	2787	3433	3539	3539	1583
Flt Permitted	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (perm)	3433	2787	3433	3539	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	453	127	264	1083	74	86
RTOR Reduction (vph)	0	106	0	0	0	54
Lane Group Flow (vph)	453	21	264	1083	74	32
Turn Type	Prot	Perm	Prot	NA	NA	Perm
Protected Phases	8		1	6	2	
Permitted Phases		8				2
Actuated Green, G (s)	6.5	6.5	3.0	18.4	11.4	11.4
Effective Green, g (s)	5.9	5.9	3.0	20.1	13.1	13.1
Actuated g/C Ratio	0.17	0.17	0.09	0.57	0.37	0.37
Clearance Time (s)	4.6	4.6	4.0	5.7	5.7	5.7
Vehicle Extension (s)	5.0	5.0	6.0	2.5	2.5	2.5
Lane Grp Cap (vph)	575	467	292	2020	1317	589
v/s Ratio Prot	c0.13		c0.08	c0.31	0.02	
v/s Ratio Perm		0.01				0.02
v/c Ratio	0.79	0.05	0.90	0.54	0.06	0.05
Uniform Delay, d1	14.0	12.3	16.0	4.7	7.1	7.1
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	8.1	0.1	31.6	0.2	0.0	0.0
Delay (s)	22.2	12.4	47.5	4.9	7.1	7.1
Level of Service	C	B	D	A	A	A
Approach Delay (s)	20.0			13.2	7.1	
Approach LOS	C			B	A	

Intersection Summary

HCM 2000 Control Delay	14.7	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.71		
Actuated Cycle Length (s)	35.2	Sum of lost time (s)	13.2
Intersection Capacity Utilization	47.1%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
50: Greenville Rd & Patterson Pass Rd

BART to Livermore Extension Project
2025 Express Bus PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	32	483	55	5	13	7	69	408	332	424	209	43
Future Volume (vph)	32	483	55	5	13	7	69	408	332	424	209	43
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.98		1.00	0.95		1.00	0.93		1.00	0.97	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1834		1770	1761		1770	1737		1770	1815	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	1834		1770	1761		1770	1737		1770	1815	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	35	525	60	5	14	8	75	443	361	461	227	47
RTOR Reduction (vph)	0	4	0	0	6	0	0	24	0	0	6	0
Lane Group Flow (vph)	35	581	0	5	16	0	75	780	0	461	268	0
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												
Actuated Green, G (s)	8.4	30.0		0.8	22.4		8.1	45.9		25.0	62.8	
Effective Green, g (s)	8.4	30.0		0.8	22.4		8.1	45.9		25.0	62.8	
Actuated g/C Ratio	0.07	0.25		0.01	0.19		0.07	0.39		0.21	0.53	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	126	467		12	335		121	677		375	968	
v/s Ratio Prot	c0.02	c0.32		0.00	0.01		0.04	c0.45		c0.26	0.15	
v/s Ratio Perm												
v/c Ratio	0.28	1.24		0.42	0.05		0.62	1.15		1.23	0.28	
Uniform Delay, d1	51.8	43.9		58.2	38.9		53.3	35.9		46.4	15.0	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	1.2	127.1		21.8	0.1		9.1	84.9		124.5	0.7	
Delay (s)	53.0	171.0		80.0	39.0		62.4	120.8		170.9	15.7	
Level of Service	D	F		E	D		E	F		F	B	
Approach Delay (s)		164.3			46.6			115.8			113.0	
Approach LOS		F			D			F			F	























Intersection Summary

HCM 2000 Control Delay	127.4	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.19		
Actuated Cycle Length (s)	117.7	Sum of lost time (s)	16.0
Intersection Capacity Utilization	104.0%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
53: Portola Ave

BART to Livermore Extension Project
2025 Express Bus PM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		 			 						 	
Traffic Volume (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Future Volume (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)												
Lane Util. Factor												
Frt												
Flt Protected												
Satd. Flow (prot)												
Flt Permitted												
Satd. Flow (perm)												
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	0	0	0	0	0	0	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Turn Type	Perm			Perm			Perm					
Protected Phases	4		8		8		2		2		6	
Permitted Phases	4		8		8		2		2		6	
Actuated Green, G (s)												
Effective Green, g (s)												
Actuated g/C Ratio												
Clearance Time (s)												
Lane Grp Cap (vph)												
v/s Ratio Prot												
v/s Ratio Perm												
v/c Ratio												
Uniform Delay, d1												
Progression Factor												
Incremental Delay, d2												
Delay (s)												
Level of Service												
Approach Delay (s)	0.0			0.0			0.0			0.0		
Approach LOS	A			A			A			A		
Intersection Summary												
HCM 2000 Control Delay	0.0			HCM 2000 Level of Service			A					
HCM 2000 Volume to Capacity ratio	0.00											
Actuated Cycle Length (s)	99.0			Sum of lost time (s)			8.0					
Intersection Capacity Utilization	0.0%			ICU Level of Service			A					
Analysis Period (min)	15											
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis
 1: Dougherty Rd & Amador Valley Rd



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	85	498	383	709	1753	137
Future Volume (vph)	85	498	383	709	1753	137
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5	5.7	5.7	
Lane Util. Factor	1.00	1.00	0.97	0.91	0.91	
Frt	1.00	0.85	1.00	1.00	0.99	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1770	1583	3433	5085	5030	
Flt Permitted	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	1770	1583	3433	5085	5030	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	92	541	416	771	1905	149
RTOR Reduction (vph)	0	195	0	0	9	0
Lane Group Flow (vph)	92	346	416	771	2045	0
Turn Type	Perm	Perm	Prot	NA	NA	
Protected Phases			5	2	6	
Permitted Phases	4	4				
Actuated Green, G (s)	21.9	21.9	12.2	56.2	39.5	
Effective Green, g (s)	21.9	21.9	12.2	56.2	39.5	
Actuated g/C Ratio	0.25	0.25	0.14	0.64	0.45	
Clearance Time (s)	4.5	4.5	4.5	5.7	5.7	
Vehicle Extension (s)	1.8	1.8	2.0	4.0	4.0	
Lane Grp Cap (vph)	438	392	474	3236	2250	
v/s Ratio Prot			c0.12	0.15	c0.41	
v/s Ratio Perm	0.05	c0.22				
v/c Ratio	0.21	0.88	0.88	0.24	0.91	
Uniform Delay, d1	26.3	32.0	37.3	6.9	22.7	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.1	19.8	16.1	0.1	6.0	
Delay (s)	26.4	51.8	53.5	6.9	28.7	
Level of Service	C	D	D	A	C	
Approach Delay (s)	48.1			23.2	28.7	
Approach LOS	D			C	C	

Intersection Summary

HCM 2000 Control Delay	30.2	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.90		
Actuated Cycle Length (s)	88.3	Sum of lost time (s)	14.7
Intersection Capacity Utilization	76.3%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
2: Dougherty Rd & Dublin Blvd

BART to Livermore Extension Project
2025 Enhanced Bus AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↑↑↑	↖↗	↖↗↘	↑↑↑	↖	↖↗↘	↑↑↑	↖↗	↖↗	↑↑↑	↖↗
Traffic Volume (vph)	40	354	427	272	617	352	654	1002	118	648	1746	75
Future Volume (vph)	40	354	427	272	617	352	654	1002	118	648	1746	75
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	6.0	5.0	5.0	5.5	5.0	5.0	5.5	5.0	5.0	5.5	
Lane Util. Factor	0.97	0.91	0.88	0.94	0.91	1.00	0.94	0.91	0.88	0.97	0.86	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	3433	5085	2787	4990	5085	1583	4990	5085	2787	3433	6368	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	3433	5085	2787	4990	5085	1583	4990	5085	2787	3433	6368	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	43	385	464	296	671	383	711	1089	128	704	1898	82
RTOR Reduction (vph)	0	0	41	0	0	101	0	0	76	0	4	0
Lane Group Flow (vph)	43	385	423	296	671	282	711	1089	52	704	1976	0
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	
Protected Phases	5	2	3	1	6	7	3	8	1	7	4	
Permitted Phases			2			6			8			
Actuated Green, G (s)	11.8	22.7	38.7	15.0	26.4	52.3	16.0	33.2	48.2	25.9	43.1	
Effective Green, g (s)	11.8	22.7	38.7	15.0	26.4	52.3	16.0	33.2	48.2	25.9	43.1	
Actuated g/C Ratio	0.10	0.19	0.33	0.13	0.22	0.44	0.14	0.28	0.41	0.22	0.36	
Clearance Time (s)	5.0	6.0	5.0	5.0	5.5	5.0	5.0	5.5	5.0	5.0	5.5	
Vehicle Extension (s)	2.0	4.5	2.0	2.0	4.5	2.0	2.0	4.5	2.0	2.0	4.5	
Lane Grp Cap (vph)	342	975	911	632	1134	699	674	1427	1135	751	2320	
v/s Ratio Prot	0.01	0.08	0.06	c0.06	c0.13	0.09	0.14	0.21	0.01	c0.21	c0.31	
v/s Ratio Perm			0.09			0.09			0.01			
v/c Ratio	0.13	0.39	0.46	0.47	0.59	0.40	1.05	0.76	0.05	0.94	0.85	
Uniform Delay, d1	48.5	41.8	31.6	47.9	41.1	22.4	51.1	39.0	21.2	45.4	34.7	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.1	0.5	0.1	0.2	1.1	0.1	50.0	2.8	0.0	18.8	3.5	
Delay (s)	48.6	42.3	31.7	48.1	42.2	22.5	101.2	41.7	21.2	64.2	38.1	
Level of Service	D	D	C	D	D	C	F	D	C	E	D	
Approach Delay (s)		37.1			37.9			62.3			45.0	
Approach LOS		D			D			E			D	

Intersection Summary

HCM 2000 Control Delay	47.4	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.80		
Actuated Cycle Length (s)	118.3	Sum of lost time (s)	21.5
Intersection Capacity Utilization	81.8%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

3: Dougherty Rd & I-580 WB Ramps

BART to Livermore Extension Project
2025 Enhanced Bus AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↔↔		↔↔		↑↑↑			↑↑↑	↔
Traffic Volume (vph)	0	0	0	392	0	637	0	1281	0	0	1672	0
Future Volume (vph)	0	0	0	392	0	637	0	1281	0	0	1672	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0		4.0		4.0			4.0	
Lane Util. Factor				0.97		0.88		0.91			0.86	
Frt				1.00		0.85		1.00			1.00	
Flt Protected				0.95		1.00		1.00			1.00	
Satd. Flow (prot)				3433		2787		5085			4806	
Flt Permitted				0.95		1.00		1.00			1.00	
Satd. Flow (perm)				3433		2787		5085			4806	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	426	0	692	0	1392	0	0	1817	0
RTOR Reduction (vph)	0	0	0	0	0	36	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	426	0	656	0	1392	0	0	1817	0
Turn Type				Prot		Prot		NA			NA	Perm
Protected Phases				4		4		2			6	
Permitted Phases												6
Actuated Green, G (s)				14.0		14.0		25.2			25.2	
Effective Green, g (s)				15.4		15.4		26.6			26.6	
Actuated g/C Ratio				0.31		0.31		0.53			0.53	
Clearance Time (s)				5.4		5.4		5.4			5.4	
Vehicle Extension (s)				3.0		3.0		3.0			3.0	
Lane Grp Cap (vph)				1057		858		2705			2556	
v/s Ratio Prot				0.12		c0.24		0.27			c0.38	
v/s Ratio Perm												
v/c Ratio				0.40		0.76		0.51			0.71	
Uniform Delay, d1				13.7		15.7		7.5			8.8	
Progression Factor				1.00		1.00		0.74			1.00	
Incremental Delay, d2				0.3		4.1		0.6			1.7	
Delay (s)				13.9		19.8		6.2			10.5	
Level of Service				B		B		A			B	
Approach Delay (s)		0.0			17.5			6.2			10.5	
Approach LOS		A			B			A			B	

Intersection Summary

HCM 2000 Control Delay	10.9	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.73		
Actuated Cycle Length (s)	50.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	53.7%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 4: Hopyard Rd/Dougherty Rd & I-580 EB Ramps

BART to Livermore Extension Project
 2025 Enhanced Bus AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↗↘		↗↘					↑↑↑	↗		↑↑↑	↗
Traffic Volume (vph)	754	0	1432	0	0	0	0	771	0	0	1527	0
Future Volume (vph)	754	0	1432	0	0	0	0	771	0	0	1527	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0					4.0			4.0	
Lane Util. Factor	0.97		0.88					0.91			0.86	
Frt	1.00		0.85					1.00			1.00	
Flt Protected	0.95		1.00					1.00			1.00	
Satd. Flow (prot)	3433		2787					5085			4806	
Flt Permitted	0.95		1.00					1.00			1.00	
Satd. Flow (perm)	3433		2787					5085			4806	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	820	0	1557	0	0	0	0	838	0	0	1660	0
RTOR Reduction (vph)	0	0	26	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	820	0	1531	0	0	0	0	838	0	0	1660	0
Turn Type	Prot		Prot					NA	Free		NA	Perm
Protected Phases	4		4					2			6	
Permitted Phases									Free			6
Actuated Green, G (s)	23.4		23.4					15.8			15.8	
Effective Green, g (s)	24.8		24.8					17.2			17.2	
Actuated g/C Ratio	0.50		0.50					0.34			0.34	
Clearance Time (s)	5.4		5.4					5.4			5.4	
Vehicle Extension (s)	3.0		3.0					3.0			3.0	
Lane Grp Cap (vph)	1702		1382					1749			1653	
v/s Ratio Prot	0.24		c0.55					0.16			c0.35	
v/s Ratio Perm												
v/c Ratio	0.48		1.11					0.48			1.00	
Uniform Delay, d1	8.3		12.6					12.9			16.4	
Progression Factor	1.00		1.00					1.00			0.70	
Incremental Delay, d2	0.2		59.4					0.9			20.3	
Delay (s)	8.6		72.0					13.8			31.7	
Level of Service	A		E					B			C	
Approach Delay (s)		50.1			0.0			13.8			31.7	
Approach LOS		D			A			B			C	

Intersection Summary

HCM 2000 Control Delay	37.6	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	1.07		
Actuated Cycle Length (s)	50.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	86.3%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
5: Hopyard Rd & Owens Rd

BART to Livermore Extension Project
2025 Enhanced Bus AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↗	↔↗		↗	↔	↗	↗	↑↑↑	↗	↗↔	↑↑↔	
Traffic Volume (vph)	203	94	52	115	131	199	137	679	136	821	1631	558
Future Volume (vph)	203	94	52	115	131	199	137	679	136	821	1631	558
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	2.7	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	0.91	0.91		1.00	0.95	0.95	1.00	0.91	1.00	0.97	0.91	
Frt	1.00	0.97		1.00	0.95	0.85	1.00	1.00	0.85	1.00	0.96	
Flt Protected	0.95	0.98		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1610	3216		1770	1685	1504	1770	5085	1583	3433	4891	
Flt Permitted	0.95	0.98		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1610	3216		1770	1685	1504	1770	5085	1583	3433	4891	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	221	102	57	125	142	216	149	738	148	892	1773	607
RTOR Reduction (vph)	0	26	0	0	19	49	0	0	110	0	69	0
Lane Group Flow (vph)	122	232	0	125	190	100	149	738	38	892	2311	0
Turn Type	Split	NA		Split	NA	pm+ov	Prot	NA	Perm	Prot	NA	
Protected Phases	8	8		4	4	1	5	2		1	6	
Permitted Phases						4			2			
Actuated Green, G (s)	6.7	6.7		9.9	9.9	41.7	8.0	21.3	21.3	31.8	45.1	
Effective Green, g (s)	8.0	8.0		11.2	11.2	44.3	8.0	23.0	23.0	31.8	46.8	
Actuated g/C Ratio	0.09	0.09		0.12	0.12	0.49	0.09	0.26	0.26	0.35	0.52	
Clearance Time (s)	5.3	5.3		5.3	5.3	4.0	4.0	5.7	5.7	4.0	5.7	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	143	285		220	209	785	157	1299	404	1212	2543	
v/s Ratio Prot	c0.08	0.07		0.07	c0.11	0.05	0.08	0.15		c0.26	c0.47	
v/s Ratio Perm						0.02			0.02			
v/c Ratio	0.85	0.81		0.57	0.91	0.13	0.95	0.57	0.09	0.74	0.91	
Uniform Delay, d1	40.4	40.3		37.1	38.9	12.4	40.8	29.2	25.6	25.4	19.7	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	36.0	16.0		3.3	37.4	0.1	56.0	0.6	0.1	2.4	5.3	
Delay (s)	76.4	56.3		40.5	76.3	12.5	96.8	29.7	25.7	27.8	24.9	
Level of Service	E	E		D	E	B	F	C	C	C	C	
Approach Delay (s)		62.7			47.3			38.8			25.7	
Approach LOS		E			D			D			C	

Intersection Summary

HCM 2000 Control Delay	33.1	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.91		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	82.6%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
6: Hopyard Rd & Stoneridge Dr

BART to Livermore Extension Project
2025 Enhanced Bus AM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	146	731	437	82	999	115	647	719	87	281	975	234
Future Volume (vph)	146	731	437	82	999	115	647	719	87	281	975	234
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.91	1.00	0.97	0.91	1.00	0.94	0.95	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5085	1583	3433	5085	1583	4990	3539	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5085	1583	3433	5085	1583	4990	3539	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	159	795	475	89	1086	125	703	782	95	305	1060	254
RTOR Reduction (vph)	0	0	222	0	0	90	0	0	68	0	0	121
Lane Group Flow (vph)	159	795	253	89	1086	35	703	782	27	305	1060	133
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8			2			6
Actuated Green, G (s)	4.0	17.6	17.6	3.2	16.8	16.8	8.0	17.0	17.0	7.0	16.0	16.0
Effective Green, g (s)	4.0	17.6	17.6	3.2	16.8	16.8	8.0	17.0	17.0	7.0	16.0	16.0
Actuated g/C Ratio	0.07	0.29	0.29	0.05	0.28	0.28	0.13	0.28	0.28	0.12	0.26	0.26
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	225	1471	458	180	1405	437	656	989	442	395	1338	416
v/s Ratio Prot	c0.05	0.16		0.03	c0.21		c0.14	c0.22		0.09	0.21	
v/s Ratio Perm			0.16			0.02			0.02			0.08
v/c Ratio	0.71	0.54	0.55	0.49	0.77	0.08	1.07	0.79	0.06	0.77	0.79	0.32
Uniform Delay, d1	27.8	18.2	18.3	28.0	20.2	16.3	26.4	20.3	16.0	26.1	20.9	18.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	9.7	0.4	1.4	2.1	2.7	0.1	55.9	4.4	0.1	9.1	3.3	0.4
Delay (s)	37.5	18.6	19.7	30.1	23.0	16.4	82.3	24.6	16.1	35.2	24.2	18.5
Level of Service	D	B	B	C	C	B	F	C	B	D	C	B
Approach Delay (s)		21.1			22.8			49.8			25.3	
Approach LOS		C			C			D			C	

Intersection Summary		
HCM 2000 Control Delay	30.3	HCM 2000 Level of Service C
HCM 2000 Volume to Capacity ratio	0.84	
Actuated Cycle Length (s)	60.8	Sum of lost time (s) 16.0
Intersection Capacity Utilization	67.9%	ICU Level of Service C
Analysis Period (min)	15	

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
7: Hopyard Rd & Las Positas Blvd

BART to Livermore Extension Project
2025 Enhanced Bus AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	150	462	373	351	447	56	412	1144	366	111	1011	90
Future Volume (vph)	150	462	373	351	447	56	412	1144	366	111	1011	90
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.95	1.00	0.97	0.95	1.00	0.97	0.91	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	3433	3539	1583	3433	5085	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	3433	3539	1583	3433	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	163	502	405	382	486	61	448	1243	398	121	1099	98
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	72
Lane Group Flow (vph)	163	502	405	382	486	61	448	1243	398	121	1099	26
Turn Type	Prot	NA	Free	Prot	NA	Free	Prot	NA	Free	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1		6
Permitted Phases			Free			Free			Free			6
Actuated Green, G (s)	4.7	14.6	64.5	8.0	17.9	64.5	9.0	22.7	64.5	3.2	16.9	16.9
Effective Green, g (s)	4.7	14.6	64.5	8.0	17.9	64.5	9.0	22.7	64.5	3.2	16.9	16.9
Actuated g/C Ratio	0.07	0.23	1.00	0.12	0.28	1.00	0.14	0.35	1.00	0.05	0.26	0.26
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	250	801	1583	425	982	1583	479	1789	1583	170	1332	414
v/s Ratio Prot	0.05	c0.14		c0.11	0.14		c0.13	0.24		0.04	c0.22	
v/s Ratio Perm			c0.26			0.04			0.25			0.02
v/c Ratio	0.65	0.63	0.26	0.90	0.49	0.04	0.94	0.69	0.25	0.71	0.83	0.06
Uniform Delay, d1	29.1	22.5	0.0	27.9	19.5	0.0	27.5	17.9	0.0	30.2	22.4	17.9
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	6.0	1.5	0.4	21.2	0.4	0.0	25.6	1.2	0.4	13.2	4.3	0.1
Delay (s)	35.1	24.0	0.4	49.0	19.9	0.0	53.1	19.1	0.4	43.3	26.7	17.9
Level of Service	D	C	A	D	B	A	D	B	A	D	C	B
Approach Delay (s)		16.8			30.6			22.8			27.6	
Approach LOS		B			C			C			C	

Intersection Summary

HCM 2000 Control Delay	24.1	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.78		
Actuated Cycle Length (s)	64.5	Sum of lost time (s)	16.0
Intersection Capacity Utilization	67.4%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
8: Willow Rd & Owens Rd

BART to Livermore Extension Project
2025 Enhanced Bus AM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	104	377	194	117	325	89	93	92	0	131	102	92
Future Volume (vph)	104	377	194	117	325	89	93	92	0	131	102	92
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	5.3	4.0		5.3	4.0	4.0
Lane Util. Factor	0.97	0.91		0.97	0.91	1.00	1.00	0.95		1.00	1.00	1.00
Frt	1.00	0.95		1.00	1.00	0.85	1.00	1.00		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	4826		3433	5085	1583	1770	3539		1770	1863	1583
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.69	1.00		0.69	1.00	1.00
Satd. Flow (perm)	3433	4826		3433	5085	1583	1277	3539		1283	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	113	410	211	127	353	97	101	100	0	142	111	100
RTOR Reduction (vph)	0	129	0	0	0	59	0	0	0	0	0	77
Lane Group Flow (vph)	113	493	0	127	353	38	101	100	0	142	111	23
Turn Type	Prot	NA		Prot	NA	Perm	Perm	NA	Perm	Perm	NA	Perm
Protected Phases	1	6		5	2			4			8	
Permitted Phases						2	4		4	8		8
Actuated Green, G (s)	3.8	14.8		3.8	14.8	14.8	8.6	8.6		8.6	8.6	8.6
Effective Green, g (s)	3.8	16.5		3.8	16.5	16.5	8.6	9.9		8.6	9.9	9.9
Actuated g/C Ratio	0.09	0.39		0.09	0.39	0.39	0.20	0.23		0.20	0.23	0.23
Clearance Time (s)	4.0	5.7		4.0	5.7	5.7	5.3	5.3		5.3	5.3	5.3
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	309	1886		309	1988	618	260	830		261	437	371
v/s Ratio Prot	0.03	c0.10		c0.04	0.07			0.03			0.06	
v/s Ratio Perm						0.02	0.08			c0.11		0.01
v/c Ratio	0.37	0.26		0.41	0.18	0.06	0.39	0.12		0.54	0.25	0.06
Uniform Delay, d1	18.1	8.7		18.1	8.4	8.0	14.5	12.7		15.0	13.1	12.5
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	0.7	0.1		0.9	0.0	0.0	1.0	0.1		2.3	0.3	0.1
Delay (s)	18.8	8.8		19.0	8.5	8.1	15.5	12.8		17.4	13.5	12.6
Level of Service	B	A		B	A	A	B	B		B	B	B
Approach Delay (s)		10.3			10.7			14.1			14.8	
Approach LOS		B			B			B			B	

Intersection Summary		
HCM 2000 Control Delay	11.7	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.35	B
Actuated Cycle Length (s)	42.2	Sum of lost time (s)
Intersection Capacity Utilization	38.9%	12.0
Analysis Period (min)	15	ICU Level of Service
		A

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
9: Hacienda Dr & Dublin Blvd

BART to Livermore Extension Project
2025 Enhanced Bus AM



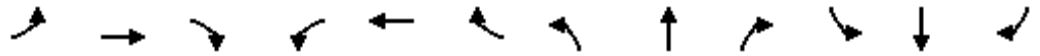
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↑↑↑	↖↗	↖↗	↑↑↑		↖↗	↑↑	↖↗	↖↗	↑↑↑	↖↗
Traffic Volume (vph)	72	335	93	272	745	80	156	631	115	12	390	132
Future Volume (vph)	72	335	93	272	745	80	156	631	115	12	390	132
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	6.0	5.0	4.5	6.0		5.0	6.0	6.0	4.5	5.5	5.5
Lane Util. Factor	0.97	0.91	0.88	0.97	0.91		0.94	0.95	0.88	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5085	2787	3433	5011		4990	3539	2787	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5085	2787	3433	5011		4990	3539	2787	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	78	364	101	296	810	87	170	686	125	13	424	143
RTOR Reduction (vph)	0	0	71	0	12	0	0	0	86	0	0	116
Lane Group Flow (vph)	78	364	30	296	885	0	170	686	39	13	424	27
Turn Type	Prot	NA	pm+ov	Prot	NA		Prot	NA	Perm	Prot	NA	Perm
Protected Phases	5	2	3	1	6		3	8		7	NA	4
Permitted Phases			2						8			4
Actuated Green, G (s)	4.8	12.1	22.2	17.3	24.6		10.1	23.3	23.3	0.6	13.8	13.8
Effective Green, g (s)	4.8	12.1	22.2	17.3	24.6		10.1	23.3	23.3	0.6	13.8	13.8
Actuated g/C Ratio	0.06	0.16	0.30	0.23	0.33		0.14	0.31	0.31	0.01	0.19	0.19
Clearance Time (s)	4.5	6.0	5.0	4.5	6.0		5.0	6.0	6.0	4.5	5.5	5.5
Vehicle Extension (s)	2.0	3.5	2.0	2.0	3.5		2.0	3.5	3.5	2.0	3.5	3.5
Lane Grp Cap (vph)	221	828	1020	799	1659		678	1109	873	27	944	294
v/s Ratio Prot	0.02	c0.07	0.00	0.09	c0.18		0.03	c0.19		0.00	c0.08	
v/s Ratio Perm			0.01						0.01			0.02
v/c Ratio	0.35	0.44	0.03	0.37	0.53		0.25	0.62	0.04	0.48	0.45	0.09
Uniform Delay, d1	33.3	28.0	18.4	23.9	20.2		28.7	21.7	17.8	36.7	26.9	25.1
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.4	0.4	0.0	0.1	0.4		0.1	1.1	0.0	4.9	0.4	0.2
Delay (s)	33.6	28.5	18.4	24.0	20.6		28.8	22.8	17.8	41.5	27.3	25.2
Level of Service	C	C	B	C	C		C	C	B	D	C	C
Approach Delay (s)		27.4			21.4			23.2			27.1	
Approach LOS		C			C			C			C	

Intersection Summary

HCM 2000 Control Delay	23.9	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.59		
Actuated Cycle Length (s)	74.3	Sum of lost time (s)	21.0
Intersection Capacity Utilization	57.8%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 10: Hacienda Dr & Martinelli Blvd/Hacienda Crossings



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗	↖↗	↖↗	↗		↖↗↘	↖↗↘	↖	↖↗	↖↗↘	
Traffic Volume (vph)	11	8	174	110	12	8	244	867	112	17	727	49
Future Volume (vph)	11	8	174	110	12	8	244	867	112	17	727	49
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	3.0	3.0	5.5	3.0		3.5	3.0	3.0	5.0	3.5	
Lane Util. Factor	1.00	0.91	0.91	0.97	1.00		0.94	0.91	1.00	0.97	0.86	
Frt	1.00	0.90	0.85	1.00	0.94		1.00	1.00	0.85	1.00	0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1770	1523	2882	3433	1748		4990	5085	1583	3433	6347	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1770	1523	2882	3433	1748		4990	5085	1583	3433	6347	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	12	9	189	120	13	9	265	942	122	18	790	53
RTOR Reduction (vph)	0	14	129	0	6	0	0	0	54	0	8	0
Lane Group Flow (vph)	12	14	41	120	16	0	265	942	68	18	835	0
Turn Type	Prot	NA	Perm	Prot	NA		Prot	NA	pm+ov	Prot	NA	
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases			2						8			
Actuated Green, G (s)	1.7	15.8	15.8	6.9	21.5		8.2	29.7	36.6	1.1	22.6	
Effective Green, g (s)	1.2	17.8	17.8	6.4	23.5		9.2	31.7	40.6	0.6	24.1	
Actuated g/C Ratio	0.02	0.24	0.24	0.09	0.32		0.13	0.43	0.56	0.01	0.33	
Clearance Time (s)	4.5	5.0	5.0	5.0	5.0		4.5	5.0	5.0	4.5	5.0	
Vehicle Extension (s)	3.0	4.0	4.0	2.0	4.0		3.0	4.0	2.0	3.0	4.0	
Lane Grp Cap (vph)	29	371	702	300	562		628	2208	945	28	2095	
v/s Ratio Prot	c0.01	0.01		c0.03	0.01		c0.05	c0.19	0.01	0.01	0.13	
v/s Ratio Perm			c0.01						0.03			
v/c Ratio	0.41	0.04	0.06	0.40	0.03		0.42	0.43	0.07	0.64	0.40	
Uniform Delay, d1	35.6	21.1	21.2	31.5	16.9		29.4	14.3	7.5	36.1	18.9	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	9.3	0.1	0.0	0.3	0.0		0.5	0.2	0.0	40.9	0.2	
Delay (s)	44.9	21.1	21.2	31.8	17.0		29.9	14.5	7.5	77.0	19.0	
Level of Service	D	C	C	C	B		C	B	A	E	B	
Approach Delay (s)		22.6			29.5			16.9			20.2	
Approach LOS		C			C			B			C	

Intersection Summary

HCM 2000 Control Delay	19.2	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.34		
Actuated Cycle Length (s)	73.0	Sum of lost time (s)	16.5
Intersection Capacity Utilization	42.6%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 11: Hacienda Dr & I-580 WB Ramps

BART to Livermore Extension Project
 2025 Enhanced Bus AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↔↔		↔↔		↑↑↑			↑↑↑	↔
Traffic Volume (vph)	0	0	0	285	0	452	0	1064	183	0	622	416
Future Volume (vph)	0	0	0	285	0	452	0	1064	183	0	622	416
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0		4.0		4.0			4.0	4.0
Lane Util. Factor				0.97		0.88		0.91			0.86	0.86
Frt				1.00		0.85		0.98			0.96	0.85
Flt Protected				0.95		1.00		1.00			1.00	1.00
Satd. Flow (prot)				3433		2787		4973			4625	1362
Flt Permitted				0.95		1.00		1.00			1.00	1.00
Satd. Flow (perm)				3433		2787		4973			4625	1362
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	310	0	491	0	1157	199	0	676	452
RTOR Reduction (vph)	0	0	0	0	0	98	0	45	0	0	92	92
Lane Group Flow (vph)	0	0	0	310	0	393	0	1311	0	0	810	134
Turn Type				Prot		Prot		NA			NA	Perm
Protected Phases				4		4		2			6	
Permitted Phases												6
Actuated Green, G (s)				10.9		10.9		27.8			27.8	27.8
Effective Green, g (s)				12.3		12.3		29.7			29.7	29.7
Actuated g/C Ratio				0.25		0.25		0.59			0.59	0.59
Clearance Time (s)				5.4		5.4		5.9			5.9	5.9
Vehicle Extension (s)				3.0		3.0		3.0			3.0	3.0
Lane Grp Cap (vph)				844		685		2953			2747	809
v/s Ratio Prot				0.09		c0.14		c0.26			0.18	
v/s Ratio Perm												0.10
v/c Ratio				0.37		0.57		0.44			0.29	0.17
Uniform Delay, d1				15.6		16.5		5.6			5.0	4.6
Progression Factor				1.00		1.00		0.53			1.00	1.00
Incremental Delay, d2				0.3		1.2		0.4			0.3	0.4
Delay (s)				15.9		17.7		3.4			5.3	5.0
Level of Service				B		B		A			A	A
Approach Delay (s)		0.0			17.0			3.4			5.2	
Approach LOS		A			B			A			A	

Intersection Summary			
HCM 2000 Control Delay	7.4	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.48		
Actuated Cycle Length (s)	50.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	47.1%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 12: Hacienda Dr & I-580 EB Ramps

BART to Livermore Extension Project
 2025 Enhanced Bus AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗		↖↗					↖↗↘	↖		↖↗↘	
Traffic Volume (vph)	751	0	1095	0	0	0	0	457	225	0	1012	149
Future Volume (vph)	751	0	1095	0	0	0	0	457	225	0	1012	149
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0					4.0	4.0		4.0	
Lane Util. Factor	0.97		0.88					0.86	0.86		0.91	
Frt	1.00		0.85					0.98	0.85		0.98	
Flt Protected	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (prot)	3433		2787					4710	1362		4987	
Flt Permitted	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (perm)	3433		2787					4710	1362		4987	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	816	0	1190	0	0	0	0	497	245	0	1100	162
RTOR Reduction (vph)	0	0	84	0	0	0	0	43	95	0	49	0
Lane Group Flow (vph)	816	0	1106	0	0	0	0	530	74	0	1213	0
Turn Type	Prot		Prot					NA	Perm		NA	
Protected Phases	4		4					2			6	
Permitted Phases									2			
Actuated Green, G (s)	18.6		18.6					20.1	20.1		20.1	
Effective Green, g (s)	20.0		20.0					22.0	22.0		22.0	
Actuated g/C Ratio	0.40		0.40					0.44	0.44		0.44	
Clearance Time (s)	5.4		5.4					5.9	5.9		5.9	
Vehicle Extension (s)	2.0		2.0					2.0	2.0		2.0	
Lane Grp Cap (vph)	1373		1114					2072	599		2194	
v/s Ratio Prot	0.24		c0.40					0.11			c0.24	
v/s Ratio Perm									0.05			
v/c Ratio	0.59		0.99					0.26	0.12		0.55	
Uniform Delay, d1	11.8		14.9					8.8	8.3		10.4	
Progression Factor	1.00		1.00					1.00	1.00		0.79	
Incremental Delay, d2	0.5		25.1					0.3	0.4		1.0	
Delay (s)	12.3		40.0					9.1	8.7		9.1	
Level of Service	B		D					A	A		A	
Approach Delay (s)		28.7			0.0			9.0			9.1	
Approach LOS		C			A			A			A	




































Intersection Summary

HCM 2000 Control Delay	18.9	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.76		
Actuated Cycle Length (s)	50.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	67.8%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
13: Hacienda Dr & Owens Rd

BART to Livermore Extension Project
2025 Enhanced Bus AM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 	  		 	  		 	  		 	  	
Traffic Volume (vph)	143	211	26	96	257	255	25	279	107	535	976	570
Future Volume (vph)	143	211	26	96	257	255	25	279	107	535	976	570
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	2.3	4.0	4.0	2.3	4.0	4.0	2.7	4.0	4.0	2.7
Lane Util. Factor	0.97	0.91	1.00	0.97	0.91	1.00	0.97	0.91	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5085	1583	3433	5085	1583	3433	5085	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5085	1583	3433	5085	1583	3433	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	155	229	28	104	279	277	27	303	116	582	1061	620
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	155	229	28	104	279	277	27	303	116	582	1061	620
Turn Type	Prot	NA	Free	Prot	NA	Free	Prot	NA	Free	Prot	NA	Free
Protected Phases	1	6		5	2		7	4		3	8	
Permitted Phases			Free			Free			Free			Free
Actuated Green, G (s)	4.0	8.8	59.2	4.0	8.8	59.2	1.4	9.0	59.2	18.4	26.0	59.2
Effective Green, g (s)	4.0	10.5	59.2	4.0	10.5	59.2	1.4	10.3	59.2	18.4	27.3	59.2
Actuated g/C Ratio	0.07	0.18	1.00	0.07	0.18	1.00	0.02	0.17	1.00	0.31	0.46	1.00
Clearance Time (s)	4.0	5.7		4.0	5.7		4.0	5.3		4.0	5.3	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	231	901	1583	231	901	1583	81	884	1583	1067	2344	1583
v/s Ratio Prot	0.05	0.05		0.03	0.05		0.01	0.06		c0.17	0.21	
v/s Ratio Perm			0.02			0.17			0.07			c0.39
v/c Ratio	0.67	0.25	0.02	0.45	0.31	0.17	0.33	0.34	0.07	0.55	0.45	0.39
Uniform Delay, d1	27.0	21.0	0.0	26.5	21.2	0.0	28.4	21.5	0.0	16.9	10.9	0.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	7.4	0.1	0.0	1.4	0.2	0.2	2.4	0.2	0.1	0.6	0.1	0.7
Delay (s)	34.4	21.1	0.0	27.9	21.4	0.2	30.9	21.7	0.1	17.5	11.0	0.7
Level of Service	C	C	A	C	C	A	C	C	A	B	B	A
Approach Delay (s)		24.7			13.5			16.6			9.9	
Approach LOS		C			B			B			A	
Intersection Summary												
HCM 2000 Control Delay			12.9			HCM 2000 Level of Service			B			
HCM 2000 Volume to Capacity ratio			0.57									
Actuated Cycle Length (s)			59.2			Sum of lost time (s)			16.0			
Intersection Capacity Utilization			45.4%			ICU Level of Service			A			
Analysis Period (min)			15									

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 14: Tassajara Rd & Dublin Blvd

BART to Livermore Extension Project
 2025 Enhanced Bus AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↑↑	↖↗	↖↗↘	↑↓		↖↗↘	↑↑↑	↖	↖↗	↑↑↑	↖↗
Traffic Volume (vph)	92	149	161	503	622	41	223	511	146	25	1245	226
Future Volume (vph)	92	149	161	503	622	41	223	511	146	25	1245	226
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	6.0	6.0	5.0	6.0		5.0	6.0	6.0	5.0	6.0	6.0
Lane Util. Factor	0.97	0.95	0.88	0.94	0.95		0.94	0.91	1.00	0.97	0.86	0.88
Frt	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	2787	4990	3506		4990	5085	1583	3433	6408	2787
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	2787	4990	3506		4990	5085	1583	3433	6408	2787
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	100	162	175	547	676	45	242	555	159	27	1353	246
RTOR Reduction (vph)	0	0	134	0	4	0	0	0	97	0	0	164
Lane Group Flow (vph)	100	162	41	547	717	0	242	555	62	27	1353	82
Turn Type	Prot	NA	Perm	Prot	NA		Prot	NA	Perm	Prot	NA	Perm
Protected Phases	5	2		1	6		3	8		7	NA	4
Permitted Phases			2						8			4
Actuated Green, G (s)	16.2	30.8	30.8	19.0	33.6		16.2	51.7	51.7	8.4	43.9	43.9
Effective Green, g (s)	16.2	30.8	30.8	19.0	33.6		16.2	51.7	51.7	8.4	43.9	43.9
Actuated g/C Ratio	0.12	0.23	0.23	0.14	0.25		0.12	0.39	0.39	0.06	0.33	0.33
Clearance Time (s)	5.0	6.0	6.0	5.0	6.0		5.0	6.0	6.0	5.0	6.0	6.0
Vehicle Extension (s)	2.0	3.0	3.0	2.0	3.0		2.0	4.0	4.0	2.0	4.0	4.0
Lane Grp Cap (vph)	421	826	650	718	893		612	1993	620	218	2132	927
v/s Ratio Prot	0.03	0.05		c0.11	c0.20		c0.05	0.11		0.01	c0.21	
v/s Ratio Perm			0.01						0.04			0.03
v/c Ratio	0.24	0.20	0.06	0.76	0.80		0.40	0.28	0.10	0.12	0.63	0.09
Uniform Delay, d1	52.3	40.6	39.3	54.3	46.1		53.3	27.4	25.4	58.3	37.2	30.2
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.1	0.1	0.0	4.3	5.3		0.2	0.1	0.1	0.1	0.7	0.1
Delay (s)	52.4	40.7	39.4	58.6	51.3		53.5	27.5	25.5	58.4	37.9	30.3
Level of Service	D	D	D	E	D		D	C	C	E	D	C
Approach Delay (s)		42.8			54.5			33.7			37.1	
Approach LOS		D			D			C			D	

Intersection Summary		
HCM 2000 Control Delay	42.1	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.69	D
Actuated Cycle Length (s)	131.9	Sum of lost time (s)
Intersection Capacity Utilization	81.5%	22.0
Analysis Period (min)	15	ICU Level of Service
		D

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 15: Tassajara Rd & I-580 WB Ramps

BART to Livermore Extension Project
 2025 Enhanced Bus AM































Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↔↔		↔↔		↑↑	↔		↑↑↔	↔
Traffic Volume (vph)	0	0	0	557	0	293	0	1033	468	0	940	935
Future Volume (vph)	0	0	0	557	0	293	0	1033	468	0	940	935
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0		4.0		4.0	4.0		4.0	4.0
Lane Util. Factor				0.97		0.88		0.95	1.00		0.86	0.86
Frt				1.00		0.85		1.00	0.85		0.95	0.85
Flt Protected				0.95		1.00		1.00	1.00		1.00	1.00
Satd. Flow (prot)				3433		2787		3539	1583		4567	1362
Flt Permitted				0.95		1.00		1.00	1.00		1.00	1.00
Satd. Flow (perm)				3433		2787		3539	1583		4567	1362
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	605	0	318	0	1123	509	0	1022	1016
RTOR Reduction (vph)	0	0	0	0	0	28	0	0	283	0	208	283
Lane Group Flow (vph)	0	0	0	605	0	290	0	1123	226	0	1322	225
Turn Type				Perm		Perm		NA	Perm		NA	Perm
Protected Phases								2			6	
Permitted Phases				8		8			2			6
Actuated Green, G (s)				12.2		12.2		16.1	16.1		16.1	16.1
Effective Green, g (s)				12.2		12.2		16.1	16.1		16.1	16.1
Actuated g/C Ratio				0.34		0.34		0.44	0.44		0.44	0.44
Clearance Time (s)				4.0		4.0		4.0	4.0		4.0	4.0
Vehicle Extension (s)				3.0		3.0		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)				1153		936		1569	702		2025	604
v/s Ratio Prot								c0.32			0.29	
v/s Ratio Perm				c0.18		0.10			0.14			0.17
v/c Ratio				0.52		0.31		0.72	0.32		0.65	0.37
Uniform Delay, d1				9.7		8.9		8.2	6.6		7.9	6.7
Progression Factor				1.00		1.00		1.00	1.00		1.00	1.00
Incremental Delay, d2				0.4		0.2		1.6	0.3		0.8	0.4
Delay (s)				10.1		9.1		9.8	6.8		8.7	7.1
Level of Service				B		A		A	A		A	A
Approach Delay (s)		0.0			9.8			8.9			8.3	
Approach LOS		A			A			A			A	

Intersection Summary			
HCM 2000 Control Delay	8.8	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.63		
Actuated Cycle Length (s)	36.3	Sum of lost time (s)	8.0
Intersection Capacity Utilization	51.1%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 16: Santa Rita Rd & I-580 EB Ramps/Pimilco Dr

BART to Livermore Extension Project
 2025 Enhanced Bus AM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 		 	 		 		  			 	
Traffic Volume (vph)	537	120	676	182	0	192	0	731	107	193	1246	0
Future Volume (vph)	537	120	676	182	0	192	0	731	107	193	1246	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0		4.0		4.0		4.0	4.0	
Lane Util. Factor	0.97	1.00	1.00	0.97		0.88		0.86		1.00	0.95	
Frt	1.00	1.00	0.85	1.00		0.85		0.98		1.00	1.00	
Flt Protected	0.95	1.00	1.00	0.95		1.00		1.00		0.95	1.00	
Satd. Flow (prot)	3433	1863	1583	3433		2787		6285		1770	3539	
Flt Permitted	0.95	1.00	1.00	0.95		1.00		1.00		0.95	1.00	
Satd. Flow (perm)	3433	1863	1583	3433		2787		6285		1770	3539	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	584	130	735	198	0	209	0	795	116	210	1354	0
RTOR Reduction (vph)	0	0	0	0	0	72	0	44	0	0	0	0
Lane Group Flow (vph)	584	130	735	198	0	137	0	867	0	210	1354	0
Turn Type	Perm	NA	Free	Prot		pm+ov		NA		Prot	NA	Perm
Protected Phases		4		3		1		2		1	6	
Permitted Phases	4		Free			3						6
Actuated Green, G (s)	14.3	14.3	57.2	4.0		12.1		14.8		8.1	26.9	
Effective Green, g (s)	14.3	14.3	57.2	4.0		12.1		14.8		8.1	26.9	
Actuated g/C Ratio	0.25	0.25	1.00	0.07		0.21		0.26		0.14	0.47	
Clearance Time (s)	4.0	4.0		4.0		4.0		4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0		3.0		3.0		3.0	3.0	
Lane Grp Cap (vph)	858	465	1583	240		589		1626		250	1664	
v/s Ratio Prot		0.07		0.06		0.03		0.14		0.12	c0.38	
v/s Ratio Perm	c0.17		c0.46			0.02						
v/c Ratio	0.68	0.28	0.46	0.82		0.23		0.53		0.84	0.81	
Uniform Delay, d1	19.4	17.3	0.0	26.3		18.7		18.2		23.9	13.0	
Progression Factor	1.00	1.00	1.00	1.00		1.00		1.00		1.00	1.00	
Incremental Delay, d2	2.2	0.3	1.0	20.1		0.2		0.3		21.2	3.2	
Delay (s)	21.6	17.6	1.0	46.3		18.9		18.6		45.2	16.2	
Level of Service	C	B	A	D		B		B		D	B	
Approach Delay (s)		10.8			32.2			18.6			20.1	
Approach LOS		B			C			B			C	
Intersection Summary												
HCM 2000 Control Delay			17.8								HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio			0.86									
Actuated Cycle Length (s)			57.2								Sum of lost time (s)	16.0
Intersection Capacity Utilization			56.4%								ICU Level of Service	B
Analysis Period (min)			15									

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 17: Santa Rita Rd & Valley Ave

BART to Livermore Extension Project
 2025 Enhanced Bus AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	187	223	79	180	331	827	92	472	72	572	917	155
Future Volume (vph)	187	223	79	180	331	827	92	472	72	572	917	155
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.97	0.95		0.97	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.98		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	3433	3469		3433	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	3433	3469		3433	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	203	242	86	196	360	899	100	513	78	622	997	168
RTOR Reduction (vph)	0	0	71	0	0	0	0	17	0	0	0	100
Lane Group Flow (vph)	203	242	15	196	360	899	100	574	0	622	997	68
Turn Type	Prot	NA	Perm	Prot	NA	Free	Prot	NA		Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			Free						6
Actuated Green, G (s)	7.7	11.5	11.5	8.1	11.9	64.8	3.1	16.1		13.1	26.1	26.1
Effective Green, g (s)	7.7	11.5	11.5	8.1	11.9	64.8	3.1	16.1		13.1	26.1	26.1
Actuated g/C Ratio	0.12	0.18	0.18	0.12	0.18	1.00	0.05	0.25		0.20	0.40	0.40
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	407	628	280	221	649	1583	164	861		694	1425	637
v/s Ratio Prot	0.06	0.07		c0.11	0.10		0.03	0.17		c0.18	c0.28	
v/s Ratio Perm			0.01			c0.57						0.04
v/c Ratio	0.50	0.39	0.05	0.89	0.55	0.57	0.61	0.67		0.90	0.70	0.11
Uniform Delay, d1	26.7	23.5	22.1	27.9	24.0	0.0	30.3	21.9		25.2	16.1	12.1
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	1.0	0.4	0.1	31.8	1.0	1.5	6.3	2.0		14.2	1.5	0.1
Delay (s)	27.7	23.9	22.2	59.7	25.1	1.5	36.5	23.9		39.4	17.6	12.1
Level of Service	C	C	C	E	C	A	D	C		D	B	B
Approach Delay (s)		25.1			15.2			25.7			24.7	
Approach LOS		C			B			C			C	

Intersection Summary		
HCM 2000 Control Delay	21.8	HCM 2000 Level of Service C
HCM 2000 Volume to Capacity ratio	0.84	
Actuated Cycle Length (s)	64.8	Sum of lost time (s) 16.0
Intersection Capacity Utilization	61.1%	ICU Level of Service B
Analysis Period (min)	15	

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
18: Bernal Ave/Valley Ave & Stanley Blvd

BART to Livermore Extension Project
2025 Enhanced Bus AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	204	202	52	250	895	954	173	476	106	139	344	116
Future Volume (vph)	204	202	52	250	895	954	173	476	106	139	344	116
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.95	1.00	0.97	0.91	0.91	1.00	0.95	1.00	0.97	0.95	0.95
Frt	1.00	1.00	0.85	1.00	0.96	0.85	1.00	1.00	0.85	1.00	0.96	0.96
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	3433	3238	1441	1770	3539	1583	3433	3405	3405
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	3433	3238	1441	1770	3539	1583	3433	3405	3405
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	222	220	57	272	973	1037	188	517	115	151	374	126
RTOR Reduction (vph)	0	0	28	0	46	28	0	0	91	0	38	0
Lane Group Flow (vph)	222	220	29	272	1342	594	188	517	24	151	462	0
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	NA
Protected Phases	7	4	5	3	8	1	5	2		1	6	
Permitted Phases			4			8			2			
Actuated Green, G (s)	6.0	32.1	43.7	11.0	37.1	46.9	11.6	18.2	18.2	9.8	16.4	16.4
Effective Green, g (s)	6.0	32.1	43.7	11.0	37.1	46.9	11.6	18.2	18.2	9.8	16.4	16.4
Actuated g/C Ratio	0.07	0.37	0.50	0.13	0.43	0.54	0.13	0.21	0.21	0.11	0.19	0.19
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	236	1304	866	433	1379	842	235	739	330	386	641	641
v/s Ratio Prot	c0.06	0.06	0.00	0.08	c0.41	0.08	c0.11	c0.15		0.04	0.14	0.14
v/s Ratio Perm			0.01			0.33			0.02			
v/c Ratio	0.94	0.17	0.03	0.63	0.97	0.71	0.80	0.70	0.07	0.39	0.72	0.72
Uniform Delay, d1	40.4	18.5	11.0	36.1	24.5	15.0	36.6	31.9	27.7	35.9	33.2	33.2
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	42.3	0.1	0.0	2.8	18.0	2.7	17.5	2.9	0.1	0.7	4.0	4.0
Delay (s)	82.7	18.6	11.0	39.0	42.5	17.7	54.1	34.8	27.8	36.5	37.2	37.2
Level of Service	F	B	B	D	D	B	D	C	C	D	D	D
Approach Delay (s)		46.2			35.3			38.2			37.0	
Approach LOS		D			D			D			D	

Intersection Summary		
HCM 2000 Control Delay	37.4	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.89	D
Actuated Cycle Length (s)	87.1	Sum of lost time (s)
Intersection Capacity Utilization	76.9%	16.0
Analysis Period (min)	15	ICU Level of Service
		D

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 19: Fallon Rd & Dublin Blvd

BART to Livermore Extension Project
 2025 Enhanced Bus AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	45	52	83	277	1084	340	739	238	27	55	664	323
Future Volume (vph)	45	52	83	277	1084	340	739	238	27	55	664	323
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.3	5.3	5.3	4.0	4.0	4.0	5.3	4.9	4.9	5.3	4.9	4.9
Lane Util. Factor	0.97	0.91	0.88	0.94	0.91	1.00	0.97	0.91	0.88	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3090	4577	2508	4491	4577	1425	3090	4577	2508	3090	4577	1425
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3090	4577	2508	4491	4577	1425	3090	4577	2508	3090	4577	1425
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	49	57	90	301	1178	370	803	259	29	60	722	351
RTOR Reduction (vph)	0	0	58	0	0	273	0	0	15	0	0	149
Lane Group Flow (vph)	49	57	32	301	1178	97	803	259	14	60	722	202
Turn Type	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	5	2	3	1	6		3	8		7	4	
Permitted Phases			2			6			8			4
Actuated Green, G (s)	3.1	9.3	39.2	22.8	29.0	29.0	29.9	54.6	54.6	4.5	29.2	29.2
Effective Green, g (s)	3.1	9.3	39.2	22.8	29.0	29.0	29.9	54.6	54.6	4.5	29.2	29.2
Actuated g/C Ratio	0.03	0.08	0.35	0.21	0.26	0.26	0.27	0.49	0.49	0.04	0.26	0.26
Clearance Time (s)	5.3	5.3	5.3	4.0	4.0	4.0	5.3	4.9	4.9	5.3	4.9	4.9
Vehicle Extension (s)	2.0	4.0	2.0	2.0	2.0	2.0	2.0	4.0	4.0	2.0	4.0	4.0
Lane Grp Cap (vph)	86	384	888	924	1199	373	834	2257	1237	125	1207	375
v/s Ratio Prot	0.02	0.01	0.01	c0.07	c0.26		c0.26	0.06		0.02	c0.16	
v/s Ratio Perm			0.00			0.07			0.01			0.14
v/c Ratio	0.57	0.15	0.04	0.33	0.98	0.26	0.96	0.11	0.01	0.48	0.60	0.54
Uniform Delay, d1	53.1	47.0	23.4	37.4	40.6	32.4	39.9	15.1	14.3	52.0	35.6	35.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	5.1	0.2	0.0	0.1	21.7	0.1	22.3	0.0	0.0	1.1	0.9	1.9
Delay (s)	58.2	47.3	23.4	37.5	62.3	32.5	62.1	15.1	14.3	53.0	36.6	36.9
Level of Service	E	D	C	D	E	C	E	B	B	D	D	D
Approach Delay (s)		39.0			52.3			49.7			37.5	
Approach LOS		D			D			D			D	

Intersection Summary

HCM 2000 Control Delay	47.1	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.84		
Actuated Cycle Length (s)	110.7	Sum of lost time (s)	19.5
Intersection Capacity Utilization	80.4%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 20: El Charro Rd/Fallon Rd & I-580 WB Ramps

BART to Livermore Extension Project
 2025 Enhanced Bus AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↙	↖	↗		↑	↘		↕	↙
Traffic Volume (vph)	0	0	0	172	0	609	0	554	478	0	523	399
Future Volume (vph)	0	0	0	172	0	609	0	554	478	0	523	399
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0	4.0	4.0		4.0	4.0		4.0	4.0
Lane Util. Factor				0.95	0.95	0.88		0.95	0.95		0.95	1.00
Frt				1.00	1.00	0.85		0.99	0.85		1.00	0.85
Flt Protected				0.95	0.95	1.00		1.00	1.00		1.00	1.00
Satd. Flow (prot)				1681	1681	2787		1749	1504		3539	1583
Flt Permitted				0.95	0.95	1.00		1.00	1.00		1.00	1.00
Satd. Flow (perm)				1681	1681	2787		1749	1504		3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	187	0	662	0	602	520	0	568	434
RTOR Reduction (vph)	0	0	0	0	0	370	0	5	177	0	0	164
Lane Group Flow (vph)	0	0	0	95	92	292	0	649	291	0	568	270
Turn Type				Perm	NA	Perm		NA	Perm		NA	Perm
Protected Phases					8			2			6	
Permitted Phases				8		8			2			6
Actuated Green, G (s)				11.4	11.4	11.4		31.1	31.1		31.1	31.1
Effective Green, g (s)				10.9	10.9	10.9		31.1	31.1		31.1	31.1
Actuated g/C Ratio				0.22	0.22	0.22		0.62	0.62		0.62	0.62
Clearance Time (s)				3.5	3.5	3.5		4.0	4.0		4.0	4.0
Vehicle Extension (s)				2.0	2.0	2.0		2.0	2.0		2.0	2.0
Lane Grp Cap (vph)				366	366	607		1087	935		2201	984
v/s Ratio Prot								c0.37			0.16	
v/s Ratio Perm				0.06	0.05	c0.10			0.19			0.17
v/c Ratio				0.26	0.25	0.48		0.60	0.31		0.26	0.27
Uniform Delay, d1				16.2	16.2	17.1		5.7	4.4		4.3	4.3
Progression Factor				1.00	1.00	1.00		0.56	0.21		1.00	1.00
Incremental Delay, d2				0.1	0.1	0.2		2.3	0.8		0.3	0.7
Delay (s)				16.3	16.3	17.3		5.5	1.7		4.5	5.0
Level of Service				B	B	B		A	A		A	A
Approach Delay (s)		0.0			17.1			3.9			4.7	
Approach LOS		A			B			A			A	

Intersection Summary

HCM 2000 Control Delay	8.0	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.57		
Actuated Cycle Length (s)	50.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	66.8%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 21: El Charro Rd & I-580 EB Ramps

BART to Livermore Extension Project
 2025 Enhanced Bus AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	245	0	401	0	0	0	0	761	142	0	375	0
Future Volume (vph)	245	0	401	0	0	0	0	761	142	0	375	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0					4.0	4.0		4.0	
Lane Util. Factor	0.97		0.88					0.91	0.91		0.91	
Frt	1.00		0.85					1.00	0.85		1.00	
Flt Protected	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (prot)	3433		2787					3379	1441		3390	
Flt Permitted	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (perm)	3433		2787					3379	1441		3390	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	266	0	436	0	0	0	0	827	154	0	408	0
RTOR Reduction (vph)	0	0	364	0	0	0	0	2	44	0	0	0
Lane Group Flow (vph)	266	0	72	0	0	0	0	843	92	0	408	0
Turn Type	Prot		Perm					NA	Perm		NA	Perm
Protected Phases	4							2			6	
Permitted Phases			4						2			6
Actuated Green, G (s)	8.2		8.2					33.8	33.8		33.8	
Effective Green, g (s)	8.2		8.2					33.8	33.8		33.8	
Actuated g/C Ratio	0.16		0.16					0.68	0.68		0.68	
Clearance Time (s)	4.0		4.0					4.0	4.0		4.0	
Vehicle Extension (s)	2.0		2.0					3.0	3.0		3.0	
Lane Grp Cap (vph)	563		457					2284	974		2291	
v/s Ratio Prot	c0.08							c0.25			0.12	
v/s Ratio Perm			0.03						0.06			
v/c Ratio	0.47		0.16					0.37	0.09		0.18	
Uniform Delay, d1	18.9		17.9					3.5	2.8		3.0	
Progression Factor	1.00		1.00					0.82	0.60		1.05	
Incremental Delay, d2	0.2		0.1					0.4	0.2		0.2	
Delay (s)	19.2		18.0					3.3	1.9		3.3	
Level of Service	B		B					A	A		A	
Approach Delay (s)		18.4			0.0			3.1			3.3	
Approach LOS		B			A			A			A	

Intersection Summary

HCM 2000 Control Delay	8.3	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.39		
Actuated Cycle Length (s)	50.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	36.2%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 22: El Charro Rd & Stoneridge Dr/Jack London Blvd

BART to Livermore Extension Project
 2025 Enhanced Bus AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔↔↔	↑↑	↗	↖	↑↑	↗↗	↖	↑↑		↖↖↖	↑	↗↗
Traffic Volume (vph)	147	99	8	16	596	632	7	96	2	210	90	176
Future Volume (vph)	147	99	8	16	596	632	7	96	2	210	90	176
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	0.94	0.95	1.00	1.00	0.95	0.88	1.00	0.95		0.94	1.00	0.88
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	4491	3185	1425	1593	3185	2508	1593	3176		4491	1676	2508
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	4491	3185	1425	1593	3185	2508	1593	3176		4491	1676	2508
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	160	108	9	17	648	687	8	104	2	228	98	191
RTOR Reduction (vph)	0	0	6	0	0	382	0	1	0	0	0	107
Lane Group Flow (vph)	160	108	3	17	648	305	8	105	0	228	98	84
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Prot	NA		Prot	NA	Perm
Protected Phases	7	4		3	8	1	5	2		1	6	
Permitted Phases			4			8						6
Actuated Green, G (s)	8.9	35.2	35.2	3.1	29.4	44.4	1.5	30.7		15.0	44.2	44.2
Effective Green, g (s)	8.9	35.2	35.2	3.1	29.4	44.4	1.5	30.7		15.0	44.2	44.2
Actuated g/C Ratio	0.09	0.35	0.35	0.03	0.29	0.44	0.02	0.31		0.15	0.44	0.44
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	399	1121	501	49	936	1113	23	975		673	740	1108
v/s Ratio Prot	c0.04	0.03		0.01	c0.20	0.04	c0.01	0.03		c0.05	c0.06	
v/s Ratio Perm			0.00			0.08						0.03
v/c Ratio	0.40	0.10	0.01	0.35	0.69	0.27	0.35	0.11		0.34	0.13	0.08
Uniform Delay, d1	43.0	21.7	21.0	47.5	31.3	17.6	48.8	24.8		38.1	16.5	16.1
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		0.95	0.92	0.97
Incremental Delay, d2	0.7	0.0	0.0	4.2	2.2	0.1	8.9	0.2		0.3	0.4	0.1
Delay (s)	43.7	21.8	21.0	51.7	33.5	17.7	57.7	25.1		36.3	15.6	15.8
Level of Service	D	C	C	D	C	B	E	C		D	B	B
Approach Delay (s)		34.4			25.7			27.3			24.8	
Approach LOS		C			C			C			C	

Intersection Summary		
HCM 2000 Control Delay	26.7	HCM 2000 Level of Service C
HCM 2000 Volume to Capacity ratio	0.39	
Actuated Cycle Length (s)	100.0	Sum of lost time (s) 16.0
Intersection Capacity Utilization	42.7%	ICU Level of Service A
Analysis Period (min)	15	

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
24: Airway Blvd/Driveway & N Canyons Pkwy

BART to Livermore Extension Project
2025 Enhanced Bus AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑	↑	↑↑	↑	↑		↑	↑↑		↑	
Traffic Volume (vph)	0	56	80	687	476	0	1136	0	896	0	0	0
Future Volume (vph)	0	56	80	687	476	0	1136	0	896	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0	4.0	4.0			4.4	4.0			
Lane Util. Factor		0.95	1.00	0.97	1.00			1.00	0.88			
Frt		1.00	0.85	1.00	1.00			1.00	0.85			
Flt Protected		1.00	1.00	0.95	1.00			0.95	1.00			
Satd. Flow (prot)		3539	1583	3433	1863			1770	2787			
Flt Permitted		1.00	1.00	0.95	1.00			0.95	1.00			
Satd. Flow (perm)		3539	1583	3433	1863			1770	2787			
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	61	87	747	517	0	1235	0	974	0	0	0
RTOR Reduction (vph)	0	0	79	0	0	0	0	0	58	0	0	0
Lane Group Flow (vph)	0	61	8	747	517	0	0	1235	916	0	0	0
Turn Type		NA	Perm	Prot	NA	Perm	Split	NA	pm+ov			
Protected Phases		2		1	6		8	8	1	4	4	
Permitted Phases			2			6			8			
Actuated Green, G (s)		10.2	10.2	36.8	53.0			76.8	113.6			
Effective Green, g (s)		12.2	12.2	38.8	55.0			76.6	117.6			
Actuated g/C Ratio		0.09	0.09	0.28	0.39			0.55	0.84			
Clearance Time (s)		6.0	6.0	6.0	6.0			4.2	6.0			
Vehicle Extension (s)		3.0	3.0	3.0	3.0			3.0	3.0			
Lane Grp Cap (vph)		308	137	951	731			968	2420			
v/s Ratio Prot		0.02		c0.22	c0.28			c0.70	0.10			
v/s Ratio Perm			0.00						0.22			
v/c Ratio		0.20	0.06	0.79	0.71			1.28	0.38			
Uniform Delay, d1		59.4	58.6	46.8	35.7			31.7	2.6			
Progression Factor		1.00	1.00	1.00	1.00			1.00	1.00			
Incremental Delay, d2		1.4	0.8	4.3	5.7			132.2	0.1			
Delay (s)		60.8	59.4	51.1	41.4			163.9	2.7			
Level of Service		E	E	D	D			F	A			
Approach Delay (s)		60.0			47.1			92.8			0.0	
Approach LOS		E			D			F			A	

Intersection Summary

HCM 2000 Control Delay	75.5	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.12		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	16.4
Intersection Capacity Utilization	96.2%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
25: Airway Blvd & I-580 WB Ramps

BART to Livermore Extension Project
2025 Enhanced Bus AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↙	↖	↗		↑↑	↗		↑↑↑	
Traffic Volume (vph)	0	0	0	63	43	814	0	1302	343	0	281	553
Future Volume (vph)	0	0	0	63	43	814	0	1302	343	0	281	553
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0	4.0	4.0		4.0	4.0		4.0	
Lane Util. Factor				0.95	0.95	0.88		0.95	1.00		0.91	
Frt				1.00	1.00	0.85		1.00	0.85		0.90	
Flt Protected				0.95	0.98	1.00		1.00	1.00		1.00	
Satd. Flow (prot)				1681	1734	2787		3539	1583		4579	
Flt Permitted				0.95	0.98	1.00		1.00	1.00		1.00	
Satd. Flow (perm)				1681	1734	2787		3539	1583		4579	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	68	47	885	0	1415	373	0	305	601
RTOR Reduction (vph)	0	0	0	0	0	31	0	0	161	0	260	0
Lane Group Flow (vph)	0	0	0	36	79	854	0	1415	212	0	646	0
Turn Type				Split	NA	Perm		NA	Perm		NA	
Protected Phases				8	8			2			6	
Permitted Phases						8			2			
Actuated Green, G (s)				35.2	35.2	35.2		55.5	55.5		55.5	
Effective Green, g (s)				35.2	35.2	35.2		56.8	56.8		56.8	
Actuated g/C Ratio				0.35	0.35	0.35		0.57	0.57		0.57	
Clearance Time (s)				4.0	4.0	4.0		5.3	5.3		5.3	
Vehicle Extension (s)				2.0	2.0	2.0		4.0	4.0		4.0	
Lane Grp Cap (vph)				591	610	981		2010	899		2600	
v/s Ratio Prot				0.02	0.05			c0.40			0.14	
v/s Ratio Perm						c0.31			0.13			
v/c Ratio				0.06	0.13	0.87		0.70	0.24		0.25	
Uniform Delay, d1				21.5	22.0	30.3		15.5	10.8		10.9	
Progression Factor				1.00	1.00	1.00		0.64	0.46		1.00	
Incremental Delay, d2				0.0	0.0	8.3		1.9	0.6		0.2	
Delay (s)				21.5	22.0	38.5		11.9	5.5		11.1	
Level of Service				C	C	D		B	A		B	
Approach Delay (s)		0.0			36.6			10.5			11.1	
Approach LOS		A			D			B			B	

Intersection Summary

HCM 2000 Control Delay	17.7	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.77		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	71.1%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 26: Airway Blvd & I-580 EB Ramps/Kitty Hawk Rd

BART to Livermore Extension Project
 2025 Enhanced Bus AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↑	↖	↖	↑	↖	↖	↕↔		↖	↕↔	
Traffic Volume (vph)	654	193	164	22	34	102	26	508	157	82	117	152
Future Volume (vph)	654	193	164	22	34	102	26	508	157	82	117	152
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.4	4.4	4.4	4.0	4.0		4.0	4.0	
Lane Util. Factor	0.97	1.00	1.00	1.00	1.00	1.00	1.00	0.95		1.00	0.95	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.96		1.00	0.92	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	3433	1863	1583	1770	1863	1583	1770	3414		1770	3239	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	3433	1863	1583	1770	1863	1583	1770	3414		1770	3239	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	711	210	178	24	37	111	28	552	171	89	127	165
RTOR Reduction (vph)	0	0	134	0	0	88	0	27	0	0	86	0
Lane Group Flow (vph)	711	210	44	24	37	23	28	696	0	89	206	0
Turn Type	Split	NA	Perm	Split	NA	pm+ov	Prot	NA		Prot	NA	
Protected Phases	7	7		8	8	1	5	2		1	6	
Permitted Phases			7			8						
Actuated Green, G (s)	24.7	24.7	24.7	8.4	8.4	18.5	3.8	39.5		10.1	46.3	
Effective Green, g (s)	24.7	24.7	24.7	8.0	8.0	17.7	3.3	40.8		10.1	47.6	
Actuated g/C Ratio	0.25	0.25	0.25	0.08	0.08	0.18	0.03	0.41		0.10	0.48	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	3.5	5.3		4.0	5.3	
Vehicle Extension (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	3.5		2.0	4.0	
Lane Grp Cap (vph)	847	460	391	141	149	349	58	1392		178	1541	
v/s Ratio Prot	c0.21	0.11		0.01	c0.02	0.01	0.02	c0.20		c0.05	0.06	
v/s Ratio Perm			0.03			0.01						
v/c Ratio	0.84	0.46	0.11	0.17	0.25	0.07	0.48	0.50		0.50	0.13	
Uniform Delay, d1	35.8	32.0	29.2	42.9	43.2	34.3	47.5	22.0		42.6	14.7	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		0.99	0.86	
Incremental Delay, d2	7.0	0.3	0.0	0.2	0.3	0.0	2.3	1.3		0.8	0.2	
Delay (s)	42.8	32.2	29.2	43.1	43.5	34.3	49.8	23.3		42.7	12.7	
Level of Service	D	C	C	D	D	C	D	C		D	B	
Approach Delay (s)		38.6			37.5			24.3			19.7	
Approach LOS		D			D			C			B	

Intersection Summary

HCM 2000 Control Delay	31.0	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.58		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	16.8
Intersection Capacity Utilization	58.9%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 27: Collier Canyon Rd & N Canyons Pkwy/Portola Ave

BART to Livermore Extension Project
 2025 Enhanced Bus AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↕	↖	↖	↕	↖	↖	↕		↖	↕	↖
Traffic Volume (vph)	188	219	104	230	828	59	48	5	113	64	14	129
Future Volume (vph)	188	219	104	230	828	59	48	5	113	64	14	129
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	5.2	5.2
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.86		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	1770	1594		1770	1863	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	1770	1594		1770	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	204	238	113	250	900	64	52	5	123	70	15	140
RTOR Reduction (vph)	0	0	81	0	0	40	0	99	0	0	0	106
Lane Group Flow (vph)	204	238	32	250	900	24	52	29	0	70	15	34
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA		Prot	NA	Perm
Protected Phases	1	6		5	2		3	8		7		4
Permitted Phases			6			2						4
Actuated Green, G (s)	5.2	17.4	17.4	11.4	23.6	23.6	2.2	11.8		6.6	16.6	16.6
Effective Green, g (s)	5.2	18.7	18.7	11.4	24.9	24.9	2.2	12.8		6.6	16.0	16.0
Actuated g/C Ratio	0.08	0.29	0.29	0.17	0.38	0.38	0.03	0.20		0.10	0.24	0.24
Clearance Time (s)	4.0	5.3	5.3	4.0	5.3	5.3	4.0	5.0		4.0	4.6	4.6
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	272	1010	451	308	1345	601	59	311		178	455	386
v/s Ratio Prot	0.06	0.07		c0.14	c0.25		c0.03	0.02		c0.04	0.01	
v/s Ratio Perm			0.02			0.02						c0.02
v/c Ratio	0.75	0.24	0.07	0.81	0.67	0.04	0.88	0.09		0.39	0.03	0.09
Uniform Delay, d1	29.5	17.9	17.1	26.0	16.9	12.8	31.5	21.6		27.6	18.9	19.1
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	11.0	0.1	0.1	14.9	1.3	0.0	75.7	0.1		1.4	0.0	0.1
Delay (s)	40.5	18.0	17.1	40.9	18.2	12.8	107.2	21.7		29.0	18.9	19.2
Level of Service	D	B	B	D	B	B	F	C		C	B	B
Approach Delay (s)		26.1			22.6			46.4			22.2	
Approach LOS		C			C			D			C	

Intersection Summary

HCM 2000 Control Delay	25.4	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.57		
Actuated Cycle Length (s)	65.5	Sum of lost time (s)	17.2
Intersection Capacity Utilization	49.5%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
28: Isabel Ave/Campus Hill Dr & Portola Ave

BART to Livermore Extension Project
2025 Enhanced Bus AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↘	↑↑	↗↗	↘↘↘	↑↑		↘↘	↑↑	↗	↘	↑↑	↗
Traffic Volume (vph)	1	190	281	631	594	141	501	300	80	39	155	1
Future Volume (vph)	1	190	281	631	594	141	501	300	80	39	155	1
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	5.8	5.8
Lane Util. Factor	1.00	0.95	0.88	0.94	0.95		0.97	0.95	1.00	1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	0.97		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3539	2787	4990	3438		3433	3539	1583	1770	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	3539	2787	4990	3438		3433	3539	1583	1770	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	1	207	305	686	646	153	545	326	87	42	168	1
RTOR Reduction (vph)	0	0	237	0	14	0	0	0	58	0	0	1
Lane Group Flow (vph)	1	207	68	686	785	0	545	326	29	42	168	0
Turn Type	Prot	NA	Perm	Prot	NA		Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4						2			6
Actuated Green, G (s)	1.5	18.3	18.3	17.1	33.9		20.1	28.3	28.3	5.3	13.9	13.9
Effective Green, g (s)	1.5	19.6	19.6	17.1	35.2		20.1	29.6	29.6	5.3	13.0	13.0
Actuated g/C Ratio	0.02	0.22	0.22	0.20	0.40		0.23	0.34	0.34	0.06	0.15	0.15
Clearance Time (s)	4.0	5.3	5.3	4.0	5.3		4.0	5.3	5.3	4.0	4.9	4.9
Vehicle Extension (s)	2.0	3.0	3.0	2.0	3.0		2.0	3.0	3.0	2.0	3.0	3.0
Lane Grp Cap (vph)	30	791	623	974	1381		787	1195	534	107	525	234
v/s Ratio Prot	0.00	0.06		c0.14	c0.23		c0.16	c0.09		0.02	0.05	
v/s Ratio Perm			0.02						0.02			0.00
v/c Ratio	0.03	0.26	0.11	0.70	0.57		0.69	0.27	0.06	0.39	0.32	0.00
Uniform Delay, d1	42.3	28.0	27.1	32.9	20.3		30.9	21.2	19.6	39.6	33.3	31.8
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.2	0.2	0.1	1.9	0.5		2.1	0.1	0.0	0.9	0.4	0.0
Delay (s)	42.5	28.2	27.1	34.8	20.9		33.1	21.3	19.6	40.5	33.7	31.8
Level of Service	D	C	C	C	C		C	C	B	D	C	C
Approach Delay (s)		27.6			27.3			27.8			35.0	
Approach LOS		C			C			C			D	

Intersection Summary		
HCM 2000 Control Delay	28.0	HCM 2000 Level of Service C
HCM 2000 Volume to Capacity ratio	0.62	
Actuated Cycle Length (s)	87.6	Sum of lost time (s) 17.8
Intersection Capacity Utilization	67.5%	ICU Level of Service C
Analysis Period (min)	15	

c Critical Lane Group























HCM Signalized Intersection Capacity Analysis
 29: Isabel Ave & I-580 WB Ramps

BART to Livermore Extension Project
 2025 Enhanced Bus AM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations													
Traffic Volume (vph)	0	0	0	652	0	414	0	494	0	0	503	593	
Future Volume (vph)	0	0	0	652	0	414	0	494	0	0	503	593	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)				4.0		4.0		5.6			5.6	5.6	
Lane Util. Factor				0.97		1.00		0.95			0.95	1.00	
Frt				1.00		0.85		1.00			1.00	0.85	
Flt Protected				0.95		1.00		1.00			1.00	1.00	
Satd. Flow (prot)				3433		1583		3539			3539	1583	
Flt Permitted				0.95		1.00		1.00			1.00	1.00	
Satd. Flow (perm)				3433		1583		3539			3539	1583	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	
Adj. Flow (vph)	0	0	0	709	0	450	0	537	0	0	547	645	
RTOR Reduction (vph)	0	0	0	0	0	162	0	0	0	0	0	310	
Lane Group Flow (vph)	0	0	0	709	0	288	0	537	0	0	547	335	
Turn Type				Prot		Prot		NA	Free		NA	Prot	
Protected Phases				8		8		2			6	6	
Permitted Phases									Free				
Actuated Green, G (s)				14.4		14.4		26.8			26.8	26.8	
Effective Green, g (s)				14.4		14.4		26.0			26.0	26.0	
Actuated g/C Ratio				0.29		0.29		0.52			0.52	0.52	
Clearance Time (s)				4.0		4.0		4.8			4.8	4.8	
Vehicle Extension (s)				2.0		2.0		4.0			4.0	4.0	
Lane Grp Cap (vph)				988		455		1840			1840	823	
v/s Ratio Prot				c0.21		0.18		0.15			0.15	c0.21	
v/s Ratio Perm													
v/c Ratio				0.72		0.63		0.29			0.30	0.41	
Uniform Delay, d1				16.0		15.5		6.8			6.8	7.3	
Progression Factor				1.00		1.00		0.80			1.00	1.00	
Incremental Delay, d2				2.1		2.1		0.4			0.1	0.5	
Delay (s)				18.1		17.6		5.8			6.9	7.8	
Level of Service				B		B		A			A	A	
Approach Delay (s)		0.0			17.9			5.8			7.4		
Approach LOS		A			B			A			A		
Intersection Summary													
HCM 2000 Control Delay			11.3		HCM 2000 Level of Service						B		
HCM 2000 Volume to Capacity ratio			0.52										
Actuated Cycle Length (s)			50.0		Sum of lost time (s)						9.6		
Intersection Capacity Utilization			47.3%		ICU Level of Service						A		
Analysis Period (min)			15										
c Critical Lane Group													

HCM Signalized Intersection Capacity Analysis
 30: Isabel Ave & I-580 EB Ramps

BART to Livermore Extension Project
 2025 Enhanced Bus AM

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations	 		 					 			 		
Traffic Volume (vph)	205	0	461	0	0	0	0	721	527	0	946	266	
Future Volume (vph)	205	0	461	0	0	0	0	721	527	0	946	266	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)	4.0		4.0					4.0	4.0		4.0	4.0	
Lane Util. Factor	0.97		0.88					0.95	1.00		0.95	1.00	
Frt	1.00		0.85					1.00	0.85		1.00	0.85	
Flt Protected	0.95		1.00					1.00	1.00		1.00	1.00	
Satd. Flow (prot)	3433		2787					3539	1583		3539	1583	
Flt Permitted	0.95		1.00					1.00	1.00		1.00	1.00	
Satd. Flow (perm)	3433		2787					3539	1583		3539	1583	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	
Adj. Flow (vph)	223	0	501	0	0	0	0	784	573	0	1028	289	
RTOR Reduction (vph)	0	0	175	0	0	0	0	0	0	0	0	0	
Lane Group Flow (vph)	223	0	326	0	0	0	0	784	573	0	1028	289	
Turn Type	Prot		Perm					NA	Free		NA	Free	
Protected Phases	4							2			6		
Permitted Phases			4						Free			Free	
Actuated Green, G (s)	9.3		9.3					31.7	50.0		31.7	50.0	
Effective Green, g (s)	9.3		9.3					32.7	50.0		32.7	50.0	
Actuated g/C Ratio	0.19		0.19					0.65	1.00		0.65	1.00	
Clearance Time (s)	4.0		4.0					5.0			5.0		
Vehicle Extension (s)	2.0		2.0					4.0			4.0		
Lane Grp Cap (vph)	638		518					2314	1583		2314	1583	
v/s Ratio Prot	0.06							0.22			c0.29		
v/s Ratio Perm			c0.12						0.36			0.18	
v/c Ratio	0.35		0.63					0.34	0.36		0.44	0.18	
Uniform Delay, d1	17.7		18.8					3.8	0.0		4.2	0.0	
Progression Factor	1.00		1.00					1.00	1.00		0.42	1.00	
Incremental Delay, d2	0.1		1.7					0.1	0.6		0.6	0.2	
Delay (s)	17.8		20.5					4.0	0.6		2.3	0.2	
Level of Service	B		C					A	A		A	A	
Approach Delay (s)		19.7			0.0			2.6			1.9		
Approach LOS		B			A			A			A		
Intersection Summary													
HCM 2000 Control Delay			5.9									HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio			0.49										
Actuated Cycle Length (s)			50.0									Sum of lost time (s)	8.0
Intersection Capacity Utilization			48.9%									ICU Level of Service	A
Analysis Period (min)			15										
c Critical Lane Group													

HCM Signalized Intersection Capacity Analysis
31: Isabel Ave & Airway Blvd

BART to Livermore Extension Project
2025 Enhanced Bus AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↑	↗	↖	↑	↗	↖	↑↑↑	↗	↖↗	↑↑↑	↗
Traffic Volume (vph)	0	56	182	136	246	110	335	1066	20	257	1338	19
Future Volume (vph)	0	56	182	136	246	110	335	1066	20	257	1338	19
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.2	5.6	5.2	5.2	5.6	4.0	4.0	4.0	4.0	4.0	5.0
Lane Util. Factor		1.00	1.00	1.00	1.00	1.00	1.00	0.91	1.00	0.97	0.91	1.00
Frt		1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1863	1583	1770	1863	1583	1770	5085	1583	3433	5085	1583
Flt Permitted		1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)		1863	1583	1770	1863	1583	1770	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	61	198	148	267	120	364	1159	22	279	1454	21
RTOR Reduction (vph)	0	0	72	0	0	75	0	0	12	0	0	14
Lane Group Flow (vph)	0	61	126	148	267	45	364	1159	10	279	1454	7
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4	5	3	8	1	5	2		1	NA	6
Permitted Phases			4			8			2			6
Actuated Green, G (s)		6.9	26.0	9.9	21.4	33.2	19.1	37.8	37.8	11.8	30.5	30.5
Effective Green, g (s)		6.3	24.8	9.3	20.8	32.0	20.1	38.8	38.8	12.8	31.5	30.5
Actuated g/C Ratio		0.07	0.29	0.11	0.24	0.37	0.23	0.45	0.45	0.15	0.37	0.36
Clearance Time (s)		4.6	5.0	4.6	4.6	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Extension (s)		3.0	3.0	3.0	3.0	3.0	3.0	5.0	5.0	3.0	5.0	5.0
Lane Grp Cap (vph)		137	458	192	452	591	415	2304	717	513	1871	564
v/s Ratio Prot		0.03	0.06	c0.08	c0.14	0.01	c0.21	0.23		0.08	c0.29	
v/s Ratio Perm			0.02			0.02			0.01			0.00
v/c Ratio		0.45	0.27	0.77	0.59	0.08	0.88	0.50	0.01	0.54	0.78	0.01
Uniform Delay, d1		38.0	23.5	37.1	28.6	17.3	31.6	16.6	12.9	33.7	23.9	17.8
Progression Factor		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2		2.3	0.3	17.2	2.1	0.1	18.4	0.4	0.0	1.2	2.5	0.0
Delay (s)		40.3	23.8	54.4	30.7	17.3	50.0	16.9	12.9	34.9	26.4	17.8
Level of Service		D	C	D	C	B	D	B	B	C	C	B
Approach Delay (s)		27.7			34.2			24.7			27.6	
Approach LOS		C			C			C			C	

Intersection Summary		
HCM 2000 Control Delay	27.4	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.83	C
Actuated Cycle Length (s)	85.6	Sum of lost time (s)
Intersection Capacity Utilization	69.6%	20.0
Analysis Period (min)	15	ICU Level of Service
		C

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
32: Isabel Ave & Jack London Blvd

BART to Livermore Extension Project
2025 Enhanced Bus AM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	26	52	53	211	755	307	350	861	97	157	1163	283
Future Volume (vph)	26	52	53	211	755	307	350	861	97	157	1163	283
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.97	0.91	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	3433	5085	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	3433	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	28	57	58	229	821	334	380	936	105	171	1264	308
RTOR Reduction (vph)	0	0	49	0	0	69	0	0	67	0	0	117
Lane Group Flow (vph)	28	57	9	229	821	265	380	936	38	171	1264	191
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8	1	5	2		1	NA	6
Permitted Phases			4			8			2			6
Actuated Green, G (s)	3.8	16.0	16.0	18.0	30.2	40.3	14.5	37.6	37.6	10.1	33.2	33.2
Effective Green, g (s)	3.8	16.0	16.0	18.0	30.2	40.3	14.5	37.6	37.6	10.1	33.2	33.2
Actuated g/C Ratio	0.04	0.16	0.16	0.17	0.29	0.39	0.14	0.37	0.37	0.10	0.32	0.32
Clearance Time (s)	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	126	550	246	309	1038	701	483	1858	578	336	1640	510
v/s Ratio Prot	0.01	0.02		c0.13	c0.23	0.04	c0.11	c0.18		0.05	c0.25	
v/s Ratio Perm			0.01			0.13			0.02			0.12
v/c Ratio	0.22	0.10	0.04	0.74	0.79	0.38	0.79	0.50	0.07	0.51	0.77	0.38
Uniform Delay, d1	48.1	37.3	36.9	40.2	33.4	22.3	42.7	25.4	21.2	44.0	31.4	26.9
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.9	0.1	0.1	9.2	4.2	0.3	8.3	0.2	0.0	1.2	2.3	0.5
Delay (s)	49.0	37.4	37.0	49.5	37.6	22.7	51.0	25.6	21.3	45.3	33.7	27.3
Level of Service	D	D	D	D	D	C	D	C	C	D	C	C
Approach Delay (s)		39.5			36.0			32.1			33.7	
Approach LOS		D			D			C			C	

Intersection Summary			
HCM 2000 Control Delay	34.1	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.80		
Actuated Cycle Length (s)	102.9	Sum of lost time (s)	21.2
Intersection Capacity Utilization	66.6%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
33: Isabel Ave Connector & Stanley Blvd



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑	↑	↑↓	↑↑	↑↓	↑↓
Traffic Volume (vph)	338	161	318	1972	385	205
Future Volume (vph)	338	161	318	1972	385	205
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	3.8	4.0	4.0	4.0	2.5
Lane Util. Factor	0.95	1.00	0.97	0.95	0.97	0.88
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	3539	1583	3433	3539	3433	2787
Flt Permitted	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (perm)	3539	1583	3433	3539	3433	2787
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	367	175	346	2143	418	223
RTOR Reduction (vph)	0	8	0	0	0	144
Lane Group Flow (vph)	367	167	346	2143	418	79
Turn Type	NA	pm+ov	Prot	NA	Prot	pm+ov
Protected Phases	2	8	1	6	8	1
Permitted Phases		2				8
Actuated Green, G (s)	38.7	52.5	11.2	53.9	13.8	25.0
Effective Green, g (s)	40.4	55.9	11.2	55.6	15.3	28.0
Actuated g/C Ratio	0.51	0.71	0.14	0.70	0.19	0.35
Clearance Time (s)	5.7	5.5	4.0	5.7	5.5	4.0
Vehicle Extension (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Grp Cap (vph)	1812	1121	487	2493	665	989
v/s Ratio Prot	0.10	0.03	0.10	c0.61	c0.12	0.01
v/s Ratio Perm		0.08				0.02
v/c Ratio	0.20	0.15	0.71	0.86	0.63	0.08
Uniform Delay, d1	10.5	3.7	32.3	8.7	29.2	16.9
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.0	0.0	4.0	3.1	1.3	0.0
Delay (s)	10.5	3.8	36.3	11.8	30.5	16.9
Level of Service	B	A	D	B	C	B
Approach Delay (s)	8.3			15.2	25.8	
Approach LOS	A			B	C	

Intersection Summary

HCM 2000 Control Delay	16.0	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.86		
Actuated Cycle Length (s)	78.9	Sum of lost time (s)	12.0
Intersection Capacity Utilization	72.2%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 34: Murrieta Blvd/Driveway & Portola Ave

BART to Livermore Extension Project
 2025 Enhanced Bus AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗		↖	↗		↖	↗	↗		↗	
Traffic Volume (vph)	0	385	93	267	1212	1	188	6	148	1	3	0
Future Volume (vph)	0	385	93	267	1212	1	188	6	148	1	3	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.8		4.0	5.8		5.2	5.2	5.2		4.0	
Lane Util. Factor		0.95		1.00	0.95		0.95	0.95	1.00		1.00	
Frt		0.97		1.00	1.00		1.00	1.00	0.85		1.00	
Flt Protected		1.00		0.95	1.00		0.95	0.96	1.00		0.99	
Satd. Flow (prot)		3436		1770	3539		1681	1691	1583		1840	
Flt Permitted		1.00		0.95	1.00		0.95	0.96	1.00		0.99	
Satd. Flow (perm)		3436		1770	3539		1681	1691	1583		1840	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	418	101	290	1317	1	204	7	161	1	3	0
RTOR Reduction (vph)	0	27	0	0	0	0	0	0	138	0	0	0
Lane Group Flow (vph)	0	492	0	290	1318	0	106	105	23	0	4	0
Turn Type	Prot	NA		Prot	NA		Split	NA	Perm		Split	NA
Protected Phases	5	2		1	6		8	8		4	4	
Permitted Phases									8			
Actuated Green, G (s)		12.5		14.5	31.0		8.1	8.1	8.1		0.6	
Effective Green, g (s)		11.6		14.5	30.1		7.5	7.5	7.5		0.6	
Actuated g/C Ratio		0.22		0.27	0.57		0.14	0.14	0.14		0.01	
Clearance Time (s)		4.9		4.0	4.9		4.6	4.6	4.6		4.0	
Vehicle Extension (s)		2.0		2.0	2.0		2.0	2.0	2.0		2.0	
Lane Grp Cap (vph)		749		482	2002		236	238	223		20	
v/s Ratio Prot		0.14		0.16	c0.37		c0.06	0.06			c0.00	
v/s Ratio Perm									0.01			
v/c Ratio		0.66		0.60	0.66		0.45	0.44	0.10		0.20	
Uniform Delay, d1		19.0		16.8	8.0		21.0	20.9	19.9		26.1	
Progression Factor		1.00		1.00	1.00		1.00	1.00	1.00		1.00	
Incremental Delay, d2		1.6		1.5	0.6		0.5	0.5	0.1		1.8	
Delay (s)		20.6		18.3	8.6		21.5	21.4	20.0		27.9	
Level of Service		C		B	A		C	C	B		C	
Approach Delay (s)		20.6			10.3			20.8			27.9	
Approach LOS		C			B			C			C	

Intersection Summary		
HCM 2000 Control Delay	14.1	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.68	B
Actuated Cycle Length (s)	53.2	Sum of lost time (s)
Intersection Capacity Utilization	61.4%	19.0
Analysis Period (min)	15	ICU Level of Service
		B

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
35: Murrieta Blvd & Jack London Blvd



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	76	257	623	206	245	167
Future Volume (vph)	76	257	623	206	245	167
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00	1.00	0.95	0.91	
Frt	1.00	0.85	1.00	1.00	0.94	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1770	1583	1770	3539	4775	
Flt Permitted	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	1770	1583	1770	3539	4775	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	83	279	677	224	266	182
RTOR Reduction (vph)	0	238	0	0	152	0
Lane Group Flow (vph)	83	41	677	224	296	0
Turn Type	Prot	Perm	Prot	NA	NA	
Protected Phases	4		5	2	6	
Permitted Phases		4				
Actuated Green, G (s)	8.5	8.5	27.3	40.7	9.4	
Effective Green, g (s)	8.5	8.5	27.3	40.7	9.4	
Actuated g/C Ratio	0.15	0.15	0.48	0.71	0.16	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	263	235	844	2518	784	
v/s Ratio Prot	c0.05		c0.38	0.06	c0.06	
v/s Ratio Perm		0.03				
v/c Ratio	0.32	0.18	0.80	0.09	0.38	
Uniform Delay, d1	21.8	21.3	12.7	2.5	21.3	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.7	0.4	5.5	0.0	0.3	
Delay (s)	22.4	21.7	18.2	2.6	21.6	
Level of Service	C	C	B	A	C	
Approach Delay (s)	21.8			14.3	21.6	
Approach LOS	C			B	C	

Intersection Summary

HCM 2000 Control Delay	17.8	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.62		
Actuated Cycle Length (s)	57.2	Sum of lost time (s)	12.0
Intersection Capacity Utilization	57.2%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 36: Murrieta Blvd & Stanley Blvd

BART to Livermore Extension Project
 2025 Enhanced Bus AM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	209	435	223	17	821	112	442	337	9	153	224	450
Future Volume (vph)	209	435	223	17	821	112	442	337	9	153	224	450
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.9	4.9	4.0	4.9	4.9	4.9	4.9		4.9	4.9	4.0
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.97	0.95		1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	3433	3525		1770	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	3433	3525		1770	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	227	473	242	18	892	122	480	366	10	166	243	489
RTOR Reduction (vph)	0	0	159	0	0	70	0	2	0	0	0	90
Lane Group Flow (vph)	227	473	83	18	892	52	480	374	0	166	243	399
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Prot	NA		Prot	NA	Perm
Protected Phases	7	4		3	8	1	5	2		1		6
Permitted Phases			4			8						6
Actuated Green, G (s)	6.0	28.9	28.9	1.6	24.5	36.6	13.0	22.7		12.1	21.8	21.8
Effective Green, g (s)	6.0	28.0	28.0	1.6	23.6	34.8	12.1	21.8		11.2	20.9	21.8
Actuated g/C Ratio	0.07	0.34	0.34	0.02	0.29	0.43	0.15	0.27		0.14	0.26	0.27
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	253	1218	545	34	1027	773	510	945		243	909	424
v/s Ratio Prot	c0.07	0.13		0.01	c0.25	0.01	c0.14	0.11		0.09	0.07	
v/s Ratio Perm			0.05			0.02						c0.25
v/c Ratio	0.90	0.39	0.15	0.53	0.87	0.07	0.94	0.40		0.68	0.27	0.94
Uniform Delay, d1	37.3	20.2	18.4	39.5	27.4	13.7	34.2	24.4		33.4	24.1	29.1
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	30.7	0.2	0.1	14.1	7.9	0.0	25.8	0.3		7.7	0.2	29.2
Delay (s)	68.1	20.4	18.6	53.6	35.3	13.7	60.1	24.6		41.1	24.3	58.3
Level of Service	E	C	B	D	D	B	E	C		D	C	E
Approach Delay (s)		31.4			33.1			44.5			45.9	
Approach LOS		C			C			D			D	

Intersection Summary		
HCM 2000 Control Delay	38.4	HCM 2000 Level of Service D
HCM 2000 Volume to Capacity ratio	0.92	
Actuated Cycle Length (s)	81.3	Sum of lost time (s) 18.7
Intersection Capacity Utilization	74.7%	ICU Level of Service D
Analysis Period (min)	15	

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
37: Livermore Ave & I-580 WB Ramps

BART to Livermore Extension Project
2025 Enhanced Bus AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	344	88	28	444	79	0	0	151	0
Future Volume (vph)	0	0	0	344	88	28	444	79	0	0	151	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)					4.0		4.0	4.0			4.0	
Lane Util. Factor					0.95		0.97	1.00			0.95	
Frt					0.99		1.00	1.00			1.00	
Flt Protected					0.96		0.95	1.00			1.00	
Satd. Flow (prot)					1690		3433	1863			3539	
Flt Permitted					0.96		0.95	1.00			1.00	
Satd. Flow (perm)					1690		3433	1863			3539	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	374	96	30	483	86	0	0	164	0
RTOR Reduction (vph)	0	0	0	0	5	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	0	495	0	483	86	0	0	164	0
Turn Type				Split	NA		Prot	NA			NA	
Protected Phases				8	8		5	2			6	
Permitted Phases												
Actuated Green, G (s)					21.1		12.0	29.2			13.7	
Effective Green, g (s)					21.1		11.5	30.9			15.4	
Actuated g/C Ratio					0.35		0.19	0.51			0.26	
Clearance Time (s)					4.0		3.5	5.7			5.7	
Vehicle Extension (s)					2.0		2.0	2.5			2.5	
Lane Grp Cap (vph)					594		657	959			908	
v/s Ratio Prot					c0.29		c0.14	0.05			c0.05	
v/s Ratio Perm												
v/c Ratio					0.83		0.74	0.09			0.18	
Uniform Delay, d1					17.8		22.8	7.4			17.4	
Progression Factor					1.00		0.73	0.26			1.00	
Incremental Delay, d2					9.4		3.4	0.2			0.4	
Delay (s)					27.2		20.0	2.1			17.8	
Level of Service					C		B	A			B	
Approach Delay (s)		0.0			27.2			17.3			17.8	
Approach LOS		A			C			B			B	

Intersection Summary

HCM 2000 Control Delay	21.4	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.60		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	46.9%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
38: Livermore Ave & I-580 EB Ramps



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕	↗					↕		↘	↕	
Traffic Volume (vph)	15	1	597	0	0	0	0	506	200	17	482	0
Future Volume (vph)	15	1	597	0	0	0	0	506	200	17	482	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0					4.0		4.0	4.0	
Lane Util. Factor		0.95	0.95					0.95		1.00	0.95	
Frt		0.86	0.85					0.96		1.00	1.00	
Flt Protected		1.00	1.00					1.00		0.95	1.00	
Satd. Flow (prot)		1514	1504					3389		1770	3539	
Flt Permitted		1.00	1.00					1.00		0.95	1.00	
Satd. Flow (perm)		1514	1504					3389		1770	3539	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	16	1	649	0	0	0	0	550	217	18	524	0
RTOR Reduction (vph)	0	224	224	0	0	0	0	52	0	0	0	0
Lane Group Flow (vph)	0	111	107	0	0	0	0	715	0	18	524	0
Turn Type	Prot	NA	Perm					NA		Prot	NA	
Protected Phases	7	4						2		1	6	
Permitted Phases			4									
Actuated Green, G (s)		15.9	15.9					30.8		1.3	35.1	
Effective Green, g (s)		15.9	15.9					31.8		0.3	36.1	
Actuated g/C Ratio		0.27	0.27					0.53		0.00	0.60	
Clearance Time (s)		4.0	4.0					5.0		3.0	5.0	
Vehicle Extension (s)		2.0	2.0					2.5		2.0	2.5	
Lane Grp Cap (vph)		401	398					1796		8	2129	
v/s Ratio Prot								c0.21		c0.01	0.15	
v/s Ratio Perm		0.07	0.07									
v/c Ratio		0.28	0.27					0.40		2.25	0.25	
Uniform Delay, d1		17.5	17.4					8.4		29.9	5.6	
Progression Factor		1.00	1.00					1.00		1.10	0.23	
Incremental Delay, d2		0.1	0.1					0.7		803.6	0.2	
Delay (s)		17.6	17.6					9.1		836.3	1.5	
Level of Service		B	B					A		F	A	
Approach Delay (s)		17.6			0.0			9.1			29.2	
Approach LOS		B			A			A			C	

Intersection Summary

HCM 2000 Control Delay	17.5	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.37		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	46.9%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 39: Livermore Ave & Portola Ave

BART to Livermore Extension Project
 2025 Enhanced Bus AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	213	263	101	30	730	60	344	433	86	97	547	346
Future Volume (vph)	213	263	101	30	730	60	344	433	86	97	547	346
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	5.3	4.0	4.0	5.3	4.0	5.8		4.0	5.8	4.9
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	1.00	0.95		1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.98		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	1770	3452		1770	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	1770	3452		1770	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	232	286	110	33	793	65	374	471	93	105	595	376
RTOR Reduction (vph)	0	0	73	0	0	47	0	15	0	0	0	95
Lane Group Flow (vph)	232	286	37	33	793	18	374	549	0	105	595	281
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA		Prot	NA	pm+ov
Protected Phases	3	8		7	4		1	6		5	2	3
Permitted Phases			8			4						2
Actuated Green, G (s)	10.0	35.2	35.2	3.4	28.6	28.6	23.3	35.9		10.7	23.3	33.3
Effective Green, g (s)	10.0	36.5	35.2	3.4	29.9	28.6	23.3	35.0		10.7	22.4	31.5
Actuated g/C Ratio	0.10	0.35	0.34	0.03	0.29	0.28	0.23	0.34		0.10	0.22	0.30
Clearance Time (s)	4.0	5.3	5.3	4.0	5.3	5.3	4.0	4.9		4.0	4.9	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	332	1249	538	58	1023	437	398	1168		183	766	482
v/s Ratio Prot	c0.07	0.08		0.02	c0.22		c0.21	0.16		0.06	c0.17	0.05
v/s Ratio Perm			0.02			0.01						0.13
v/c Ratio	0.70	0.23	0.07	0.57	0.78	0.04	0.94	0.47		0.57	0.78	0.58
Uniform Delay, d1	45.2	23.5	23.0	49.3	33.7	27.4	39.4	26.9		44.2	38.1	30.4
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	6.3	0.1	0.1	12.2	3.7	0.0	29.8	0.3		4.3	5.0	1.8
Delay (s)	51.5	23.6	23.1	61.5	37.4	27.4	69.2	27.2		48.5	43.1	32.2
Level of Service	D	C	C	E	D	C	E	C		D	D	C
Approach Delay (s)		33.9			37.6			43.9			39.8	
Approach LOS		C			D			D			D	

Intersection Summary

HCM 2000 Control Delay	39.3	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.82		
Actuated Cycle Length (s)	103.4	Sum of lost time (s)	18.7
Intersection Capacity Utilization	75.3%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
40: First St/Springtown Blvd & I-580 WB Ramps

BART to Livermore Extension Project
2025 Enhanced Bus AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations			↗↗			↗	↗↗	↑			↖↖	↖
Traffic Volume (vph)	0	0	443	0	0	0	341	375	0	0	875	612
Future Volume (vph)	0	0	443	0	0	0	341	375	0	0	875	612
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)			4.0				4.0	4.0			5.0	5.0
Lane Util. Factor			0.88				0.97	1.00			0.95	1.00
Frt			0.85				1.00	1.00			1.00	0.85
Flt Protected			1.00				0.95	1.00			1.00	1.00
Satd. Flow (prot)			2787				3433	1863			3539	1583
Flt Permitted			1.00				0.95	1.00			1.00	1.00
Satd. Flow (perm)			2787				3433	1863			3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	482	0	0	0	371	408	0	0	951	665
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	62
Lane Group Flow (vph)	0	0	482	0	0	0	371	408	0	0	951	603
Turn Type			Over			Free	Prot	NA			NA	Perm
Protected Phases			5				5	2			6	
Permitted Phases						Free						6
Actuated Green, G (s)			21.7				21.7	100.0			70.3	70.3
Effective Green, g (s)			21.2				21.2	100.0			69.8	69.8
Actuated g/C Ratio			0.21				0.21	1.00			0.70	0.70
Clearance Time (s)			3.5				3.5	4.0			4.5	4.5
Vehicle Extension (s)			2.0				2.0	0.2			4.0	4.0
Lane Grp Cap (vph)			590				727	1863			2470	1104
v/s Ratio Prot			c0.17				0.11	0.22			0.27	
v/s Ratio Perm												c0.38
v/c Ratio			0.82				0.51	0.22			0.39	0.55
Uniform Delay, d1			37.6				34.8	0.0			6.2	7.4
Progression Factor			1.00				1.02	1.00			1.00	1.00
Incremental Delay, d2			8.2				0.2	0.3			0.1	0.7
Delay (s)			45.7				35.7	0.3			6.4	8.1
Level of Service			D				D	A			A	A
Approach Delay (s)		45.7			0.0			17.2			7.1	
Approach LOS		D			A			B			A	

Intersection Summary

HCM 2000 Control Delay	16.3	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.61		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	55.1%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
41: First St & I-580 EB Ramps



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕	↗↘					↕↕	↗	↘	↕↕	
Traffic Volume (vph)	96	1	355	0	0	0	0	627	309	65	1224	0
Future Volume (vph)	96	1	355	0	0	0	0	627	309	65	1224	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0					5.0	5.0	4.0	5.0	
Lane Util. Factor		1.00	0.88					0.95	1.00	1.00	0.95	
Frt		1.00	0.85					1.00	0.85	1.00	1.00	
Flt Protected		0.95	1.00					1.00	1.00	0.95	1.00	
Satd. Flow (prot)		1775	2787					3539	1583	1770	3539	
Flt Permitted		0.95	1.00					1.00	1.00	0.95	1.00	
Satd. Flow (perm)		1775	2787					3539	1583	1770	3539	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	104	1	386	0	0	0	0	682	336	71	1330	0
RTOR Reduction (vph)	0	0	108	0	0	0	0	0	167	0	0	0
Lane Group Flow (vph)	0	105	278	0	0	0	0	682	169	71	1330	0
Turn Type	Perm	NA	Perm					NA	Perm	Prot	NA	
Protected Phases		4						2		1	6	
Permitted Phases	4		4						2			
Actuated Green, G (s)		9.2	9.2					25.7	25.7	4.1	32.8	
Effective Green, g (s)		8.7	8.7					25.2	25.2	3.1	32.3	
Actuated g/C Ratio		0.17	0.17					0.50	0.50	0.06	0.65	
Clearance Time (s)		3.5	3.5					4.5	4.5	3.0	4.5	
Vehicle Extension (s)		2.5	2.5					4.0	4.0	2.0	4.0	
Lane Grp Cap (vph)		308	484					1783	797	109	2286	
v/s Ratio Prot								0.19		0.04	c0.38	
v/s Ratio Perm		0.06	c0.10						0.11			
v/c Ratio		0.34	0.57					0.38	0.21	0.65	0.58	
Uniform Delay, d1		18.1	18.9					7.6	6.9	22.9	5.0	
Progression Factor		1.00	1.00					1.00	1.00	1.00	1.04	
Incremental Delay, d2		0.5	1.4					0.6	0.6	9.2	1.0	
Delay (s)		18.6	20.3					8.2	7.5	32.1	6.2	
Level of Service		B	C					A	A	C	A	
Approach Delay (s)		19.9			0.0			8.0			7.5	
Approach LOS		B			A			A			A	

Intersection Summary		
HCM 2000 Control Delay	9.8	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.64	A
Actuated Cycle Length (s)	50.0	Sum of lost time (s)
Intersection Capacity Utilization	53.8%	13.0
Analysis Period (min)	15	ICU Level of Service
		A

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
42: 1st St & Mines Rd

BART to Livermore Extension Project
2025 Enhanced Bus AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗		↖↗	↑	↖	↖	↑↑↑		↖↗	↑↑↑	
Traffic Volume (vph)	33	70	42	538	108	333	18	839	305	215	1245	20
Future Volume (vph)	33	70	42	538	108	333	18	839	305	215	1245	20
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		0.97	1.00	1.00	1.00	0.91		0.97	0.91	
Frt	1.00	0.94		1.00	1.00	0.85	1.00	0.96		1.00	1.00	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1757		3433	1863	1583	1770	4882		3433	5073	
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	1757		3433	1863	1583	1770	4882		3433	5073	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	36	76	46	585	117	362	20	912	332	234	1353	22
RTOR Reduction (vph)	0	35	0	0	0	77	0	86	0	0	2	0
Lane Group Flow (vph)	36	87	0	585	117	285	20	1158	0	234	1373	0
Turn Type	Prot	NA		Prot	NA	pm+ov	Prot	NA		Prot	NA	
Protected Phases	7	4		3	8	1	5	2		1	6	
Permitted Phases						8						
Actuated Green, G (s)	1.8	8.5		12.2	18.9	25.0	0.7	22.7		6.1	28.1	
Effective Green, g (s)	1.8	8.5		12.2	18.9	25.0	0.7	22.7		6.1	28.1	
Actuated g/C Ratio	0.03	0.13		0.19	0.29	0.38	0.01	0.35		0.09	0.43	
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	48	228		639	537	700	18	1691		319	2176	
v/s Ratio Prot	0.02	0.05		c0.17	0.06	c0.04	0.01	0.24		c0.07	c0.27	
v/s Ratio Perm						0.14						
v/c Ratio	0.75	0.38		0.92	0.22	0.41	1.11	0.69		0.73	0.63	
Uniform Delay, d1	31.6	26.1		26.1	17.7	14.8	32.4	18.3		28.9	14.6	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	48.1	1.1		17.8	0.2	0.4	250.0	1.2		8.4	0.6	
Delay (s)	79.7	27.2		43.9	17.9	15.2	282.4	19.5		37.4	15.2	
Level of Service	E	C		D	B	B	F	B		D	B	
Approach Delay (s)		39.1			31.3			23.7			18.5	
Approach LOS		D			C			C			B	



















Intersection Summary

HCM 2000 Control Delay	24.2	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.75		
Actuated Cycle Length (s)	65.5	Sum of lost time (s)	16.0
Intersection Capacity Utilization	61.2%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group




















HCM Unsignalized Intersection Capacity Analysis
43: Vasco Rd & I-580 WB Ramps

BART to Livermore Extension Project
2025 Enhanced Bus AM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	0	0	168	0	825	0	0	1533	0
Future Volume (Veh/h)	0	0	0	0	0	168	0	825	0	0	1533	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	0	0	0	183	0	897	0	0	1666	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage (veh)												
Upstream signal (ft)											487	
pX, platoon unblocked												
vC, conflicting volume	2298	2563	1666	2563	2563	448	1666			897		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	2298	2563	1666	2563	2563	448	1666			897		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	100	100	67	100			100		
cM capacity (veh/h)	14	26	86	13	26	558	382			753		
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	SB 1	SB 2					
Volume Total	0	183	448	448	0	1666	0					
Volume Left	0	0	0	0	0	0	0					
Volume Right	0	183	0	0	0	0	0					
cSH	1700	558	1700	1700	1700	1700	1700					
Volume to Capacity	0.00	0.33	0.26	0.26	0.00	0.98	0.00					
Queue Length 95th (ft)	0	36	0	0	0	0	0					
Control Delay (s)	0.0	14.6	0.0	0.0	0.0	0.0	0.0					
Lane LOS	A	B										
Approach Delay (s)	0.0	14.6	0.0			0.0						
Approach LOS	A	B										
Intersection Summary												
Average Delay			1.0									
Intersection Capacity Utilization			84.0%	ICU Level of Service	E							
Analysis Period (min)			15									

HCM Unsignalized Intersection Capacity Analysis
 44: Vasco Rd & I-580 EB Ramps

BART to Livermore Extension Project
 2025 Enhanced Bus AM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	0	0	0	0	1154	0	73	1761	0
Future Volume (Veh/h)	0	0	0	0	0	0	0	1154	0	73	1761	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	0	0	0	0	0	1254	0	79	1914	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	2699	3326	1914	3326	3326	627	1914			1254		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	2699	3326	1914	3326	3326	627	1914			1254		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	100	100	100	100			86		
cM capacity (veh/h)	9	7	58	3	7	426	306			551		
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2						
Volume Total	0	0	836	418	79	1914						
Volume Left	0	0	0	0	79	0						
Volume Right	0	0	0	0	0	0						
cSH	1700	1700	1700	1700	551	1700						
Volume to Capacity	0.00	0.00	0.49	0.25	0.14	1.13						
Queue Length 95th (ft)	0	0	0	0	12	0						
Control Delay (s)	0.0	0.0	0.0	0.0	12.6	0.0						
Lane LOS	A	A			B							
Approach Delay (s)	0.0	0.0	0.0		0.5							
Approach LOS	A	A										
Intersection Summary												
Average Delay			0.3									
Intersection Capacity Utilization			96.0%	ICU Level of Service	F							
Analysis Period (min)			15									

HCM Signalized Intersection Capacity Analysis
45: Vasco Rd & East Ave

BART to Livermore Extension Project
2025 Enhanced Bus AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	278	325	50	7	17	14	62	250	182	234	286	277
Future Volume (vph)	278	325	50	7	17	14	62	250	182	234	286	277
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	0.95		0.97	1.00	1.00
Frt	1.00	0.98		1.00	0.93		1.00	0.94		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	3469		1770	3298		1770	3316		3433	1863	1583
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1770	3469		1770	3298		1770	3316		3433	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	302	353	54	8	18	15	67	272	198	254	311	301
RTOR Reduction (vph)	0	21	0	0	14	0	0	145	0	0	0	202
Lane Group Flow (vph)	302	386	0	8	19	0	67	325	0	254	311	99
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												6
Actuated Green, G (s)	12.2	14.3		0.6	2.7		2.2	13.2		5.2	16.2	16.2
Effective Green, g (s)	12.2	14.3		0.6	2.7		2.2	13.2		5.2	16.2	16.2
Actuated g/C Ratio	0.25	0.29		0.01	0.05		0.04	0.27		0.11	0.33	0.33
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	438	1006		21	180		78	887		362	612	520
v/s Ratio Prot	c0.17	c0.11		0.00	0.01		0.04	0.10		c0.07	c0.17	
v/s Ratio Perm												0.06
v/c Ratio	0.69	0.38		0.38	0.10		0.86	0.37		0.70	0.51	0.19
Uniform Delay, d1	16.8	14.0		24.2	22.2		23.4	14.7		21.3	13.3	11.9
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	4.5	0.2		11.2	0.3		56.5	0.3		6.0	0.7	0.2
Delay (s)	21.3	14.2		35.3	22.4		79.9	14.9		27.3	14.0	12.0
Level of Service	C	B		D	C		E	B		C	B	B
Approach Delay (s)		17.2			24.9			23.0			17.2	
Approach LOS		B			C			C			B	

Intersection Summary

HCM 2000 Control Delay	18.8	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.64		
Actuated Cycle Length (s)	49.3	Sum of lost time (s)	16.0
Intersection Capacity Utilization	51.5%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Unsignalized Intersection Capacity Analysis
 46: I-580 WB Ramps & Northfront Rd/Northfront Road



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↻			↻	↻	↻
Traffic Volume (veh/h)	116	214	1317	124	64	541
Future Volume (Veh/h)	116	214	1317	124	64	541
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	126	233	1432	135	70	588
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None		None			
Median storage (veh)						
Upstream signal (ft)	1007					
pX, platoon unblocked					0.50	
vC, conflicting volume			126	3242 242		
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			126	5003	242	
tC, single (s)			4.1	6.4	6.2	
tC, 2 stage (s)						
tF (s)			2.2	3.5	3.3	
p0 queue free %			2	0	26	
cM capacity (veh/h)			1460	0	796	
Direction, Lane #	EB 1	WB 1	NB 1	NB 2		
Volume Total	359	1567	70	588		
Volume Left	0	1432	70	0		
Volume Right	233	0	0	588		
cSH	1700	1460	0	796		
Volume to Capacity	0.21	0.98	Err	0.74		
Queue Length 95th (ft)	0	537	Err	168		
Control Delay (s)	0.0	36.4	Err	21.1		
Lane LOS	E		F	C		
Approach Delay (s)	0.0	36.4	1082.6			
Approach LOS			F			
Intersection Summary						
Average Delay			297.7			
Intersection Capacity Utilization			112.3%	ICU Level of Service		H
Analysis Period (min)			15			

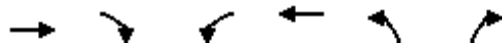
Intersection	
Intersection Delay, s/veh	10
Intersection LOS	A

Movement	EBU	EBL	EBT	WBU	WBT	WBR	SBU	SBL	SBR
Lane Configurations		↘	↕↕		↕	↘		↘↘	↘
Traffic Vol, veh/h	0	43	26	0	166	106	0	311	83
Future Vol, veh/h	0	43	26	0	166	106	0	311	83
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	47	28	0	180	115	0	338	90
Number of Lanes	0	1	2	0	1	1	0	2	1

Approach	EB	WB	SB
Opposing Approach	WB	EB	
Opposing Lanes	2	3	0
Conflicting Approach Left	SB		WB
Conflicting Lanes Left	3	0	2
Conflicting Approach Right		SB	EB
Conflicting Lanes Right	0	3	3
HCM Control Delay	9.6	10.2	10
HCM LOS	A	B	A

Lane	EBLn1	EBLn2	EBLn3	WBLn1	WBLn2	SBLn1	SBLn2	SBLn3
Vol Left, %	100%	0%	0%	0%	0%	100%	100%	0%
Vol Thru, %	0%	100%	100%	100%	0%	0%	0%	0%
Vol Right, %	0%	0%	0%	0%	100%	0%	0%	100%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	43	13	13	166	106	156	156	83
LT Vol	43	0	0	0	0	156	156	0
Through Vol	0	13	13	166	0	0	0	0
RT Vol	0	0	0	0	106	0	0	83
Lane Flow Rate	47	14	14	180	115	169	169	90
Geometry Grp	8	8	8	8	8	7	7	7
Degree of Util (X)	0.09	0.025	0.018	0.293	0.164	0.28	0.28	0.076
Departure Headway (Hd)	6.897	6.392	4.638	5.841	5.135	5.955	5.955	3.019
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cap	523	563	776	610	690	598	598	1162
Service Time	4.597	4.092	2.338	3.632	2.925	3.738	3.738	0.802
HCM Lane V/C Ratio	0.09	0.025	0.018	0.295	0.167	0.283	0.283	0.077
HCM Control Delay	10.3	9.3	7.4	11.1	8.9	11.1	11.1	6.1
HCM Lane LOS	B	A	A	B	A	B	B	A
HCM 95th-tile Q	0.3	0.1	0.1	1.2	0.6	1.1	1.1	0.2

HCM Signalized Intersection Capacity Analysis
48: Greenville Rd & Northfront Road/Altamont Pass Road



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↑	↑	↑	↑	↑
Traffic Volume (vph)	4	652	270	861	584	62
Future Volume (vph)	4	652	270	861	584	62
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	1863	1583	1770	1863	1770	1583
Flt Permitted	1.00	1.00	0.76	1.00	0.95	1.00
Satd. Flow (perm)	1863	1583	1407	1863	1770	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	4	709	293	936	635	67
RTOR Reduction (vph)	0	327	0	0	0	23
Lane Group Flow (vph)	4	382	293	936	635	44
Turn Type	NA	Perm	Perm	NA	Prot	Perm
Protected Phases	4			8	2	
Permitted Phases		4	8			2
Actuated Green, G (s)	60.2	60.2	60.2	60.2	43.5	43.5
Effective Green, g (s)	60.2	60.2	60.2	60.2	43.5	43.5
Actuated g/C Ratio	0.54	0.54	0.54	0.54	0.39	0.39
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	1004	853	758	1004	689	616
v/s Ratio Prot	0.00			c0.50	c0.36	
v/s Ratio Perm		0.24	0.21			0.03
v/c Ratio	0.00	0.45	0.39	0.93	0.92	0.07
Uniform Delay, d1	11.9	15.7	15.0	23.9	32.5	21.4
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.0	0.4	0.3	14.8	17.8	0.0
Delay (s)	11.9	16.0	15.3	38.6	50.3	21.5
Level of Service	B	B	B	D	D	C
Approach Delay (s)	16.0			33.1	47.5	
Approach LOS	B			C	D	

Intersection Summary

HCM 2000 Control Delay	32.3	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.93		
Actuated Cycle Length (s)	111.7	Sum of lost time (s)	8.0
Intersection Capacity Utilization	84.3%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
49: Greenville Rd & Southfront Rd



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	114	230	136	526	744	128
Future Volume (vph)	114	230	136	526	744	128
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.2	5.2	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.88	0.97	0.95	0.95	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	3433	2787	3433	3539	3539	1583
Flt Permitted	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (perm)	3433	2787	3433	3539	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	124	250	148	572	809	139
RTOR Reduction (vph)	0	219	0	0	0	73
Lane Group Flow (vph)	124	31	148	572	809	66
Turn Type	Prot	Perm	Prot	NA	NA	Perm
Protected Phases	8		1	6	2	
Permitted Phases		8				2
Actuated Green, G (s)	5.7	5.7	3.1	24.5	17.4	17.4
Effective Green, g (s)	5.1	5.1	3.1	26.2	19.1	19.1
Actuated g/C Ratio	0.13	0.13	0.08	0.65	0.47	0.47
Clearance Time (s)	4.6	4.6	4.0	5.7	5.7	5.7
Vehicle Extension (s)	5.0	5.0	6.0	2.5	2.5	2.5
Lane Grp Cap (vph)	432	350	262	2289	1669	746
v/s Ratio Prot	c0.04		c0.04	0.16	c0.23	
v/s Ratio Perm		0.01				0.04
v/c Ratio	0.29	0.09	0.56	0.25	0.48	0.09
Uniform Delay, d1	16.1	15.6	18.0	3.0	7.3	5.9
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.8	0.2	5.7	0.0	0.2	0.0
Delay (s)	16.8	15.9	23.7	3.1	7.5	5.9
Level of Service	B	B	C	A	A	A
Approach Delay (s)	16.2			7.3	7.3	
Approach LOS	B			A	A	

Intersection Summary

HCM 2000 Control Delay	8.9	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.46		
Actuated Cycle Length (s)	40.5	Sum of lost time (s)	13.2
Intersection Capacity Utilization	38.8%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
50: Greenville Rd & Patterson Pass Rd

BART to Livermore Extension Project
2025 Enhanced Bus AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	28	3	26	226	404	567	10	144	1	9	338	53
Future Volume (vph)	28	3	26	226	404	567	10	144	1	9	338	53
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.86		1.00	0.91		1.00	1.00		1.00	0.98	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1610		1770	1700		1770	1861		1770	1825	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	1610		1770	1700		1770	1861		1770	1825	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	30	3	28	246	439	616	11	157	1	10	367	58
RTOR Reduction (vph)	0	21	0	0	40	0	0	0	0	0	5	0
Lane Group Flow (vph)	30	10	0	246	1015	0	11	158	0	10	420	0
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												
Actuated Green, G (s)	2.3	30.0		40.5	68.2		0.7	28.1		0.7	28.1	
Effective Green, g (s)	2.3	30.0		40.5	68.2		0.7	28.1		0.7	28.1	
Actuated g/C Ratio	0.02	0.26		0.35	0.59		0.01	0.24		0.01	0.24	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	35	418		621	1005		10	453		10	444	
v/s Ratio Prot	c0.02	0.01		0.14	c0.60		c0.01	0.08		0.01	c0.23	
v/s Ratio Perm												
v/c Ratio	0.86	0.02		0.40	1.01		1.10	0.35		1.00	0.95	
Uniform Delay, d1	56.3	31.8		28.2	23.5		57.3	36.0		57.3	42.9	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	94.8	0.0		0.4	31.0		321.8	2.1		284.6	31.3	
Delay (s)	151.1	31.8		28.6	54.5		379.1	38.2		341.9	74.2	
Level of Service	F	C		C	D		F	D		F	E	
Approach Delay (s)		90.5			49.6			60.3			80.3	
Approach LOS		F			D			E			F	

Intersection Summary

HCM 2000 Control Delay	58.6	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	0.99		
Actuated Cycle Length (s)	115.3	Sum of lost time (s)	16.0
Intersection Capacity Utilization	83.7%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
1: Dougherty Rd & Amador Valley Rd



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	330	452	599	1923	1078	209
Future Volume (vph)	330	452	599	1923	1078	209
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5	5.7	5.7	
Lane Util. Factor	1.00	1.00	0.97	0.91	0.91	
Frt	1.00	0.85	1.00	1.00	0.98	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1770	1583	3433	5085	4962	
Flt Permitted	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	1770	1583	3433	5085	4962	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	359	491	651	2090	1172	227
RTOR Reduction (vph)	0	228	0	0	29	0
Lane Group Flow (vph)	359	263	651	2090	1370	0
Turn Type	Perm	Perm	Prot	NA	NA	
Protected Phases			5	2	6	
Permitted Phases	4	4				
Actuated Green, G (s)	21.1	21.1	13.6	54.7	36.6	
Effective Green, g (s)	21.1	21.1	13.6	54.7	36.6	
Actuated g/C Ratio	0.25	0.25	0.16	0.64	0.43	
Clearance Time (s)	4.5	4.5	4.5	5.7	5.7	
Vehicle Extension (s)	1.8	1.8	2.0	4.0	4.0	
Lane Grp Cap (vph)	434	388	542	3234	2111	
v/s Ratio Prot			c0.19	c0.41	0.28	
v/s Ratio Perm	c0.20	0.17				
v/c Ratio	0.83	0.68	1.20	0.65	0.65	
Uniform Delay, d1	30.7	29.4	36.2	9.7	19.6	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	11.7	3.7	107.2	0.5	0.8	
Delay (s)	42.4	33.1	143.4	10.2	20.4	
Level of Service	D	C	F	B	C	
Approach Delay (s)	37.0			41.8	20.4	
Approach LOS	D			D	C	

Intersection Summary

HCM 2000 Control Delay	35.0	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.83		
Actuated Cycle Length (s)	86.0	Sum of lost time (s)	14.7
Intersection Capacity Utilization	73.1%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
2: Dougherty Rd & Dublin Blvd

BART to Livermore Extension Project
2025 Enhanced Bus PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↑↑↑	↖↗	↖↗↘	↑↑↑	↖	↖↗↘	↑↑↑	↖↗	↖↗	↑↑↑	↖↗
Traffic Volume (vph)	82	1029	930	534	801	654	842	1849	307	621	1254	36
Future Volume (vph)	82	1029	930	534	801	654	842	1849	307	621	1254	36
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	6.0	5.0	5.0	5.5	5.0	5.0	5.5	5.0	5.0	5.5	
Lane Util. Factor	0.97	0.91	0.88	0.94	0.91	1.00	0.94	0.91	0.88	0.97	0.86	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	3433	5085	2787	4990	5085	1583	4990	5085	2787	3433	6381	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	3433	5085	2787	4990	5085	1583	4990	5085	2787	3433	6381	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	89	1118	1011	580	871	711	915	2010	334	675	1363	39
RTOR Reduction (vph)	0	0	36	0	0	61	0	0	34	0	3	0
Lane Group Flow (vph)	89	1118	975	580	871	650	915	2010	300	675	1399	0
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	
Protected Phases	5	2	3	1	6	7	3	8	1	7	4	
Permitted Phases			2			6			8			
Actuated Green, G (s)	15.0	35.0	54.8	17.5	38.0	52.1	19.8	45.0	62.5	14.1	39.3	
Effective Green, g (s)	15.0	35.0	54.8	17.5	38.0	52.1	19.8	45.0	62.5	14.1	39.3	
Actuated g/C Ratio	0.11	0.26	0.41	0.13	0.29	0.39	0.15	0.34	0.47	0.11	0.30	
Clearance Time (s)	5.0	6.0	5.0	5.0	5.5	5.0	5.0	5.5	5.0	5.0	5.5	
Vehicle Extension (s)	2.0	4.5	2.0	2.0	4.5	2.0	2.0	4.5	2.0	2.0	4.5	
Lane Grp Cap (vph)	386	1337	1147	656	1451	619	742	1719	1308	363	1884	
v/s Ratio Prot	0.03	0.22	0.13	c0.12	0.17	c0.11	c0.18	c0.40	0.03	c0.20	0.22	
v/s Ratio Perm			0.22			0.30			0.08			
v/c Ratio	0.23	0.84	0.85	0.88	0.60	1.05	1.23	1.17	0.23	1.86	0.74	
Uniform Delay, d1	53.8	46.3	35.4	56.8	41.0	40.5	56.6	44.0	21.0	59.5	42.3	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.1	5.1	6.0	13.1	0.9	50.1	116.5	82.8	0.0	397.2	1.8	
Delay (s)	53.9	51.5	41.4	69.9	41.9	90.6	173.1	126.9	21.0	456.7	44.2	
Level of Service	D	D	D	E	D	F	F	F	C	F	D	
Approach Delay (s)		47.0			65.4			129.0			178.2	
Approach LOS		D			E			F			F	

Intersection Summary

HCM 2000 Control Delay	106.7	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.21		
Actuated Cycle Length (s)	133.1	Sum of lost time (s)	21.5
Intersection Capacity Utilization	103.7%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
3: Dougherty Rd & I-580 WB Ramps

BART to Livermore Extension Project
2025 Enhanced Bus PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations				↔↔		↔↔		↑↑↑			↑↑↑	↔	
Traffic Volume (vph)	0	0	0	314	0	678	0	2349	0	0	1647	0	
Future Volume (vph)	0	0	0	314	0	678	0	2349	0	0	1647	0	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)				4.0		4.0		4.0			4.0		
Lane Util. Factor				0.97		0.88		0.91			0.86		
Frt				1.00		0.85		1.00			1.00		
Flt Protected				0.95		1.00		1.00			1.00		
Satd. Flow (prot)				3433		2787		5085			4806		
Flt Permitted				0.95		1.00		1.00			1.00		
Satd. Flow (perm)				3433		2787		5085			4806		
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	
Adj. Flow (vph)	0	0	0	341	0	737	0	2553	0	0	1790	0	
RTOR Reduction (vph)	0	0	0	0	0	17	0	0	0	0	0	0	
Lane Group Flow (vph)	0	0	0	341	0	720	0	2553	0	0	1790	0	
Turn Type				Prot		Prot		NA			NA	Perm	
Protected Phases				4		4		2			6		
Permitted Phases												6	
Actuated Green, G (s)				32.3		32.3		66.9			66.9		
Effective Green, g (s)				33.7		33.7		68.3			68.3		
Actuated g/C Ratio				0.31		0.31		0.62			0.62		
Clearance Time (s)				5.4		5.4		5.4			5.4		
Vehicle Extension (s)				3.0		3.0		3.0			3.0		
Lane Grp Cap (vph)				1051		853		3157			2984		
v/s Ratio Prot				0.10		c0.26		c0.50			0.37		
v/s Ratio Perm													
v/c Ratio				0.32		0.84		0.81			0.60		
Uniform Delay, d1				29.4		35.7		15.9			12.6		
Progression Factor				1.00		1.00		0.68			1.00		
Incremental Delay, d2				0.2		7.7		0.8			0.9		
Delay (s)				29.6		43.4		11.7			13.5		
Level of Service				C		D		B			B		
Approach Delay (s)		0.0			39.0			11.7			13.5		
Approach LOS		A			D			B			B		
Intersection Summary													
HCM 2000 Control Delay			17.7		HCM 2000 Level of Service						B		
HCM 2000 Volume to Capacity ratio			0.82										
Actuated Cycle Length (s)			110.0		Sum of lost time (s)						8.0		
Intersection Capacity Utilization			75.8%		ICU Level of Service						D		
Analysis Period (min)			15										

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 4: Hopyard Rd/Dougherty Rd & I-580 EB Ramps



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗		↖↗					↑↑↑	↖		↑↑↑	↖
Traffic Volume (vph)	1098	0	861	0	0	0	0	2457	0	0	1147	0
Future Volume (vph)	1098	0	861	0	0	0	0	2457	0	0	1147	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0					4.0			4.0	
Lane Util. Factor	0.97		0.88					0.91			0.86	
Frt	1.00		0.85					1.00			1.00	
Flt Protected	0.95		1.00					1.00			1.00	
Satd. Flow (prot)	3433		2787					5085			4806	
Flt Permitted	0.95		1.00					1.00			1.00	
Satd. Flow (perm)	3433		2787					5085			4806	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	1193	0	936	0	0	0	0	2671	0	0	1247	0
RTOR Reduction (vph)	0	0	59	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	1193	0	877	0	0	0	0	2671	0	0	1247	0
Turn Type	Prot		Prot					NA	Free		NA	Perm
Protected Phases	4		4					2			6	
Permitted Phases									Free			6
Actuated Green, G (s)	39.6		39.6					59.6			59.6	
Effective Green, g (s)	41.0		41.0					61.0			61.0	
Actuated g/C Ratio	0.37		0.37					0.55			0.55	
Clearance Time (s)	5.4		5.4					5.4			5.4	
Vehicle Extension (s)	3.0		3.0					3.0			3.0	
Lane Grp Cap (vph)	1279		1038					2819			2665	
v/s Ratio Prot	c0.35		0.31					c0.53			0.26	
v/s Ratio Perm												
v/c Ratio	0.93		0.84					0.95			0.47	
Uniform Delay, d1	33.2		31.6					23.0			14.7	
Progression Factor	1.00		1.00					1.00			1.68	
Incremental Delay, d2	12.3		6.4					8.5			0.5	
Delay (s)	45.5		38.0					31.5			25.2	
Level of Service	D		D					C			C	
Approach Delay (s)		42.2			0.0			31.5			25.2	
Approach LOS		D			A			C			C	

Intersection Summary		
HCM 2000 Control Delay	34.0	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.94	C
Actuated Cycle Length (s)	110.0	Sum of lost time (s)
Intersection Capacity Utilization	85.5%	8.0
Analysis Period (min)	15	ICU Level of Service
		E

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
5: Hopyard Rd & Owens Rd

BART to Livermore Extension Project
2025 Enhanced Bus PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↘	↔↗		↘	↗	↗	↘	↑↑↑	↗	↗↘	↑↑↗	
Traffic Volume (vph)	365	247	300	518	283	282	275	894	261	339	1474	242
Future Volume (vph)	365	247	300	518	283	282	275	894	261	339	1474	242
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	2.7	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	0.91	0.91		1.00	0.95	0.95	1.00	0.91	1.00	0.97	0.91	
Frt	1.00	0.94		1.00	0.96	0.85	1.00	1.00	0.85	1.00	0.98	
Flt Protected	0.95	0.99		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1610	3139		1770	1707	1504	1770	5085	1583	3433	4978	
Flt Permitted	0.95	0.99		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1610	3139		1770	1707	1504	1770	5085	1583	3433	4978	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	397	268	326	563	308	307	299	972	284	368	1602	263
RTOR Reduction (vph)	0	99	0	0	9	41	0	0	201	0	19	0
Lane Group Flow (vph)	218	674	0	563	394	171	299	972	83	368	1846	0
Turn Type	Split	NA		Split	NA	pm+ov	Prot	NA	Perm	Prot	NA	
Protected Phases	8	8		4	4	1	5	2		1	6	
Permitted Phases						4			2			
Actuated Green, G (s)	16.7	16.7		26.7	26.7	49.7	15.0	33.3	33.3	23.0	41.3	
Effective Green, g (s)	18.0	18.0		28.0	28.0	52.3	15.0	35.0	35.0	23.0	43.0	
Actuated g/C Ratio	0.15	0.15		0.23	0.23	0.44	0.12	0.29	0.29	0.19	0.36	
Clearance Time (s)	5.3	5.3		5.3	5.3	4.0	4.0	5.7	5.7	4.0	5.7	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	241	470		413	398	689	221	1483	461	657	1783	
v/s Ratio Prot	0.14	c0.21		c0.32	0.23	0.05	c0.17	0.19		0.11	c0.37	
v/s Ratio Perm						0.06			0.05			
v/c Ratio	0.90	1.43		1.36	0.99	0.25	1.35	0.66	0.18	0.56	1.04	
Uniform Delay, d1	50.2	51.0		46.0	45.9	21.4	52.5	37.2	31.8	43.9	38.5	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	33.4	207.6		178.4	41.8	0.2	185.5	2.3	0.9	1.1	31.1	
Delay (s)	83.6	258.6		224.4	87.7	21.6	238.0	39.5	32.6	45.0	69.6	
Level of Service	F	F		F	F	C	F	D	C	D	E	
Approach Delay (s)		220.1			141.1			76.4			65.6	
Approach LOS		F			F			E			E	

Intersection Summary

HCM 2000 Control Delay	109.1	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.24		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	109.2%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
6: Hopyard Rd & Stoneridge Dr

BART to Livermore Extension Project
2025 Enhanced Bus PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	270	1375	705	118	1313	190	592	826	101	288	856	188
Future Volume (vph)	270	1375	705	118	1313	190	592	826	101	288	856	188
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.91	1.00	0.97	0.91	1.00	0.94	0.95	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5085	1583	3433	5085	1583	4990	3539	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5085	1583	3433	5085	1583	4990	3539	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	293	1495	766	128	1427	207	643	898	110	313	930	204
RTOR Reduction (vph)	0	0	193	0	0	138	0	0	79	0	0	157
Lane Group Flow (vph)	293	1495	573	128	1427	69	643	898	31	313	930	47
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8			2			6
Actuated Green, G (s)	9.0	35.0	35.0	4.0	30.0	30.0	13.8	25.5	25.5	9.0	20.7	20.7
Effective Green, g (s)	9.0	35.0	35.0	4.0	30.0	30.0	13.8	25.5	25.5	9.0	20.7	20.7
Actuated g/C Ratio	0.10	0.39	0.39	0.04	0.34	0.34	0.15	0.28	0.28	0.10	0.23	0.23
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	345	1988	619	153	1704	530	769	1008	451	345	1176	366
v/s Ratio Prot	c0.09	0.29		0.04	0.28		c0.13	c0.25		0.09	0.18	
v/s Ratio Perm			c0.36			0.04			0.02			0.03
v/c Ratio	0.85	0.75	0.93	0.84	0.84	0.13	0.84	0.89	0.07	0.91	0.79	0.13
Uniform Delay, d1	39.6	23.5	26.0	42.4	27.5	20.7	36.8	30.7	23.3	39.8	32.4	27.3
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	17.4	1.7	19.8	30.9	3.8	0.1	7.9	10.0	0.1	26.3	3.7	0.2
Delay (s)	57.0	25.2	45.8	73.3	31.3	20.8	44.6	40.6	23.4	66.1	36.1	27.4
Level of Service	E	C	D	E	C	C	D	D	C	E	D	C
Approach Delay (s)		35.0			33.1			41.0			41.4	
Approach LOS		D			C			D			D	

Intersection Summary		
HCM 2000 Control Delay	37.1	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.95	D
Actuated Cycle Length (s)	89.5	Sum of lost time (s)
Intersection Capacity Utilization	77.5%	16.0
Analysis Period (min)	15	ICU Level of Service
		D

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
7: Hopyard Rd & Las Positas Blvd

BART to Livermore Extension Project
2025 Enhanced Bus PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↑↑	↖	↖↗	↑↑	↖	↖↗	↑↑↑	↖	↖↗	↑↑↑	↖
Traffic Volume (vph)	99	255	423	540	407	50	344	938	252	74	1383	72
Future Volume (vph)	99	255	423	540	407	50	344	938	252	74	1383	72
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.95	1.00	0.97	0.95	1.00	0.97	0.91	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	3433	3539	1583	3433	5085	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	3433	3539	1583	3433	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	108	277	460	587	442	54	374	1020	274	80	1503	78
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	50
Lane Group Flow (vph)	108	277	460	587	442	54	374	1020	274	80	1503	28
Turn Type	Prot	NA	Free	Prot	NA	Free	Prot	NA	Free	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1		6
Permitted Phases			Free			Free			Free			6
Actuated Green, G (s)	4.7	12.8	87.0	16.7	24.8	87.0	10.0	37.6	87.0	3.9	31.5	31.5
Effective Green, g (s)	4.7	12.8	87.0	16.7	24.8	87.0	10.0	37.6	87.0	3.9	31.5	31.5
Actuated g/C Ratio	0.05	0.15	1.00	0.19	0.29	1.00	0.11	0.43	1.00	0.04	0.36	0.36
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	185	520	1583	658	1008	1583	394	2197	1583	153	1841	573
v/s Ratio Prot	0.03	c0.08		c0.17	0.12		c0.11	0.20		0.02	c0.30	
v/s Ratio Perm			0.29			0.03			0.17			0.02
v/c Ratio	0.58	0.53	0.29	0.89	0.44	0.03	0.95	0.46	0.17	0.52	0.82	0.05
Uniform Delay, d1	40.2	34.3	0.0	34.3	25.4	0.0	38.2	17.5	0.0	40.6	25.1	18.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	4.6	1.1	0.5	14.4	0.3	0.0	32.1	0.2	0.2	3.2	2.9	0.0
Delay (s)	44.8	35.4	0.5	48.6	25.7	0.0	70.4	17.7	0.2	43.8	28.1	18.1
Level of Service	D	D	A	D	C	A	E	B	A	D	C	B
Approach Delay (s)		17.6			36.9			26.6			28.3	
Approach LOS		B			D			C			C	

Intersection Summary

HCM 2000 Control Delay	27.8	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.80		
Actuated Cycle Length (s)	87.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	72.3%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
8: Willow Rd & Owens Rd

BART to Livermore Extension Project
2025 Enhanced Bus PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↕↗		↖↗	↕↕↕	↖	↖	↕↕	↖	↖	↕	↖
Traffic Volume (vph)	78	644	162	121	607	82	161	79	0	177	67	109
Future Volume (vph)	78	644	162	121	607	82	161	79	0	177	67	109
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	5.3	4.0		5.3	4.0	4.0
Lane Util. Factor	0.97	0.91		0.97	0.91	1.00	1.00	0.95		1.00	1.00	1.00
Frt	1.00	0.97		1.00	1.00	0.85	1.00	1.00		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	4932		3433	5085	1583	1770	3539		1770	1863	1583
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.71	1.00		0.70	1.00	1.00
Satd. Flow (perm)	3433	4932		3433	5085	1583	1322	3539		1301	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	85	700	176	132	660	89	175	86	0	192	73	118
RTOR Reduction (vph)	0	27	0	0	0	37	0	0	0	0	0	93
Lane Group Flow (vph)	85	849	0	132	660	52	175	86	0	192	73	25
Turn Type	Prot	NA		Prot	NA	Perm	Perm	NA	Perm	Perm	NA	Perm
Protected Phases	1	6		5	2			4			8	
Permitted Phases						2	4		4	8		8
Actuated Green, G (s)	10.5	62.4		10.4	62.3	62.3	22.2	22.2		22.2	22.2	22.2
Effective Green, g (s)	10.5	64.1		10.4	64.0	64.0	22.2	23.5		22.2	23.5	23.5
Actuated g/C Ratio	0.10	0.58		0.09	0.58	0.58	0.20	0.21		0.20	0.21	0.21
Clearance Time (s)	4.0	5.7		4.0	5.7	5.7	5.3	5.3		5.3	5.3	5.3
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	327	2874		324	2958	921	266	756		262	398	338
v/s Ratio Prot	0.02	c0.17		c0.04	0.13			0.02			0.04	
v/s Ratio Perm						0.03	0.13			c0.15		0.02
v/c Ratio	0.26	0.30		0.41	0.22	0.06	0.66	0.11		0.73	0.18	0.07
Uniform Delay, d1	46.1	11.6		46.9	11.1	9.9	40.4	34.9		41.1	35.4	34.6
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	0.4	0.3		0.8	0.2	0.1	5.8	0.1		10.1	0.2	0.1
Delay (s)	46.6	11.8		47.7	11.2	10.1	46.2	34.9		51.2	35.6	34.7
Level of Service	D	B		D	B	B	D	C		D	D	C
Approach Delay (s)		14.9			16.6			42.5			43.2	
Approach LOS		B			B			D			D	

Intersection Summary

HCM 2000 Control Delay	22.7	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.40		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	46.0%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 9: Hacienda Dr & Dublin Blvd

BART to Livermore Extension Project
 2025 Enhanced Bus PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↑↑↑	↖↗	↖↗	↑↑↑		↖↗	↑↑	↖↗	↖↗	↑↑↑	↖
Traffic Volume (vph)	50	1019	127	228	485	34	222	584	471	43	631	165
Future Volume (vph)	50	1019	127	228	485	34	222	584	471	43	631	165
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	6.0	5.0	4.5	6.0		5.0	6.0	6.0	4.5	5.5	5.5
Lane Util. Factor	0.97	0.91	0.88	0.97	0.91		0.94	0.95	0.88	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5085	2787	3433	5035		4990	3539	2787	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5085	2787	3433	5035		4990	3539	2787	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	54	1108	138	248	527	37	241	635	512	47	686	179
RTOR Reduction (vph)	0	0	64	0	7	0	0	0	233	0	0	138
Lane Group Flow (vph)	54	1108	74	248	557	0	241	635	279	47	686	41
Turn Type	Prot	NA	pm+ov	Prot	NA		Prot	NA	Perm	Prot	NA	Perm
Protected Phases	5	2	3	1	6		3	8		7	NA	4
Permitted Phases			2						8			4
Actuated Green, G (s)	4.1	29.8	40.6	10.9	36.6		10.8	29.7	29.7	2.8	21.7	21.7
Effective Green, g (s)	4.1	29.8	40.6	10.9	36.6		10.8	29.7	29.7	2.8	21.7	21.7
Actuated g/C Ratio	0.04	0.32	0.43	0.12	0.39		0.11	0.32	0.32	0.03	0.23	0.23
Clearance Time (s)	4.5	6.0	5.0	4.5	6.0		5.0	6.0	6.0	4.5	5.5	5.5
Vehicle Extension (s)	2.0	3.5	2.0	2.0	3.5		2.0	3.5	3.5	2.0	3.5	3.5
Lane Grp Cap (vph)	149	1608	1349	397	1956		572	1115	878	102	1171	364
v/s Ratio Prot	0.02	c0.22	0.01	c0.07	0.11		0.05	c0.18		0.01	c0.13	
v/s Ratio Perm			0.02						0.10			0.03
v/c Ratio	0.36	0.69	0.05	0.62	0.28		0.42	0.57	0.32	0.46	0.59	0.11
Uniform Delay, d1	43.8	28.1	15.6	39.7	19.8		38.8	26.9	24.5	45.0	32.3	28.6
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.5	1.3	0.0	2.2	0.1		0.2	0.7	0.2	1.2	0.8	0.2
Delay (s)	44.3	29.4	15.6	41.9	19.9		39.0	27.6	24.8	46.2	33.1	28.8
Level of Service	D	C	B	D	B		D	C	C	D	C	C
Approach Delay (s)		28.6			26.6			28.6			32.9	
Approach LOS		C			C			C			C	

Intersection Summary

HCM 2000 Control Delay	29.1	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.64		
Actuated Cycle Length (s)	94.2	Sum of lost time (s)	21.0
Intersection Capacity Utilization	63.3%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 10: Hacienda Dr & Martinelli Blvd/Hacienda Crossings

BART to Livermore Extension Project
 2025 Enhanced Bus PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗	↖↗	↖↗	↗		↖↗↘	↖↗↘	↗	↖↗	↖↗↘	
Traffic Volume (vph)	23	50	391	290	37	21	419	1264	468	59	912	71
Future Volume (vph)	23	50	391	290	37	21	419	1264	468	59	912	71
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	3.0	3.0	5.5	3.0		3.5	3.0	3.0	5.0	3.5	
Lane Util. Factor	1.00	0.91	0.91	0.97	1.00		0.94	0.91	1.00	0.97	0.86	
Frt	1.00	0.93	0.85	1.00	0.95		1.00	1.00	0.85	1.00	0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1770	1582	2882	3433	1761		4990	5085	1583	3433	6339	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1770	1582	2882	3433	1761		4990	5085	1583	3433	6339	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	25	54	425	315	40	23	455	1374	509	64	991	77
RTOR Reduction (vph)	0	31	278	0	15	0	0	0	194	0	10	0
Lane Group Flow (vph)	25	66	104	315	48	0	455	1374	315	64	1058	0
Turn Type	Prot	NA	Perm	Prot	NA		Prot	NA	pm+ov	Prot	NA	
Protected Phases	5	2		1	6		3	8	1	7	4	
Permitted Phases			2						8			
Actuated Green, G (s)	2.2	13.3	13.3	15.2	26.8		14.2	35.0	50.2	4.6	25.4	
Effective Green, g (s)	1.7	15.3	15.3	14.7	28.8		15.2	37.0	54.2	4.1	26.9	
Actuated g/C Ratio	0.02	0.17	0.17	0.17	0.33		0.17	0.42	0.62	0.05	0.31	
Clearance Time (s)	4.5	5.0	5.0	5.0	5.0		4.5	5.0	5.0	4.5	5.0	
Vehicle Extension (s)	3.0	4.0	4.0	2.0	4.0		3.0	4.0	2.0	3.0	4.0	
Lane Grp Cap (vph)	34	276	503	576	578		865	2147	979	160	1946	
v/s Ratio Prot	c0.01	c0.04		c0.09	0.03		0.09	c0.27	0.06	0.02	c0.17	
v/s Ratio Perm			0.04						0.14			
v/c Ratio	0.74	0.24	0.21	0.55	0.08		0.53	0.64	0.32	0.40	0.54	
Uniform Delay, d1	42.7	31.1	31.0	33.4	20.3		32.9	20.0	7.9	40.6	25.2	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	57.7	0.6	0.3	0.6	0.1		0.6	0.7	0.1	1.6	0.4	
Delay (s)	100.4	31.8	31.2	34.0	20.4		33.5	20.7	8.0	42.2	25.6	
Level of Service	F	C	C	C	C		C	C	A	D	C	
Approach Delay (s)		34.8			31.7			20.5			26.6	
Approach LOS		C			C			C			C	

Intersection Summary		
HCM 2000 Control Delay	24.7	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.55	C
Actuated Cycle Length (s)	87.6	Sum of lost time (s)
Intersection Capacity Utilization	62.8%	16.5
Analysis Period (min)	15	ICU Level of Service
		B

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 11: Hacienda Dr & I-580 WB Ramps

BART to Livermore Extension Project
 2025 Enhanced Bus PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↔↔		↔↔		↑↑↑			↑↑↑	↔
Traffic Volume (vph)	0	0	0	357	0	363	0	1523	760	0	802	755
Future Volume (vph)	0	0	0	357	0	363	0	1523	760	0	802	755
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0		4.0		4.0			4.0	4.0
Lane Util. Factor				0.97		0.88		0.91			0.86	0.86
Frt				1.00		0.85		0.95			0.95	0.85
Flt Protected				0.95		1.00		1.00			1.00	1.00
Satd. Flow (prot)				3433		2787		4831			4575	1362
Flt Permitted				0.95		1.00		1.00			1.00	1.00
Satd. Flow (perm)				3433		2787		4831			4575	1362
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	388	0	395	0	1655	826	0	872	821
RTOR Reduction (vph)	0	0	0	0	0	46	0	159	0	0	146	145
Lane Group Flow (vph)	0	0	0	388	0	349	0	2322	0	0	1137	265
Turn Type				Prot		Prot		NA			NA	Perm
Protected Phases				4		4		2			6	
Permitted Phases												6
Actuated Green, G (s)				10.1		10.1		33.6			33.6	33.6
Effective Green, g (s)				11.5		11.5		35.5			35.5	35.5
Actuated g/C Ratio				0.21		0.21		0.65			0.65	0.65
Clearance Time (s)				5.4		5.4		5.9			5.9	5.9
Vehicle Extension (s)				3.0		3.0		3.0			3.0	3.0
Lane Grp Cap (vph)				717		582		3118			2952	879
v/s Ratio Prot				0.11		c0.13		c0.48			0.25	
v/s Ratio Perm												0.19
v/c Ratio				0.54		0.60		0.74			0.39	0.30
Uniform Delay, d1				19.4		19.7		6.7			4.6	4.3
Progression Factor				1.00		1.00		0.75			1.00	1.00
Incremental Delay, d2				0.8		1.7		1.1			0.4	0.9
Delay (s)				20.2		21.3		6.1			5.0	5.2
Level of Service				C		C		A			A	A
Approach Delay (s)		0.0			20.8			6.1			5.0	
Approach LOS		A			C			A			A	

Intersection Summary			
HCM 2000 Control Delay	8.1	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.71		
Actuated Cycle Length (s)	55.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	65.8%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
12: Hacienda Dr & I-580 EB Ramps

BART to Livermore Extension Project
2025 Enhanced Bus PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗		↖↗					↖↗↘	↖		↖↗↘	
Traffic Volume (vph)	886	0	444	0	0	0	0	1567	857	0	745	313
Future Volume (vph)	886	0	444	0	0	0	0	1567	857	0	745	313
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0					4.0	4.0		4.0	
Lane Util. Factor	0.97		0.88					0.86	0.86		0.91	
Frt	1.00		0.85					0.98	0.85		0.96	
Flt Protected	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (prot)	3433		2787					4701	1362		4860	
Flt Permitted	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (perm)	3433		2787					4701	1362		4860	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	963	0	483	0	0	0	0	1703	932	0	810	340
RTOR Reduction (vph)	0	0	180	0	0	0	0	18	265	0	62	0
Lane Group Flow (vph)	963	0	303	0	0	0	0	1974	378	0	1088	0
Turn Type	Prot		Prot					NA	Perm		NA	
Protected Phases	4		4					2			6	
Permitted Phases									2			
Actuated Green, G (s)	35.9		35.9					62.8	62.8		62.8	
Effective Green, g (s)	37.3		37.3					64.7	64.7		64.7	
Actuated g/C Ratio	0.34		0.34					0.59	0.59		0.59	
Clearance Time (s)	5.4		5.4					5.9	5.9		5.9	
Vehicle Extension (s)	2.0		2.0					2.0	2.0		2.0	
Lane Grp Cap (vph)	1164		945					2765	801		2858	
v/s Ratio Prot	c0.28		0.11					c0.42			0.22	
v/s Ratio Perm									0.28			
v/c Ratio	0.83		0.32					0.71	0.47		0.38	
Uniform Delay, d1	33.4		27.0					16.1	12.9		12.0	
Progression Factor	1.00		1.00					1.00	1.00		0.81	
Incremental Delay, d2	4.7		0.1					1.6	2.0		0.4	
Delay (s)	38.1		27.0					17.7	14.9		10.0	
Level of Service	D		C					B	B		B	
Approach Delay (s)		34.4			0.0			17.0			10.0	
Approach LOS		C			A			B			B	

Intersection Summary			
HCM 2000 Control Delay	20.3	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.76		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	68.6%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 13: Hacienda Dr & Owens Rd

BART to Livermore Extension Project
 2025 Enhanced Bus PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔↔	↑↑↑	↔	↔↔	↑↑↑	↔	↔↔	↑↑↑	↔	↔↔	↑↑↑	↔
Traffic Volume (vph)	677	731	52	119	301	751	35	982	274	448	468	258
Future Volume (vph)	677	731	52	119	301	751	35	982	274	448	468	258
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	2.3	4.0	4.0	2.3	4.0	4.0	2.7	4.0	4.0	2.7
Lane Util. Factor	0.97	0.91	1.00	0.97	0.91	1.00	0.97	0.91	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5085	1583	3433	5085	1583	3433	5085	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5085	1583	3433	5085	1583	3433	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	736	795	57	129	327	816	38	1067	298	487	509	280
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	736	795	57	129	327	816	38	1067	298	487	509	280
Turn Type	Prot	NA	Free	Prot	NA	Free	Prot	NA	Free	Prot	NA	Free
Protected Phases	1	6		5	2		7	4		3	8	
Permitted Phases			Free			Free			Free			Free
Actuated Green, G (s)	37.9	41.3	115.0	7.8	11.2	115.0	2.7	31.9	115.0	15.0	44.2	115.0
Effective Green, g (s)	37.9	43.0	115.0	7.8	12.9	115.0	2.7	33.2	115.0	15.0	45.5	115.0
Actuated g/C Ratio	0.33	0.37	1.00	0.07	0.11	1.00	0.02	0.29	1.00	0.13	0.40	1.00
Clearance Time (s)	4.0	5.7		4.0	5.7		4.0	5.3		4.0	5.3	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	1131	1901	1583	232	570	1583	80	1468	1583	447	2011	1583
v/s Ratio Prot	c0.21	0.16		0.04	0.06		0.01	c0.21		c0.14	0.10	
v/s Ratio Perm			0.04			c0.52			0.19			0.18
v/c Ratio	0.65	0.42	0.04	0.56	0.57	0.52	0.47	0.73	0.19	1.09	0.25	0.18
Uniform Delay, d1	32.9	26.7	0.0	51.9	48.4	0.0	55.5	36.8	0.0	50.0	23.3	0.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.4	0.7	0.0	2.9	4.2	1.2	4.4	1.8	0.3	68.9	0.1	0.2
Delay (s)	34.3	27.4	0.0	54.8	52.6	1.2	59.8	38.6	0.3	118.9	23.4	0.2
Level of Service	C	C	A	D	D	A	E	D	A	F	C	A
Approach Delay (s)		29.6			19.9			31.1			54.8	
Approach LOS		C			B			C			D	

Intersection Summary		
HCM 2000 Control Delay	33.5	HCM 2000 Level of Service C
HCM 2000 Volume to Capacity ratio	0.75	
Actuated Cycle Length (s)	115.0	Sum of lost time (s) 16.0
Intersection Capacity Utilization	70.2%	ICU Level of Service C
Analysis Period (min)	15	

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
14: Tassajara Rd & Dublin Blvd

BART to Livermore Extension Project
2025 Enhanced Bus PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	250	801	449	245	293	20	379	872	493	30	787	138
Future Volume (vph)	250	801	449	245	293	20	379	872	493	30	787	138
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	6.0	6.0	5.0	6.0		5.0	6.0	6.0	5.0	6.0	6.0
Lane Util. Factor	0.97	0.95	0.88	0.94	0.95		0.94	0.91	1.00	0.97	0.86	0.88
Frt	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	2787	4990	3505		4990	5085	1583	3433	6408	2787
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	2787	4990	3505		4990	5085	1583	3433	6408	2787
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	272	871	488	266	318	22	412	948	536	33	855	150
RTOR Reduction (vph)	0	0	286	0	3	0	0	0	251	0	0	109
Lane Group Flow (vph)	272	871	202	266	337	0	412	948	285	33	855	41
Turn Type	Prot	NA	Perm	Prot	NA		Prot	NA	Perm	Prot	NA	Perm
Protected Phases	5	2		1	6		3	8		7		4
Permitted Phases			2						8			4
Actuated Green, G (s)	17.0	41.3	41.3	16.4	40.7		17.1	46.0	46.0	8.1	37.0	37.0
Effective Green, g (s)	17.0	41.3	41.3	16.4	40.7		17.1	46.0	46.0	8.1	37.0	37.0
Actuated g/C Ratio	0.13	0.31	0.31	0.12	0.30		0.13	0.34	0.34	0.06	0.28	0.28
Clearance Time (s)	5.0	6.0	6.0	5.0	6.0		5.0	6.0	6.0	5.0	6.0	6.0
Vehicle Extension (s)	2.0	3.0	3.0	2.0	3.0		2.0	4.0	4.0	2.0	4.0	4.0
Lane Grp Cap (vph)	436	1092	860	611	1066		637	1748	544	207	1772	770
v/s Ratio Prot	c0.08	c0.25		0.05	0.10		c0.08	c0.19		0.01	0.13	
v/s Ratio Perm			0.07						0.18			0.01
v/c Ratio	0.62	0.80	0.23	0.44	0.32		0.65	0.54	0.52	0.16	0.48	0.05
Uniform Delay, d1	55.4	42.4	34.5	54.4	35.8		55.5	35.4	35.1	59.6	40.4	35.5
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	2.0	4.1	0.1	0.2	0.2		1.7	0.4	1.2	0.1	0.3	0.0
Delay (s)	57.4	46.6	34.6	54.6	36.0		57.2	35.8	36.3	59.8	40.7	35.6
Level of Service	E	D	C	D	D		E	D	D	E	D	D
Approach Delay (s)		44.8			44.2			40.6			40.6	
Approach LOS		D			D			D			D	

Intersection Summary

HCM 2000 Control Delay	42.3	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.68		
Actuated Cycle Length (s)	133.8	Sum of lost time (s)	22.0
Intersection Capacity Utilization	83.2%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 15: Tassajara Rd & I-580 WB Ramps

BART to Livermore Extension Project
 2025 Enhanced Bus PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↔↔		↔↔		↑↑	↔		↑↑↔	↔
Traffic Volume (vph)	0	0	0	489	0	227	0	1353	645	0	1171	614
Future Volume (vph)	0	0	0	489	0	227	0	1353	645	0	1171	614
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0		4.0		4.0	4.0		4.0	4.0
Lane Util. Factor				0.97		0.88		0.95	1.00		0.86	0.86
Frt				1.00		0.85		1.00	0.85		0.98	0.85
Flt Protected				0.95		1.00		1.00	1.00		1.00	1.00
Satd. Flow (prot)				3433		2787		3539	1583		4697	1362
Flt Permitted				0.95		1.00		1.00	1.00		1.00	1.00
Satd. Flow (perm)				3433		2787		3539	1583		4697	1362
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	532	0	247	0	1471	701	0	1273	667
RTOR Reduction (vph)	0	0	0	0	0	42	0	0	275	0	38	173
Lane Group Flow (vph)	0	0	0	532	0	205	0	1471	426	0	1462	267
Turn Type				Perm		Perm		NA	Perm		NA	Perm
Protected Phases								2			6	
Permitted Phases				8		8			2			6
Actuated Green, G (s)				13.6		13.6		33.4	33.4		33.4	33.4
Effective Green, g (s)				13.6		13.6		33.4	33.4		33.4	33.4
Actuated g/C Ratio				0.25		0.25		0.61	0.61		0.61	0.61
Clearance Time (s)				4.0		4.0		4.0	4.0		4.0	4.0
Vehicle Extension (s)				3.0		3.0		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)				848		689		2149	961		2852	827
v/s Ratio Prot								c0.42			0.31	
v/s Ratio Perm				c0.15		0.07			0.27			0.20
v/c Ratio				0.63		0.30		0.68	0.44		0.51	0.32
Uniform Delay, d1				18.4		16.8		7.3	5.8		6.2	5.3
Progression Factor				1.00		1.00		1.00	1.00		1.00	1.00
Incremental Delay, d2				1.5		0.2		1.8	1.5		0.7	1.0
Delay (s)				19.9		17.1		9.1	7.3		6.8	6.3
Level of Service				B		B		A	A		A	A
Approach Delay (s)		0.0			19.0			8.5			6.7	
Approach LOS		A			B			A			A	

Intersection Summary			
HCM 2000 Control Delay	9.5	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.67		
Actuated Cycle Length (s)	55.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	58.0%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 16: Santa Rita Rd & I-580 EB Ramps/Pimilco Dr

BART to Livermore Extension Project
 2025 Enhanced Bus PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	389	90	235	143	0	315	0	1194	180	318	954	0
Future Volume (vph)	389	90	235	143	0	315	0	1194	180	318	954	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0		4.0		4.0		4.0	4.0	
Lane Util. Factor	0.97	1.00	1.00	0.97		0.88		0.86		1.00	0.95	
Frt	1.00	1.00	0.85	1.00		0.85		0.98		1.00	1.00	
Flt Protected	0.95	1.00	1.00	0.95		1.00		1.00		0.95	1.00	
Satd. Flow (prot)	3433	1863	1583	3433		2787		6282		1770	3539	
Flt Permitted	0.95	1.00	1.00	0.95		1.00		1.00		0.95	1.00	
Satd. Flow (perm)	3433	1863	1583	3433		2787		6282		1770	3539	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	423	98	255	155	0	342	0	1298	196	346	1037	0
RTOR Reduction (vph)	0	0	98	0	0	35	0	22	0	0	0	0
Lane Group Flow (vph)	423	98	157	155	0	307	0	1472	0	346	1037	0
Turn Type	Perm	NA	Perm	Prot		pm+ov		NA		Prot	NA	Perm
Protected Phases		4		3		1		2		1	6	
Permitted Phases	4		4			3						6
Actuated Green, G (s)	19.1	19.1	19.1	7.5		33.5		41.4		26.0	71.4	
Effective Green, g (s)	19.1	19.1	19.1	7.5		33.5		41.4		26.0	71.4	
Actuated g/C Ratio	0.17	0.17	0.17	0.07		0.30		0.38		0.24	0.65	
Clearance Time (s)	4.0	4.0	4.0	4.0		4.0		4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0		3.0		3.0		3.0	3.0	
Lane Grp Cap (vph)	596	323	274	234		848		2364		418	2297	
v/s Ratio Prot		0.05		c0.05		0.09		c0.23		c0.20	0.29	
v/s Ratio Perm	c0.12		0.10			0.02						
v/c Ratio	0.71	0.30	0.57	0.66		0.36		0.62		0.83	0.45	
Uniform Delay, d1	42.8	39.6	41.7	50.0		29.9		27.9		39.9	9.6	
Progression Factor	1.00	1.00	1.00	1.00		1.00		1.00		1.00	1.00	
Incremental Delay, d2	3.9	0.5	2.9	6.9		0.3		1.2		12.7	0.6	
Delay (s)	46.7	40.2	44.6	56.9		30.2		29.2		52.5	10.2	
Level of Service	D	D	D	E		C		C		D	B	
Approach Delay (s)		45.2			38.5			29.2			20.8	
Approach LOS		D			D			C			C	

Intersection Summary		
HCM 2000 Control Delay	30.5	HCM 2000 Level of Service C
HCM 2000 Volume to Capacity ratio	0.70	
Actuated Cycle Length (s)	110.0	Sum of lost time (s) 16.0
Intersection Capacity Utilization	60.1%	ICU Level of Service B
Analysis Period (min)	15	

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 17: Santa Rita Rd & Valley Ave

BART to Livermore Extension Project
 2025 Enhanced Bus PM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	351	484	113	129	314	775	150	761	134	1025	1094	243
Future Volume (vph)	351	484	113	129	314	775	150	761	134	1025	1094	243
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.97	0.95		0.97	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.98		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	3433	3460		3433	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	3433	3460		3433	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	382	526	123	140	341	842	163	827	146	1114	1189	264
RTOR Reduction (vph)	0	0	99	0	0	0	0	12	0	0	0	113
Lane Group Flow (vph)	382	526	24	140	341	842	163	961	0	1114	1189	151
Turn Type	Prot	NA	Perm	Prot	NA	Free	Prot	NA		Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1		6
Permitted Phases			4			Free						6
Actuated Green, G (s)	14.0	19.7	19.7	10.0	15.7	119.7	9.5	34.0		40.0	64.5	64.5
Effective Green, g (s)	14.0	19.7	19.7	10.0	15.7	119.7	9.5	34.0		40.0	64.5	64.5
Actuated g/C Ratio	0.12	0.16	0.16	0.08	0.13	1.00	0.08	0.28		0.33	0.54	0.54
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	401	582	260	147	464	1583	272	982		1147	1906	852
v/s Ratio Prot	c0.11	c0.15		0.08	0.10		0.05	c0.28		c0.32	0.34	
v/s Ratio Perm			0.02			c0.53						0.10
v/c Ratio	0.95	0.90	0.09	0.95	0.73	0.53	0.60	0.98		0.97	0.62	0.18
Uniform Delay, d1	52.5	49.1	42.4	54.6	50.0	0.0	53.3	42.5		39.3	19.2	14.1
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	32.7	17.4	0.2	59.6	6.0	1.3	3.5	23.3		19.9	0.6	0.1
Delay (s)	85.3	66.5	42.6	114.2	56.0	1.3	56.8	65.8		59.2	19.8	14.2
Level of Service	F	E	D	F	E	A	E	E		E	B	B
Approach Delay (s)		70.6			27.3			64.5			36.3	
Approach LOS		E			C			E			D	

Intersection Summary		
HCM 2000 Control Delay	45.5	HCM 2000 Level of Service D
HCM 2000 Volume to Capacity ratio	0.98	
Actuated Cycle Length (s)	119.7	Sum of lost time (s) 16.0
Intersection Capacity Utilization	88.4%	ICU Level of Service E
Analysis Period (min)	15	

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
18: Bernal Ave/Valley Ave & Stanley Blvd

BART to Livermore Extension Project
2025 Enhanced Bus PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↗↘	↑↑	↗	↗↘	↑↑	↗	↗	↑↑	↗	↗↘	↑↑	
Traffic Volume (vph)	204	834	61	105	231	341	86	328	302	826	579	120
Future Volume (vph)	204	834	61	105	231	341	86	328	302	826	579	120
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	0.97	0.95	1.00	0.97	0.91	0.91	1.00	0.95	1.00	0.97	0.95	
Frt	1.00	1.00	0.85	1.00	0.94	0.85	1.00	1.00	0.85	1.00	0.97	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	3433	3539	1583	3433	3182	1441	1770	3539	1583	3433	3448	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	3433	3539	1583	3433	3182	1441	1770	3539	1583	3433	3448	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	222	907	66	114	251	371	93	357	328	898	629	130
RTOR Reduction (vph)	0	0	41	0	115	52	0	0	168	0	19	0
Lane Group Flow (vph)	222	907	25	114	310	145	93	357	160	898	740	0
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	
Protected Phases	7	4	5	3	8	1	5	2		1	6	
Permitted Phases			4			8			2			
Actuated Green, G (s)	9.4	25.1	32.5	4.0	19.7	44.8	7.4	15.8	15.8	25.1	33.5	
Effective Green, g (s)	9.4	25.1	32.5	4.0	19.7	44.8	7.4	15.8	15.8	25.1	33.5	
Actuated g/C Ratio	0.11	0.29	0.38	0.05	0.23	0.52	0.09	0.18	0.18	0.29	0.39	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	375	1032	671	159	728	817	152	650	290	1001	1343	
v/s Ratio Prot	c0.06	c0.26	0.00	0.03	0.10	0.05	0.05	0.10		c0.26	c0.21	
v/s Ratio Perm			0.01			0.05			0.10			
v/c Ratio	0.59	0.88	0.04	0.72	0.43	0.18	0.61	0.55	0.55	0.90	0.55	
Uniform Delay, d1	36.5	29.0	16.9	40.4	28.3	10.9	37.9	31.9	31.9	29.2	20.4	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	2.5	8.7	0.0	14.3	0.4	0.1	7.1	1.0	2.3	10.5	0.5	
Delay (s)	39.0	37.7	16.9	54.7	28.7	11.0	45.0	32.8	34.1	39.7	20.9	
Level of Service	D	D	B	D	C	B	D	C	C	D	C	
Approach Delay (s)		36.8			28.0			34.8			31.1	
Approach LOS		D			C			C			C	




































Intersection Summary

HCM 2000 Control Delay	32.8	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.83		
Actuated Cycle Length (s)	86.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	75.3%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 19: Fallon Rd & Dublin Blvd

BART to Livermore Extension Project
 2025 Enhanced Bus PM

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations	 	  	 	  	  		 	  	 	 			
Traffic Volume (vph)	215	626	427	48	18	55	193	618	172	112	586	27	
Future Volume (vph)	215	626	427	48	18	55	193	618	172	112	586	27	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)	5.3	5.3	5.3	4.0	4.0	4.0	5.3	4.9	4.9	5.3	4.9	4.9	
Lane Util. Factor	0.97	0.91	0.88	0.94	0.91	1.00	0.97	0.91	0.88	0.97	0.91	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	3090	4577	2508	4491	4577	1425	3090	4577	2508	3090	4577	1425	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	3090	4577	2508	4491	4577	1425	3090	4577	2508	3090	4577	1425	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	
Adj. Flow (vph)	234	680	464	52	20	60	210	672	187	122	637	29	
RTOR Reduction (vph)	0	0	105	0	0	57	0	0	123	0	0	21	
Lane Group Flow (vph)	234	680	359	52	20	3	210	672	64	122	637	8	
Turn Type	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm	
Protected Phases	5	2	3	1	6		3	8		7	NA	4	
Permitted Phases			2			6			8			4	
Actuated Green, G (s)	17.8	19.5	29.3	2.1	3.8	3.8	9.8	24.5	24.5	6.1	20.8	20.8	
Effective Green, g (s)	17.8	19.5	29.3	2.1	3.8	3.8	9.8	24.5	24.5	6.1	20.8	20.8	
Actuated g/C Ratio	0.25	0.27	0.41	0.03	0.05	0.05	0.14	0.34	0.34	0.09	0.29	0.29	
Clearance Time (s)	5.3	5.3	5.3	4.0	4.0	4.0	5.3	4.9	4.9	5.3	4.9	4.9	
Vehicle Extension (s)	2.0	4.0	2.0	2.0	2.0	2.0	2.0	4.0	4.0	2.0	4.0	4.0	
Lane Grp Cap (vph)	767	1244	1024	131	242	75	422	1563	856	262	1327	413	
v/s Ratio Prot	c0.08	c0.15	0.05	0.01	0.00		c0.07	c0.15		0.04	0.14		
v/s Ratio Perm			0.10			0.00			0.03			0.01	
v/c Ratio	0.31	0.55	0.35	0.40	0.08	0.04	0.50	0.43	0.07	0.47	0.48	0.02	
Uniform Delay, d1	21.9	22.3	14.6	34.2	32.3	32.2	28.7	18.2	15.9	31.2	21.0	18.2	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.1	0.6	0.1	0.7	0.1	0.1	0.3	0.3	0.1	0.5	0.4	0.0	
Delay (s)	22.0	22.9	14.7	34.9	32.3	32.3	29.0	18.5	16.0	31.7	21.4	18.2	
Level of Service	C	C	B	C	C	C	C	B	B	C	C	B	
Approach Delay (s)		20.0			33.3			20.1			22.9		
Approach LOS		C			C			C			C		
Intersection Summary													
HCM 2000 Control Delay			21.2									HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio			0.51										
Actuated Cycle Length (s)			71.7									Sum of lost time (s)	19.5
Intersection Capacity Utilization			45.7%									ICU Level of Service	A
Analysis Period (min)			15										
c Critical Lane Group													

HCM Signalized Intersection Capacity Analysis
20: El Charro Rd/Fallon Rd & I-580 WB Ramps

BART to Livermore Extension Project
2025 Enhanced Bus PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	267	0	444	0	664	245	0	857	375
Future Volume (vph)	0	0	0	267	0	444	0	664	245	0	857	375
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0	4.0	4.0		4.0	4.0		4.0	4.0
Lane Util. Factor				0.95	0.95	0.88		0.95	0.95		0.95	1.00
Frt				1.00	1.00	0.85		0.99	0.85		1.00	0.85
Flt Protected				0.95	0.95	1.00		1.00	1.00		1.00	1.00
Satd. Flow (prot)				1681	1681	2787		1760	1504		3539	1583
Flt Permitted				0.95	0.95	1.00		1.00	1.00		1.00	1.00
Satd. Flow (perm)				1681	1681	2787		1760	1504		3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	290	0	483	0	722	266	0	932	408
RTOR Reduction (vph)	0	0	0	0	0	352	0	2	80	0	0	136
Lane Group Flow (vph)	0	0	0	148	142	131	0	747	159	0	932	272
Turn Type				Perm	NA	Perm		NA	Perm		NA	Perm
Protected Phases					8			2			6	
Permitted Phases				8		8			2			6
Actuated Green, G (s)				10.9	10.9	10.9		36.6	36.6		36.6	36.6
Effective Green, g (s)				10.4	10.4	10.4		36.6	36.6		36.6	36.6
Actuated g/C Ratio				0.19	0.19	0.19		0.67	0.67		0.67	0.67
Clearance Time (s)				3.5	3.5	3.5		4.0	4.0		4.0	4.0
Vehicle Extension (s)				2.0	2.0	2.0		2.0	2.0		2.0	2.0
Lane Grp Cap (vph)				317	317	526		1171	1000		2355	1053
v/s Ratio Prot								c0.42			0.26	
v/s Ratio Perm				c0.09	0.08	0.05			0.11			0.17
v/c Ratio				0.47	0.45	0.25		0.64	0.16		0.40	0.26
Uniform Delay, d1				19.8	19.8	19.0		5.3	3.4		4.2	3.7
Progression Factor				1.00	1.00	1.00		1.04	2.30		1.00	1.00
Incremental Delay, d2				0.4	0.4	0.1		2.4	0.3		0.5	0.6
Delay (s)				20.2	20.1	19.1		8.0	8.2		4.7	4.3
Level of Service				C	C	B		A	A		A	A
Approach Delay (s)		0.0			19.5			8.0			4.6	
Approach LOS		A			B			A			A	

Intersection Summary

HCM 2000 Control Delay	9.4	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.60		
Actuated Cycle Length (s)	55.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	62.1%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
21: El Charro Rd & I-580 EB Ramps

BART to Livermore Extension Project
2025 Enhanced Bus PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔		↔					↕	↔		↕	↔
Traffic Volume (vph)	321	0	357	0	0	0	0	904	281	0	876	0
Future Volume (vph)	321	0	357	0	0	0	0	904	281	0	876	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0					4.0	4.0		4.0	
Lane Util. Factor	0.97		0.88					0.91	0.91		0.91	
Frt	1.00		0.85					0.99	0.85		1.00	
Flt Protected	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (prot)	3433		2787					3372	1441		3390	
Flt Permitted	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (perm)	3433		2787					3372	1441		3390	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	349	0	388	0	0	0	0	983	305	0	952	0
RTOR Reduction (vph)	0	0	194	0	0	0	0	4	87	0	0	0
Lane Group Flow (vph)	349	0	194	0	0	0	0	1016	181	0	952	0
Turn Type	Prot		Perm					NA	Perm		NA	Perm
Protected Phases	4							2			6	
Permitted Phases			4						2			6
Actuated Green, G (s)	9.9		9.9					37.1	37.1		37.1	
Effective Green, g (s)	9.9		9.9					37.1	37.1		37.1	
Actuated g/C Ratio	0.18		0.18					0.67	0.67		0.67	
Clearance Time (s)	4.0		4.0					4.0	4.0		4.0	
Vehicle Extension (s)	2.0		2.0					3.0	3.0		3.0	
Lane Grp Cap (vph)	617		501					2274	972		2286	
v/s Ratio Prot	c0.10							c0.30			0.28	
v/s Ratio Perm			0.07						0.13			
v/c Ratio	0.57		0.39					0.45	0.19		0.42	
Uniform Delay, d1	20.6		19.9					4.2	3.3		4.1	
Progression Factor	1.00		1.00					1.00	1.00		0.73	
Incremental Delay, d2	0.7		0.2					0.6	0.4		0.5	
Delay (s)	21.3		20.1					4.8	3.8		3.5	
Level of Service	C		C					A	A		A	
Approach Delay (s)		20.6			0.0			4.6			3.5	
Approach LOS		C			A			A			A	

Intersection Summary

HCM 2000 Control Delay	8.2	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.47		
Actuated Cycle Length (s)	55.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	43.8%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 22: El Charro Rd & Stoneridge Dr/Jack London Blvd

BART to Livermore Extension Project
 2025 Enhanced Bus PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔↔↔	↑↑	↔	↔	↑↑	↔↔	↔	↑↑		↔↔↔	↑	↔↔
Traffic Volume (vph)	260	562	4	3	311	469	2	33	3	746	25	136
Future Volume (vph)	260	562	4	3	311	469	2	33	3	746	25	136
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	0.94	0.95	1.00	1.00	0.95	0.88	1.00	0.95		0.94	1.00	0.88
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	4491	3185	1425	1593	3185	2508	1593	3149		4491	1676	2508
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	4491	3185	1425	1593	3185	2508	1593	3149		4491	1676	2508
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	283	611	4	3	338	510	2	36	3	811	27	148
RTOR Reduction (vph)	0	0	3	0	0	234	0	3	0	0	0	90
Lane Group Flow (vph)	283	611	1	3	338	276	2	36	0	811	27	58
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Prot	NA		Prot	NA	Perm
Protected Phases	7	4		3	8	1	5	2		1	NA	6
Permitted Phases			4			8						6
Actuated Green, G (s)	8.5	23.3	23.3	0.7	15.5	36.2	0.7	6.3		20.7	26.3	26.3
Effective Green, g (s)	8.5	23.3	23.3	0.7	15.5	36.2	0.7	6.3		20.7	26.3	26.3
Actuated g/C Ratio	0.13	0.35	0.35	0.01	0.23	0.54	0.01	0.09		0.31	0.39	0.39
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	569	1107	495	16	736	1355	16	296		1387	657	984
v/s Ratio Prot	0.06	c0.19		0.00	c0.11	0.06	0.00	c0.01		c0.18	0.02	
v/s Ratio Perm			0.00			0.05						0.02
v/c Ratio	0.50	0.55	0.00	0.19	0.46	0.20	0.12	0.12		0.58	0.04	0.06
Uniform Delay, d1	27.3	17.6	14.3	32.9	22.1	8.0	32.8	27.8		19.5	12.6	12.7
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	0.7	0.6	0.0	5.6	0.5	0.1	3.5	0.2		0.6	0.0	0.0
Delay (s)	27.9	18.2	14.3	38.5	22.6	8.0	36.4	28.0		20.2	12.6	12.7
Level of Service	C	B	B	D	C	A	D	C		C	B	B
Approach Delay (s)		21.3			13.9			28.4			18.8	
Approach LOS		C			B			C			B	

Intersection Summary		
HCM 2000 Control Delay	18.3	HCM 2000 Level of Service B
HCM 2000 Volume to Capacity ratio	0.53	
Actuated Cycle Length (s)	67.0	Sum of lost time (s) 16.0
Intersection Capacity Utilization	53.0%	ICU Level of Service A
Analysis Period (min)	15	

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
24: Airway Blvd/Driveway & N Canyons Pkwy



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑	↑	↑↑	↑	↑		↑	↑↑		↑	
Traffic Volume (vph)	0	531	330	826	68	0	49	0	743	0	0	0
Future Volume (vph)	0	531	330	826	68	0	49	0	743	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0	4.0	4.0			4.4	4.0			
Lane Util. Factor		0.95	1.00	0.97	1.00			1.00	0.88			
Frt		1.00	0.85	1.00	1.00			1.00	0.85			
Flt Protected		1.00	1.00	0.95	1.00			0.95	1.00			
Satd. Flow (prot)		3539	1583	3433	1863			1770	2787			
Flt Permitted		1.00	1.00	0.95	1.00			0.95	1.00			
Satd. Flow (perm)		3539	1583	3433	1863			1770	2787			
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	577	359	898	74	0	53	0	808	0	0	0
RTOR Reduction (vph)	0	0	240	0	0	0	0	0	400	0	0	0
Lane Group Flow (vph)	0	577	119	898	74	0	0	53	408	0	0	0
Turn Type		NA	Perm	Prot	NA	Perm	Split	NA	pm+ov			
Protected Phases		2		1	6		8	8	1	4	4	
Permitted Phases			2			6			8			
Actuated Green, G (s)		18.4	18.4	23.2	47.6			4.0	27.2			
Effective Green, g (s)		20.4	20.4	25.2	49.6			3.8	31.2			
Actuated g/C Ratio		0.33	0.33	0.41	0.80			0.06	0.50			
Clearance Time (s)		6.0	6.0	6.0	6.0			4.2	6.0			
Vehicle Extension (s)		3.0	3.0	3.0	3.0			3.0	3.0			
Lane Grp Cap (vph)		1168	522	1399	1495			108	1587			
v/s Ratio Prot		c0.16		c0.26	0.04			0.03	c0.10			
v/s Ratio Perm			0.07						0.04			
v/c Ratio		0.49	0.23	0.64	0.05			0.49	0.26			
Uniform Delay, d1		16.6	15.0	14.7	1.3			28.1	8.7			
Progression Factor		1.00	1.00	1.00	1.00			1.00	1.00			
Incremental Delay, d2		0.3	0.2	1.0	0.0			3.5	0.1			
Delay (s)		16.9	15.2	15.7	1.3			31.5	8.8			
Level of Service		B	B	B	A			C	A			
Approach Delay (s)		16.3			14.6			10.2			0.0	
Approach LOS		B			B			B			A	

Intersection Summary

HCM 2000 Control Delay	13.8	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.62		
Actuated Cycle Length (s)	61.8	Sum of lost time (s)	16.4
Intersection Capacity Utilization	51.9%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
25: Airway Blvd & I-580 WB Ramps

BART to Livermore Extension Project
2025 Enhanced Bus PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↙	↖	↗		↑↑	↗		↑↑↑	
Traffic Volume (vph)	0	0	0	71	27	156	0	694	305	0	579	641
Future Volume (vph)	0	0	0	71	27	156	0	694	305	0	579	641
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0	4.0	4.0		4.0	4.0		4.0	
Lane Util. Factor				0.95	0.95	0.88		0.95	1.00		0.91	
Frt				1.00	1.00	0.85		1.00	0.85		0.92	
Flt Protected				0.95	0.97	1.00		1.00	1.00		1.00	
Satd. Flow (prot)				1681	1722	2787		3539	1583		4684	
Flt Permitted				0.95	0.97	1.00		1.00	1.00		1.00	
Satd. Flow (perm)				1681	1722	2787		3539	1583		4684	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	77	29	170	0	754	332	0	629	697
RTOR Reduction (vph)	0	0	0	0	0	154	0	0	64	0	135	0
Lane Group Flow (vph)	0	0	0	41	65	16	0	754	268	0	1191	0
Turn Type				Split	NA	Perm		NA	Perm		NA	
Protected Phases				8	8			2			6	
Permitted Phases						8			2			
Actuated Green, G (s)				7.5	7.5	7.5		63.2	63.2		63.2	
Effective Green, g (s)				7.5	7.5	7.5		64.5	64.5		64.5	
Actuated g/C Ratio				0.09	0.09	0.09		0.81	0.81		0.81	
Clearance Time (s)				4.0	4.0	4.0		5.3	5.3		5.3	
Vehicle Extension (s)				2.0	2.0	2.0		4.0	4.0		4.0	
Lane Grp Cap (vph)				157	161	261		2853	1276		3776	
v/s Ratio Prot				0.02	c0.04			0.21			c0.25	
v/s Ratio Perm						0.01			0.17			
v/c Ratio				0.26	0.40	0.06		0.26	0.21		0.32	
Uniform Delay, d1				33.7	34.1	33.0		1.9	1.8		2.0	
Progression Factor				1.00	1.00	1.00		0.40	0.44		1.00	
Incremental Delay, d2				0.3	0.6	0.0		0.2	0.3		0.2	
Delay (s)				34.0	34.7	33.1		1.0	1.1		2.2	
Level of Service				C	C	C		A	A		A	
Approach Delay (s)		0.0			33.6			1.0			2.2	
Approach LOS		A			C			A			A	

Intersection Summary		
HCM 2000 Control Delay	5.0	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.32	A
Actuated Cycle Length (s)	80.0	Sum of lost time (s)
Intersection Capacity Utilization	35.6%	8.0
Analysis Period (min)	15	ICU Level of Service
		A

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
26: Airway Blvd & I-580 EB Ramps/Kitty Hawk Rd

BART to Livermore Extension Project
2025 Enhanced Bus PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↑	↖	↖	↑	↖	↖	↕↗		↖	↕↗	
Traffic Volume (vph)	569	224	310	66	73	142	25	321	132	111	258	240
Future Volume (vph)	569	224	310	66	73	142	25	321	132	111	258	240
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.4	4.4	4.4	4.0	4.0		4.0	4.0	
Lane Util. Factor	0.97	1.00	1.00	1.00	1.00	1.00	1.00	0.95		1.00	0.95	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.96		1.00	0.93	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	3433	1863	1583	1770	1863	1583	1770	3385		1770	3283	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	3433	1863	1583	1770	1863	1583	1770	3385		1770	3283	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	618	243	337	72	79	154	27	349	143	121	280	261
RTOR Reduction (vph)	0	0	228	0	0	117	0	77	0	0	180	0
Lane Group Flow (vph)	618	243	109	72	79	37	27	415	0	121	361	0
Turn Type	Split	NA	Perm	Split	NA	pm+ov	Prot	NA		Prot	NA	
Protected Phases	7	7		8	8	1	5	2		1	6	
Permitted Phases			7			8						
Actuated Green, G (s)	25.9	25.9	25.9	11.2	11.2	20.1	2.5	16.7		8.9	23.6	
Effective Green, g (s)	25.9	25.9	25.9	10.8	10.8	19.3	2.0	18.0		8.9	24.9	
Actuated g/C Ratio	0.32	0.32	0.32	0.14	0.14	0.24	0.02	0.22		0.11	0.31	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	3.5	5.3		4.0	5.3	
Vehicle Extension (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	3.5		2.0	4.0	
Lane Grp Cap (vph)	1111	603	512	238	251	381	44	761		196	1021	
v/s Ratio Prot	c0.18	0.13		0.04	c0.04	0.01	0.02	c0.12		c0.07	0.11	
v/s Ratio Perm			0.07			0.01						
v/c Ratio	0.56	0.40	0.21	0.30	0.31	0.10	0.61	0.55		0.62	0.35	
Uniform Delay, d1	22.3	21.0	19.6	31.2	31.3	23.6	38.6	27.4		33.9	21.3	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		0.99	0.85	
Incremental Delay, d2	0.3	0.2	0.1	0.3	0.3	0.0	16.5	2.8		3.9	0.9	
Delay (s)	22.7	21.2	19.7	31.5	31.5	23.6	55.1	30.2		37.3	19.1	
Level of Service	C	C	B	C	C	C	E	C		D	B	
Approach Delay (s)		21.5			27.5			31.5			22.4	
Approach LOS		C			C			C			C	

Intersection Summary

HCM 2000 Control Delay	24.4	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.52		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	16.8
Intersection Capacity Utilization	60.8%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 27: Collier Canyon Rd & N Canyons Pkwy/Portola Ave



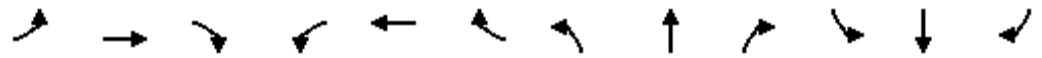
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	305	706	150	82	251	24	49	7	305	129	13	98
Future Volume (vph)	305	706	150	82	251	24	49	7	305	129	13	98
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	5.2	5.2
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.85		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	1770	1590		1770	1863	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	1770	1590		1770	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	332	767	163	89	273	26	53	8	332	140	14	107
RTOR Reduction (vph)	0	0	106	0	0	18	0	227	0	0	0	76
Lane Group Flow (vph)	332	767	57	89	273	8	53	113	0	140	14	31
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA		Prot	NA	Perm
Protected Phases	1	6		5	2		3	8		7	NA	4
Permitted Phases			6			2						4
Actuated Green, G (s)	11.5	26.0	26.0	7.0	21.5	21.5	3.8	15.9		10.2	22.7	22.7
Effective Green, g (s)	11.5	27.3	27.3	7.0	22.8	22.8	3.8	16.9		10.2	22.1	22.1
Actuated g/C Ratio	0.15	0.35	0.35	0.09	0.29	0.29	0.05	0.22		0.13	0.29	0.29
Clearance Time (s)	4.0	5.3	5.3	4.0	5.3	5.3	4.0	5.0		4.0	4.6	4.6
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	510	1248	558	160	1042	466	86	347		233	531	451
v/s Ratio Prot	c0.10	c0.22		0.05	0.08		0.03	c0.07		c0.08	0.01	
v/s Ratio Perm			0.04			0.00						0.02
v/c Ratio	0.65	0.61	0.10	0.56	0.26	0.02	0.62	0.33		0.60	0.03	0.07
Uniform Delay, d1	31.1	20.7	16.8	33.7	20.9	19.4	36.1	25.5		31.7	19.9	20.1
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	3.0	0.9	0.1	4.1	0.1	0.0	12.4	0.6		4.3	0.0	0.1
Delay (s)	34.0	21.6	16.9	37.9	21.0	19.4	48.5	26.0		36.0	19.9	20.2
Level of Service	C	C	B	D	C	B	D	C		D	B	C
Approach Delay (s)		24.3			24.8			29.0			28.7	
Approach LOS		C			C			C			C	

Intersection Summary		
HCM 2000 Control Delay	25.7	HCM 2000 Level of Service C
HCM 2000 Volume to Capacity ratio	0.58	
Actuated Cycle Length (s)	77.4	Sum of lost time (s) 17.2
Intersection Capacity Utilization	63.8%	ICU Level of Service B
Analysis Period (min)	15	

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
28: Isabel Ave/Campus Hill Dr & Portola Ave

BART to Livermore Extension Project
2025 Enhanced Bus PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↘	↗	↖	↘↗↖	↗↖		↘↗	↗↖	↘	↘	↗	↘
Traffic Volume (vph)	4	638	522	242	178	104	231	340	85	127	276	2
Future Volume (vph)	4	638	522	242	178	104	231	340	85	127	276	2
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	5.8	5.8
Lane Util. Factor	1.00	0.95	0.88	0.94	0.95		0.97	0.95	1.00	1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	0.94		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3539	2787	4990	3343		3433	3539	1583	1770	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	3539	2787	4990	3343		3433	3539	1583	1770	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	4	693	567	263	193	113	251	370	92	138	300	2
RTOR Reduction (vph)	0	0	363	0	60	0	0	0	74	0	0	2
Lane Group Flow (vph)	4	693	204	263	246	0	251	370	18	138	300	0
Turn Type	Prot	NA	Perm	Prot	NA		Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4						2			6
Actuated Green, G (s)	1.4	28.1	28.1	9.2	35.9		9.2	14.7	14.7	11.1	17.0	17.0
Effective Green, g (s)	1.4	29.4	29.4	9.2	37.2		9.2	16.0	16.0	11.1	16.1	16.1
Actuated g/C Ratio	0.02	0.36	0.36	0.11	0.46		0.11	0.20	0.20	0.14	0.20	0.20
Clearance Time (s)	4.0	5.3	5.3	4.0	5.3		4.0	5.3	5.3	4.0	4.9	4.9
Vehicle Extension (s)	2.0	3.0	3.0	2.0	3.0		2.0	3.0	3.0	2.0	3.0	3.0
Lane Grp Cap (vph)	30	1273	1002	561	1522		386	693	310	240	697	311
v/s Ratio Prot	0.00	c0.20		c0.05	0.07		0.07	c0.10		c0.08	0.08	
v/s Ratio Perm			0.07						0.01			0.00
v/c Ratio	0.13	0.54	0.20	0.47	0.16		0.65	0.53	0.06	0.57	0.43	0.00
Uniform Delay, d1	39.6	20.8	18.1	34.0	13.1		34.7	29.5	26.7	33.1	28.8	26.3
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.7	0.5	0.1	0.2	0.1		3.0	0.8	0.1	2.1	0.4	0.0
Delay (s)	40.3	21.3	18.2	34.2	13.1		37.7	30.3	26.8	35.2	29.2	26.3
Level of Service	D	C	B	C	B		D	C	C	D	C	C
Approach Delay (s)		20.0			22.9			32.4			31.1	
Approach LOS		B			C			C			C	

Intersection Summary		
HCM 2000 Control Delay	25.1	HCM 2000 Level of Service C
HCM 2000 Volume to Capacity ratio	0.55	
Actuated Cycle Length (s)	81.7	Sum of lost time (s) 17.8
Intersection Capacity Utilization	57.5%	ICU Level of Service B
Analysis Period (min)	15	

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
29: Isabel Ave & I-580 WB Ramps

BART to Livermore Extension Project
2025 Enhanced Bus PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↖↗		↖		↕↕	↖↗		↕↕	↖
Traffic Volume (vph)	0	0	0	680	0	270	0	364	0	0	618	419
Future Volume (vph)	0	0	0	680	0	270	0	364	0	0	618	419
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0		4.0		5.6			5.6	5.6
Lane Util. Factor				0.97		1.00		0.95			0.95	1.00
Frt				1.00		0.85		1.00			1.00	0.85
Flt Protected				0.95		1.00		1.00			1.00	1.00
Satd. Flow (prot)				3433		1583		3539			3539	1583
Flt Permitted				0.95		1.00		1.00			1.00	1.00
Satd. Flow (perm)				3433		1583		3539			3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	739	0	293	0	396	0	0	672	455
RTOR Reduction (vph)	0	0	0	0	0	209	0	0	0	0	0	239
Lane Group Flow (vph)	0	0	0	739	0	84	0	396	0	0	672	216
Turn Type				Prot		Prot		NA	Free		NA	Prot
Protected Phases				8		8		2			6	6
Permitted Phases									Free			
Actuated Green, G (s)				11.4		11.4		19.8			19.8	19.8
Effective Green, g (s)				11.4		11.4		19.0			19.0	19.0
Actuated g/C Ratio				0.29		0.29		0.48			0.48	0.48
Clearance Time (s)				4.0		4.0		4.8			4.8	4.8
Vehicle Extension (s)				2.0		2.0		4.0			4.0	4.0
Lane Grp Cap (vph)				978		451		1681			1681	751
v/s Ratio Prot				c0.22		0.05		0.11			c0.19	0.14
v/s Ratio Perm												
v/c Ratio				0.76		0.19		0.24			0.40	0.29
Uniform Delay, d1				13.0		10.8		6.2			6.8	6.4
Progression Factor				1.00		1.00		0.98			1.00	1.00
Incremental Delay, d2				3.0		0.1		0.3			0.2	0.3
Delay (s)				16.0		10.9		6.4			7.0	6.7
Level of Service				B		B		A			A	A
Approach Delay (s)		0.0			14.6			6.4			6.9	
Approach LOS		A			B			A			A	

Intersection Summary

HCM 2000 Control Delay	9.9	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.53		
Actuated Cycle Length (s)	40.0	Sum of lost time (s)	9.6
Intersection Capacity Utilization	44.5%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 30: Isabel Ave & I-580 EB Ramps

BART to Livermore Extension Project
 2025 Enhanced Bus PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↖		↗↗					↑↑	↗		↑↑	↗
Traffic Volume (vph)	188	0	359	0	0	0	0	691	703	0	891	638
Future Volume (vph)	188	0	359	0	0	0	0	691	703	0	891	638
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0					4.0	4.0		4.0	4.0
Lane Util. Factor	0.97		0.88					0.95	1.00		0.95	1.00
Frt	1.00		0.85					1.00	0.85		1.00	0.85
Flt Protected	0.95		1.00					1.00	1.00		1.00	1.00
Satd. Flow (prot)	3433		2787					3539	1583		3539	1583
Flt Permitted	0.95		1.00					1.00	1.00		1.00	1.00
Satd. Flow (perm)	3433		2787					3539	1583		3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	204	0	390	0	0	0	0	751	764	0	968	693
RTOR Reduction (vph)	0	0	210	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	204	0	180	0	0	0	0	751	764	0	968	693
Turn Type	Prot		Perm					NA	Free		NA	Free
Protected Phases	4							2			6	
Permitted Phases			4						Free			Free
Actuated Green, G (s)	9.8		9.8					61.2	80.0		61.2	80.0
Effective Green, g (s)	9.8		9.8					62.2	80.0		62.2	80.0
Actuated g/C Ratio	0.12		0.12					0.78	1.00		0.78	1.00
Clearance Time (s)	4.0		4.0					5.0			5.0	
Vehicle Extension (s)	2.0		2.0					4.0			4.0	
Lane Grp Cap (vph)	420		341					2751	1583		2751	1583
v/s Ratio Prot	0.06							0.21			0.27	
v/s Ratio Perm			0.06						c0.48			0.44
v/c Ratio	0.49		0.53					0.27	0.48		0.35	0.44
Uniform Delay, d1	32.7		32.9					2.5	0.0		2.7	0.0
Progression Factor	1.00		1.00					1.00	1.00		0.67	1.00
Incremental Delay, d2	0.3		0.7					0.1	1.1		0.3	0.8
Delay (s)	33.1		33.6					2.6	1.1		2.1	0.8
Level of Service	C		C					A	A		A	A
Approach Delay (s)		33.4			0.0			1.8			1.6	
Approach LOS		C			A			A			A	

Intersection Summary		
HCM 2000 Control Delay	6.7	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.54	A
Actuated Cycle Length (s)	80.0	Sum of lost time (s)
Intersection Capacity Utilization	43.9%	8.0
Analysis Period (min)	15	ICU Level of Service
		A

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

31: Isabel Ave & Airway Blvd

BART to Livermore Extension Project
2025 Enhanced Bus PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↘	↑	↗	↘	↑	↗	↘	↑↑↑	↗	↘↗	↑↑↑	↗
Traffic Volume (vph)	0	164	445	105	115	77	249	1183	30	308	1331	12
Future Volume (vph)	0	164	445	105	115	77	249	1183	30	308	1331	12
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.2	5.6	5.2	5.2	5.6	4.0	4.0	4.0	4.0	4.0	5.0
Lane Util. Factor		1.00	1.00	1.00	1.00	1.00	1.00	0.91	1.00	0.97	0.91	1.00
Frt		1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1863	1583	1770	1863	1583	1770	5085	1583	3433	5085	1583
Flt Permitted		1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)		1863	1583	1770	1863	1583	1770	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	178	484	114	125	84	271	1286	33	335	1447	13
RTOR Reduction (vph)	0	0	69	0	0	49	0	0	19	0	0	8
Lane Group Flow (vph)	0	178	415	114	125	35	271	1286	14	335	1447	5
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4	5	3	8	1	5	2		1	NA	6
Permitted Phases			4			8			2			6
Actuated Green, G (s)		14.0	31.0	8.8	27.4	40.0	17.0	37.5	37.5	12.6	33.1	33.1
Effective Green, g (s)		13.4	29.8	8.2	26.8	38.8	18.0	38.5	38.5	13.6	34.1	33.1
Actuated g/C Ratio		0.15	0.32	0.09	0.29	0.42	0.20	0.42	0.42	0.15	0.37	0.36
Clearance Time (s)		4.6	5.0	4.6	4.6	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Extension (s)		3.0	3.0	3.0	3.0	3.0	3.0	5.0	5.0	3.0	5.0	5.0
Lane Grp Cap (vph)		271	512	157	542	666	345	2125	661	506	1882	568
v/s Ratio Prot		0.10	c0.14	c0.06	0.07	0.01	c0.15	0.25		0.10	c0.28	
v/s Ratio Perm			0.12			0.02			0.01			0.00
v/c Ratio		0.66	0.81	0.73	0.23	0.05	0.79	0.61	0.02	0.66	0.77	0.01
Uniform Delay, d1		37.2	28.6	40.9	24.8	15.8	35.2	20.9	15.7	37.1	25.5	19.0
Progression Factor		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2		5.6	9.4	15.4	0.2	0.0	11.2	0.7	0.0	3.2	2.3	0.0
Delay (s)		42.8	38.0	56.2	25.0	15.8	46.4	21.6	15.8	40.3	27.8	19.0
Level of Service		D	D	E	C	B	D	C	B	D	C	B
Approach Delay (s)		39.3			33.6			25.7			30.1	
Approach LOS		D			C			C			C	

Intersection Summary

HCM 2000 Control Delay	30.2	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.80		
Actuated Cycle Length (s)	92.1	Sum of lost time (s)	20.0
Intersection Capacity Utilization	71.4%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 32: Isabel Ave & Jack London Blvd

BART to Livermore Extension Project
 2025 Enhanced Bus PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↗↘	↗↗	↗	↘	↗↗	↗	↗↘	↗↗↗	↗	↗↘	↗↗↗	↗
Traffic Volume (vph)	127	672	255	202	144	297	89	1105	327	440	1224	59
Future Volume (vph)	127	672	255	202	144	297	89	1105	327	440	1224	59
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.97	0.91	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	3433	5085	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	3433	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	138	730	277	220	157	323	97	1201	355	478	1330	64
RTOR Reduction (vph)	0	0	140	0	0	31	0	0	206	0	0	39
Lane Group Flow (vph)	138	730	137	220	157	292	97	1201	149	478	1330	25
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8	1	5	2		1	NA	6
Permitted Phases			4			8			2			6
Actuated Green, G (s)	9.6	31.1	31.1	20.2	41.7	63.6	7.9	37.6	37.6	21.9	51.6	51.6
Effective Green, g (s)	9.6	31.1	31.1	20.2	41.7	63.6	7.9	37.6	37.6	21.9	51.6	51.6
Actuated g/C Ratio	0.07	0.24	0.24	0.15	0.32	0.48	0.06	0.28	0.28	0.17	0.39	0.39
Clearance Time (s)	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	249	833	372	270	1118	826	205	1448	450	569	1987	618
v/s Ratio Prot	0.04	c0.21		c0.12	0.04	0.06	0.03	c0.24		c0.14	0.26	
v/s Ratio Perm			0.09			0.13			0.09			0.02
v/c Ratio	0.55	0.88	0.37	0.81	0.14	0.35	0.47	0.83	0.33	0.84	0.67	0.04
Uniform Delay, d1	59.1	48.6	42.2	54.1	32.3	21.4	60.0	44.2	37.3	53.4	33.2	24.9
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	2.7	10.2	0.6	17.0	0.1	0.3	1.7	4.1	0.4	10.8	0.9	0.0
Delay (s)	61.8	58.8	42.9	71.1	32.4	21.6	61.8	48.3	37.7	64.1	34.0	24.9
Level of Service	E	E	D	E	C	C	E	D	D	E	C	C
Approach Delay (s)		55.3			39.6			46.8			41.4	
Approach LOS		E			D			D			D	

Intersection Summary		
HCM 2000 Control Delay	45.8	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.84	D
Actuated Cycle Length (s)	132.0	Sum of lost time (s)
Intersection Capacity Utilization	81.3%	21.2
Analysis Period (min)	15	ICU Level of Service
		D

c Critical Lane Group



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑	↑	↑↑	↑↑	↑↑	↑↑
Traffic Volume (vph)	1689	443	214	553	159	371
Future Volume (vph)	1689	443	214	553	159	371
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	3.8	4.0	4.0	4.0	2.5
Lane Util. Factor	0.95	1.00	0.97	0.95	0.97	0.88
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	3539	1583	3433	3539	3433	2787
Flt Permitted	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (perm)	3539	1583	3433	3539	3433	2787
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	1836	482	233	601	173	403
RTOR Reduction (vph)	0	2	0	0	0	7
Lane Group Flow (vph)	1836	480	233	601	173	396
Turn Type	NA	pm+ov	Prot	NA	Prot	pm+ov
Protected Phases	2	8	1	6	8	1
Permitted Phases		2				8
Actuated Green, G (s)	43.8	52.5	6.0	53.8	8.7	14.7
Effective Green, g (s)	45.5	55.9	6.0	55.5	10.2	17.7
Actuated g/C Ratio	0.62	0.76	0.08	0.75	0.14	0.24
Clearance Time (s)	5.7	5.5	4.0	5.7	5.5	4.0
Vehicle Extension (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Grp Cap (vph)	2184	1200	279	2665	475	669
v/s Ratio Prot	c0.52	0.06	c0.07	0.17	0.05	c0.06
v/s Ratio Perm		0.25				0.08
v/c Ratio	0.84	0.40	0.84	0.23	0.36	0.59
Uniform Delay, d1	11.2	3.1	33.4	2.7	28.8	24.8
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	3.0	0.1	18.2	0.0	0.2	0.9
Delay (s)	14.2	3.2	51.6	2.7	29.0	25.7
Level of Service	B	A	D	A	C	C
Approach Delay (s)	11.9			16.4	26.7	
Approach LOS	B			B	C	

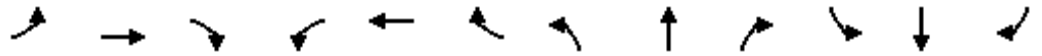
Intersection Summary

HCM 2000 Control Delay	15.2	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.80		
Actuated Cycle Length (s)	73.7	Sum of lost time (s)	12.0
Intersection Capacity Utilization	69.5%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 34: Murrieta Blvd/Driveway & Portola Ave

BART to Livermore Extension Project
 2025 Enhanced Bus PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗		↖	↗		↖	↗	↗		↗	
Traffic Volume (vph)	0	972	123	221	608	1	128	5	318	4	7	0
Future Volume (vph)	0	972	123	221	608	1	128	5	318	4	7	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.8		4.0	5.8		5.2	5.2	5.2		4.0	
Lane Util. Factor		0.95		1.00	0.95		0.95	0.95	1.00		1.00	
Frt		0.98		1.00	1.00		1.00	1.00	0.85		1.00	
Flt Protected		1.00		0.95	1.00		0.95	0.96	1.00		0.98	
Satd. Flow (prot)		3479		1770	3538		1681	1691	1583		1832	
Flt Permitted		1.00		0.95	1.00		0.95	0.96	1.00		0.98	
Satd. Flow (perm)		3479		1770	3538		1681	1691	1583		1832	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	1057	134	240	661	1	139	5	346	4	8	0
RTOR Reduction (vph)	0	9	0	0	0	0	0	0	266	0	0	0
Lane Group Flow (vph)	0	1182	0	240	662	0	72	72	80	0	12	0
Turn Type	Prot	NA		Prot	NA		Split	NA	Perm		Split	NA
Protected Phases	5	2		1	6		8	8			4	4
Permitted Phases									8			
Actuated Green, G (s)		30.7		12.2	46.9		8.8	8.8	8.8		0.6	
Effective Green, g (s)		29.8		12.2	46.0		8.2	8.2	8.2		0.6	
Actuated g/C Ratio		0.43		0.17	0.66		0.12	0.12	0.12		0.01	
Clearance Time (s)		4.9		4.0	4.9		4.6	4.6	4.6		4.0	
Vehicle Extension (s)		2.0		2.0	2.0		2.0	2.0	2.0		2.0	
Lane Grp Cap (vph)		1485		309	2331		197	198	185		15	
v/s Ratio Prot		c0.34		c0.14	0.19		0.04	0.04			c0.01	
v/s Ratio Perm									c0.05			
v/c Ratio		0.80		0.78	0.28		0.37	0.36	0.43		0.80	
Uniform Delay, d1		17.4		27.5	5.0		28.4	28.4	28.6		34.5	
Progression Factor		1.00		1.00	1.00		1.00	1.00	1.00		1.00	
Incremental Delay, d2		2.8		10.6	0.0		0.4	0.4	0.6		127.3	
Delay (s)		20.2		38.1	5.0		28.8	28.8	29.2		161.8	
Level of Service		C		D	A		C	C	C		F	
Approach Delay (s)		20.2			13.8			29.1			161.8	
Approach LOS		C			B			C			F	

Intersection Summary

HCM 2000 Control Delay	20.3	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.73		
Actuated Cycle Length (s)	69.8	Sum of lost time (s)	19.0
Intersection Capacity Utilization	66.3%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 35: Murrieta Blvd & Jack London Blvd



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	256	753	433	245	279	128
Future Volume (vph)	256	753	433	245	279	128
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00	1.00	0.95	0.91	
Frt	1.00	0.85	1.00	1.00	0.95	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1770	1583	1770	3539	4845	
Flt Permitted	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	1770	1583	1770	3539	4845	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	278	818	471	266	303	139
RTOR Reduction (vph)	0	507	0	0	115	0
Lane Group Flow (vph)	278	311	471	266	327	0
Turn Type	Prot	Perm	Prot	NA	NA	
Protected Phases	4		5	2	6	
Permitted Phases		4				
Actuated Green, G (s)	15.4	15.4	19.1	32.8	9.7	
Effective Green, g (s)	15.4	15.4	19.1	32.8	9.7	
Actuated g/C Ratio	0.27	0.27	0.34	0.58	0.17	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	485	433	601	2065	836	
v/s Ratio Prot	0.16		c0.27	0.08	c0.07	
v/s Ratio Perm		c0.20				
v/c Ratio	0.57	0.72	0.78	0.13	0.39	
Uniform Delay, d1	17.6	18.4	16.7	5.3	20.6	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	1.6	5.6	6.6	0.0	0.3	
Delay (s)	19.2	24.1	23.3	5.3	20.9	
Level of Service	B	C	C	A	C	
Approach Delay (s)	22.8			16.8	20.9	
Approach LOS	C			B	C	

Intersection Summary

HCM 2000 Control Delay	20.5	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.67		
Actuated Cycle Length (s)	56.2	Sum of lost time (s)	12.0
Intersection Capacity Utilization	61.5%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 36: Murrieta Blvd & Stanley Blvd

BART to Livermore Extension Project
 2025 Enhanced Bus PM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	272	1057	485	41	527	157	228	380	18	253	331	183
Future Volume (vph)	272	1057	485	41	527	157	228	380	18	253	331	183
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.9	4.9	4.0	4.9	4.9	4.9	4.9		4.9	4.9	4.0
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.97	0.95		1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	3433	3515		1770	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	3433	3515		1770	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	296	1149	527	45	573	171	248	413	20	275	360	199
RTOR Reduction (vph)	0	0	307	0	0	69	0	4	0	0	0	150
Lane Group Flow (vph)	296	1149	220	45	573	102	248	429	0	275	360	49
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Prot	NA		Prot	NA	Perm
Protected Phases	7	4		3	8	1	5	2		1	6	
Permitted Phases			4			8						6
Actuated Green, G (s)	10.7	28.7	28.7	2.2	20.2	34.6	9.8	14.0		14.4	18.6	18.6
Effective Green, g (s)	10.7	27.8	27.8	2.2	19.3	32.8	8.9	13.1		13.5	17.7	18.6
Actuated g/C Ratio	0.14	0.37	0.37	0.03	0.26	0.44	0.12	0.17		0.18	0.24	0.25
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	487	1306	584	51	907	792	405	611		317	831	391
v/s Ratio Prot	c0.09	c0.32		0.03	0.16	0.02	0.07	c0.12		c0.16	c0.10	
v/s Ratio Perm			0.14			0.04						0.03
v/c Ratio	0.61	0.88	0.38	0.88	0.63	0.13	0.61	0.70		0.87	0.43	0.13
Uniform Delay, d1	30.3	22.2	17.4	36.4	24.8	12.7	31.6	29.3		30.0	24.5	22.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	2.2	7.1	0.4	83.2	1.4	0.1	2.7	3.6		21.3	0.4	0.1
Delay (s)	32.5	29.3	17.8	119.6	26.3	12.8	34.3	32.9		51.3	24.9	22.2
Level of Service	C	C	B	F	C	B	C	C		D	C	C
Approach Delay (s)		26.7			28.7			33.4			33.0	
Approach LOS		C			C			C			C	

Intersection Summary		
HCM 2000 Control Delay	29.3	HCM 2000 Level of Service C
HCM 2000 Volume to Capacity ratio	0.82	
Actuated Cycle Length (s)	75.3	Sum of lost time (s) 18.7
Intersection Capacity Utilization	73.2%	ICU Level of Service D
Analysis Period (min)	15	

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 37: Livermore Ave & I-580 WB Ramps

BART to Livermore Extension Project
 2025 Enhanced Bus PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↵	↔		↵↵	↑			↕↕	
Traffic Volume (vph)	0	0	0	264	17	17	829	460	0	0	112	0
Future Volume (vph)	0	0	0	264	17	17	829	460	0	0	112	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)					4.0		4.0	4.0			4.0	
Lane Util. Factor					0.95		0.97	1.00			0.95	
Frt					0.99		1.00	1.00			1.00	
Flt Protected					0.96		0.95	1.00			1.00	
Satd. Flow (prot)					1680		3433	1863			3539	
Flt Permitted					0.96		0.95	1.00			1.00	
Satd. Flow (perm)					1680		3433	1863			3539	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	287	18	18	901	500	0	0	122	0
RTOR Reduction (vph)	0	0	0	0	4	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	0	319	0	901	500	0	0	122	0
Turn Type				Split	NA		Prot	NA			NA	
Protected Phases				8	8		5	2			6	
Permitted Phases												
Actuated Green, G (s)					14.5		19.4	35.8			12.9	
Effective Green, g (s)					14.5		18.9	37.5			14.6	
Actuated g/C Ratio					0.24		0.31	0.62			0.24	
Clearance Time (s)					4.0		3.5	5.7			5.7	
Vehicle Extension (s)					2.0		2.0	2.5			2.5	
Lane Grp Cap (vph)					406		1081	1164			861	
v/s Ratio Prot					c0.19		c0.26	c0.27			0.03	
v/s Ratio Perm												
v/c Ratio					0.79		0.83	0.43			0.14	
Uniform Delay, d1					21.3		19.1	5.8			17.8	
Progression Factor					1.00		0.56	0.19			1.00	
Incremental Delay, d2					9.0		0.5	0.1			0.3	
Delay (s)					30.2		11.2	1.2			18.1	
Level of Service					C		B	A			B	
Approach Delay (s)		0.0			30.2			7.6			18.1	
Approach LOS		A			C			A			B	

Intersection Summary			
HCM 2000 Control Delay	12.3	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.71		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	102.8%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 38: Livermore Ave & I-580 EB Ramps

BART to Livermore Extension Project
 2025 Enhanced Bus PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕	↗					↕		↘	↕	
Traffic Volume (vph)	283	11	1244	0	0	0	0	1019	232	58	320	0
Future Volume (vph)	283	11	1244	0	0	0	0	1019	232	58	320	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0					4.0		4.0	4.0	
Lane Util. Factor		0.95	0.95					0.95		1.00	0.95	
Frt		0.90	0.85					0.97		1.00	1.00	
Flt Protected		0.98	1.00					1.00		0.95	1.00	
Satd. Flow (prot)		1566	1504					3441		1770	3539	
Flt Permitted		0.98	1.00					1.00		0.95	1.00	
Satd. Flow (perm)		1566	1504					3441		1770	3539	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	308	12	1352	0	0	0	0	1108	252	63	348	0
RTOR Reduction (vph)	0	124	314	0	0	0	0	30	0	0	0	0
Lane Group Flow (vph)	0	858	376	0	0	0	0	1330	0	63	348	0
Turn Type	Prot	NA	Perm					NA		Prot	NA	
Protected Phases	7	4						2		1	6	
Permitted Phases			4									
Actuated Green, G (s)		20.0	20.0					23.9		4.1	31.0	
Effective Green, g (s)		20.0	20.0					24.9		3.1	32.0	
Actuated g/C Ratio		0.33	0.33					0.41		0.05	0.53	
Clearance Time (s)		4.0	4.0					5.0		3.0	5.0	
Vehicle Extension (s)		2.0	2.0					2.5		2.0	2.5	
Lane Grp Cap (vph)		522	501					1428		91	1887	
v/s Ratio Prot								c0.39		c0.04	0.10	
v/s Ratio Perm		0.55	0.25									
v/c Ratio		1.64	0.75					0.93		0.69	0.18	
Uniform Delay, d1		20.0	17.8					16.7		28.0	7.2	
Progression Factor		1.00	1.00					1.00		1.22	0.09	
Incremental Delay, d2		298.2	5.6					12.3		14.6	0.2	
Delay (s)		318.2	23.3					29.0		48.8	0.8	
Level of Service		F	C					C		D	A	
Approach Delay (s)		196.5			0.0			29.0			8.2	
Approach LOS		F			A			C			A	

Intersection Summary			
HCM 2000 Control Delay	107.9	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.21		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	102.8%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 39: Livermore Ave & Portola Ave

BART to Livermore Extension Project
 2025 Enhanced Bus PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	501	492	144	18	321	59	176	494	78	200	860	405
Future Volume (vph)	501	492	144	18	321	59	176	494	78	200	860	405
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	5.8		4.0	5.8	4.9
Lane Util. Factor	0.97	0.95		1.00	0.95		1.00	0.95		1.00	0.95	1.00
Frt	1.00	0.97		1.00	0.98		1.00	0.98		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3419		1770	3457		1770	3467		1770	3539	1583
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3419		1770	3457		1770	3467		1770	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	545	535	157	20	349	64	191	537	85	217	935	440
RTOR Reduction (vph)	0	25	0	0	16	0	0	10	0	0	0	101
Lane Group Flow (vph)	545	667	0	20	397	0	191	612	0	217	935	339
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	pm+ov
Protected Phases	3	8		7	4		1	6		5	2	3
Permitted Phases												2
Actuated Green, G (s)	19.7	34.3		1.9	16.5		12.1	30.4		13.1	31.4	51.1
Effective Green, g (s)	19.7	35.6		1.9	17.8		12.1	29.5		13.1	30.5	49.3
Actuated g/C Ratio	0.20	0.36		0.02	0.18		0.12	0.30		0.13	0.31	0.50
Clearance Time (s)	4.0	5.3		4.0	5.3		4.0	4.9		4.0	4.9	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	690	1243		34	628		218	1044		236	1102	797
v/s Ratio Prot	c0.16	0.19		0.01	c0.11		0.11	0.18		c0.12	c0.26	0.08
v/s Ratio Perm												0.13
v/c Ratio	0.79	0.54		0.59	0.63		0.88	0.59		0.92	0.85	0.43
Uniform Delay, d1	37.1	24.6		47.6	37.0		42.2	29.0		41.9	31.5	15.3
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	6.0	0.4		23.4	2.1		30.1	0.8		36.9	6.2	0.4
Delay (s)	43.1	25.1		71.0	39.1		72.2	29.9		78.8	37.8	15.7
Level of Service	D	C		E	D		E	C		E	D	B
Approach Delay (s)		33.0			40.6			39.8			37.3	
Approach LOS		C			D			D			D	

Intersection Summary

HCM 2000 Control Delay	36.8	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.82		
Actuated Cycle Length (s)	97.9	Sum of lost time (s)	18.7
Intersection Capacity Utilization	73.4%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
40: First St/Springtown Blvd & I-580 WB Ramps

BART to Livermore Extension Project
2025 Enhanced Bus PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations			↗↗			↗	↗↗	↑			↗↗	↗
Traffic Volume (vph)	0	0	262	0	0	0	387	1489	0	0	421	194
Future Volume (vph)	0	0	262	0	0	0	387	1489	0	0	421	194
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)			4.0				4.0	4.0			5.0	5.0
Lane Util. Factor			0.88				0.97	1.00			0.95	1.00
Frt			0.85				1.00	1.00			1.00	0.85
Flt Protected			1.00				0.95	1.00			1.00	1.00
Satd. Flow (prot)			2787				3433	1863			3539	1583
Flt Permitted			1.00				0.95	1.00			1.00	1.00
Satd. Flow (perm)			2787				3433	1863			3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	285	0	0	0	421	1618	0	0	458	211
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	33
Lane Group Flow (vph)	0	0	285	0	0	0	421	1618	0	0	458	178
Turn Type			Over			Free	Prot	NA			NA	Perm
Protected Phases			5				5	2			6	
Permitted Phases						Free						6
Actuated Green, G (s)			33.8				33.8	80.0			38.2	38.2
Effective Green, g (s)			33.3				33.3	80.0			37.7	37.7
Actuated g/C Ratio			0.42				0.42	1.00			0.47	0.47
Clearance Time (s)			3.5				3.5	4.0			4.5	4.5
Vehicle Extension (s)			2.0				2.0	0.2			4.0	4.0
Lane Grp Cap (vph)			1160				1428	1863			1667	745
v/s Ratio Prot			0.10				0.12	c0.87			0.13	
v/s Ratio Perm												0.11
v/c Ratio			0.25				0.29	0.87			0.27	0.24
Uniform Delay, d1			15.2				15.5	0.0			12.8	12.6
Progression Factor			1.00				0.98	1.00			1.00	1.00
Incremental Delay, d2			0.0				0.0	1.7			0.1	0.2
Delay (s)			15.2				15.2	1.7			13.0	12.8
Level of Service			B				B	A			B	B
Approach Delay (s)		15.2			0.0			4.5			12.9	
Approach LOS		B			A			A			B	
Intersection Summary												
HCM 2000 Control Delay			7.4				HCM 2000 Level of Service				A	
HCM 2000 Volume to Capacity ratio			0.98									
Actuated Cycle Length (s)			80.0				Sum of lost time (s)				9.0	
Intersection Capacity Utilization			81.7%				ICU Level of Service				D	
Analysis Period (min)			15									

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
41: First St & I-580 EB Ramps



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕	↗↘					↕↕	↗	↘	↕↕	
Traffic Volume (vph)	551	5	753	0	0	0	0	1344	458	85	854	0
Future Volume (vph)	551	5	753	0	0	0	0	1344	458	85	854	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0					5.0	5.0	4.0	5.0	
Lane Util. Factor		1.00	0.88					0.95	1.00	1.00	0.95	
Frt		1.00	0.85					1.00	0.85	1.00	1.00	
Flt Protected		0.95	1.00					1.00	1.00	0.95	1.00	
Satd. Flow (prot)		1775	2787					3539	1583	1770	3539	
Flt Permitted		0.95	1.00					1.00	1.00	0.95	1.00	
Satd. Flow (perm)		1775	2787					3539	1583	1770	3539	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	599	5	818	0	0	0	0	1461	498	92	928	0
RTOR Reduction (vph)	0	0	127	0	0	0	0	0	286	0	0	0
Lane Group Flow (vph)	0	604	691	0	0	0	0	1461	212	92	928	0
Turn Type	Perm	NA	Perm					NA	Perm	Prot	NA	
Protected Phases		4						2		1	6	
Permitted Phases	4		4						2			
Actuated Green, G (s)		28.5	28.5					34.5	34.5	6.0	43.5	
Effective Green, g (s)		28.0	28.0					34.0	34.0	5.0	43.0	
Actuated g/C Ratio		0.35	0.35					0.42	0.42	0.06	0.54	
Clearance Time (s)		3.5	3.5					4.5	4.5	3.0	4.5	
Vehicle Extension (s)		2.5	2.5					4.0	4.0	2.0	4.0	
Lane Grp Cap (vph)		621	975					1504	672	110	1902	
v/s Ratio Prot								c0.41		c0.05	0.26	
v/s Ratio Perm		0.34	0.25						0.13			
v/c Ratio		0.97	0.71					0.97	0.31	0.84	0.49	
Uniform Delay, d1		25.6	22.5					22.5	15.3	37.1	11.6	
Progression Factor		1.00	1.00					1.00	1.00	0.89	0.66	
Incremental Delay, d2		29.1	2.2					17.3	1.2	38.1	0.9	
Delay (s)		54.8	24.7					39.9	16.5	71.1	8.6	
Level of Service		D	C					D	B	E	A	
Approach Delay (s)		37.5			0.0			33.9			14.2	
Approach LOS		D			A			C			B	

Intersection Summary

HCM 2000 Control Delay	30.5	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.96		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	13.0
Intersection Capacity Utilization	83.5%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
42: 1st St & Mines Rd

BART to Livermore Extension Project
2025 Enhanced Bus PM





















Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	69	238	59	425	295	390	74	1474	874	363	870	50
Future Volume (vph)	69	238	59	425	295	390	74	1474	874	363	870	50
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	0.97	1.00	1.00	1.00	0.91	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	1863	1583	3433	1863	1583	1770	5085	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	1863	1583	3433	1863	1583	1770	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	75	259	64	462	321	424	80	1602	950	395	946	54
RTOR Reduction (vph)	0	0	54	0	0	36	0	0	174	0	0	28
Lane Group Flow (vph)	75	259	10	462	321	388	80	1602	776	395	946	26
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8	1	5	2		1	6	
Permitted Phases			4			8			2			6
Actuated Green, G (s)	4.8	16.4	16.4	13.0	24.6	35.6	7.6	44.8	44.8	11.0	48.2	48.2
Effective Green, g (s)	4.8	16.4	16.4	13.0	24.6	35.6	7.6	44.8	44.8	11.0	48.2	48.2
Actuated g/C Ratio	0.05	0.16	0.16	0.13	0.24	0.35	0.08	0.44	0.44	0.11	0.48	0.48
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	83	301	256	440	452	619	132	2251	700	373	2421	753
v/s Ratio Prot	0.04	c0.14		c0.13	0.17	0.07	0.05	0.32		c0.12	c0.19	
v/s Ratio Perm			0.01			0.18			c0.49			0.02
v/c Ratio	0.90	0.86	0.04	1.05	0.71	0.63	0.61	0.71	1.11	1.06	0.39	0.03
Uniform Delay, d1	48.0	41.3	35.8	44.1	35.0	27.3	45.3	22.9	28.2	45.1	17.1	14.1
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	67.1	21.4	0.1	56.6	5.2	2.0	7.6	1.1	67.8	63.0	0.1	0.0
Delay (s)	115.0	62.6	35.8	100.7	40.2	29.3	53.0	24.0	96.0	108.1	17.2	14.1
Level of Service	F	E	D	F	D	C	D	C	F	F	B	B
Approach Delay (s)		68.2			59.5			50.9			42.8	
Approach LOS		E			E			D			D	

Intersection Summary			
HCM 2000 Control Delay	52.0	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	1.02		
Actuated Cycle Length (s)	101.2	Sum of lost time (s)	16.0
Intersection Capacity Utilization	87.0%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group



















HCM Unsignalized Intersection Capacity Analysis
 43: Vasco Rd & I-580 WB Ramps

BART to Livermore Extension Project
 2025 Enhanced Bus PM

														
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR		
Lane Configurations														
Traffic Volume (veh/h)	0	0	0	0	0	88	0	1858	0	0	428	0		
Future Volume (Veh/h)	0	0	0	0	0	88	0	1858	0	0	428	0		
Sign Control		Stop			Stop			Free			Free			
Grade		0%			0%			0%			0%			
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92		
Hourly flow rate (vph)	0	0	0	0	0	96	0	2020	0	0	465	0		
Pedestrians														
Lane Width (ft)														
Walking Speed (ft/s)														
Percent Blockage														
Right turn flare (veh)														
Median type								None			None			
Median storage (veh)														
Upstream signal (ft)											487			
pX, platoon unblocked														
vC, conflicting volume	1571	2485	465	2485	2485	1010	465			2020				
vC1, stage 1 conf vol														
vC2, stage 2 conf vol														
vCu, unblocked vol	1571	2485	465	2485	2485	1010	465			2020				
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1				
tC, 2 stage (s)														
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2				
p0 queue free %	100	100	100	100	100	60	100			100				
cM capacity (veh/h)	44	29	544	15	29	238	1093			278				
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	SB 1	SB 2							
Volume Total	0	96	1010	1010	0	465	0							
Volume Left	0	0	0	0	0	0	0							
Volume Right	0	96	0	0	0	0	0							
cSH	1700	238	1700	1700	1700	1700	1700							
Volume to Capacity	0.00	0.40	0.59	0.59	0.00	0.27	0.00							
Queue Length 95th (ft)	0	46	0	0	0	0	0							
Control Delay (s)	0.0	30.0	0.0	0.0	0.0	0.0	0.0							
Lane LOS	A	D												
Approach Delay (s)	0.0	30.0	0.0				0.0							
Approach LOS	A	D												
Intersection Summary														
Average Delay			1.1											
Intersection Capacity Utilization			63.5%	ICU Level of Service									B	
Analysis Period (min)			15											

HCM Unsignalized Intersection Capacity Analysis
44: Vasco Rd & I-580 EB Ramps

BART to Livermore Extension Project
2025 Enhanced Bus PM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	0	0	0	0	2095	0	64	558	0
Future Volume (Veh/h)	0	0	0	0	0	0	0	2095	0	64	558	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	0	0	0	0	0	2277	0	70	607	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1886	3024	607	3024	3024	1138	607			2277		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1886	3024	607	3024	3024	1138	607			2277		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	100	100	100	100			68		
cM capacity (veh/h)	33	9	439	4	9	195	967			220		
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2						
Volume Total	0	0	1518	759	70	607						
Volume Left	0	0	0	0	70	0						
Volume Right	0	0	0	0	0	0						
cSH	1700	1700	1700	1700	220	1700						
Volume to Capacity	0.00	0.00	0.89	0.45	0.32	0.36						
Queue Length 95th (ft)	0	0	0	0	33	0						
Control Delay (s)	0.0	0.0	0.0	0.0	28.8	0.0						
Lane LOS	A	A			D							
Approach Delay (s)	0.0	0.0	0.0		3.0							
Approach LOS	A	A										
Intersection Summary												
Average Delay			0.7									
Intersection Capacity Utilization			61.2%	ICU Level of Service	B							
Analysis Period (min)			15									

HCM Signalized Intersection Capacity Analysis
45: Vasco Rd & East Ave

BART to Livermore Extension Project
2025 Enhanced Bus PM



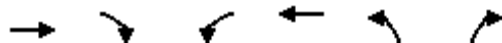
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	467	27	95	141	364	234	103	339	12	13	347	362
Future Volume (vph)	467	27	95	141	364	234	103	339	12	13	347	362
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	0.95		0.97	1.00	1.00
Frt	1.00	0.88		1.00	0.94		1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	3125		1770	3332		1770	3521		3433	1863	1583
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1770	3125		1770	3332		1770	3521		3433	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	508	29	103	153	396	254	112	368	13	14	377	393
RTOR Reduction (vph)	0	65	0	0	130	0	0	3	0	0	0	294
Lane Group Flow (vph)	508	67	0	153	520	0	112	378	0	14	377	99
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												6
Actuated Green, G (s)	23.7	30.3		9.5	16.1		6.0	26.0		0.8	20.8	20.8
Effective Green, g (s)	23.7	30.3		9.5	16.1		6.0	26.0		0.8	20.8	20.8
Actuated g/C Ratio	0.29	0.37		0.12	0.19		0.07	0.31		0.01	0.25	0.25
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	507	1146		203	649		128	1108		33	469	398
v/s Ratio Prot	c0.29	0.02		0.09	c0.16		c0.06	0.11		0.00	c0.20	
v/s Ratio Perm												0.06
v/c Ratio	1.00	0.06		0.75	0.80		0.88	0.34		0.42	0.80	0.25
Uniform Delay, d1	29.4	16.9		35.4	31.7		37.9	21.7		40.7	29.0	24.7
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	40.5	0.0		14.6	7.0		43.8	0.2		8.6	9.6	0.3
Delay (s)	69.9	16.9		50.0	38.7		81.8	21.9		49.2	38.6	25.0
Level of Service	E	B		D	D		F	C		D	D	C
Approach Delay (s)		59.0			40.9			35.5			32.0	
Approach LOS		E			D			D			C	

Intersection Summary

HCM 2000 Control Delay	41.6	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.88		
Actuated Cycle Length (s)	82.6	Sum of lost time (s)	16.0
Intersection Capacity Utilization	80.7%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Unsignalized Intersection Capacity Analysis
 46: I-580 WB Ramps & Northfront Rd/Northfront Road



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↔			↔	↔	↔
Traffic Volume (veh/h)	625	39	253	134	3	133
Future Volume (Veh/h)	625	39	253	134	3	133
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	679	42	275	146	3	145
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None		None			
Median storage (veh)						
Upstream signal (ft)	1007					
pX, platoon unblocked						
vC, conflicting volume			679		1396	700
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			679		1396	700
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			70		97	67
cM capacity (veh/h)			913		109	439
Direction, Lane #	EB 1	WB 1	NB 1	NB 2		
Volume Total	721	421	3	145		
Volume Left	0	275	3	0		
Volume Right	42	0	0	145		
cSH	1700	913	109	439		
Volume to Capacity	0.42	0.30	0.03	0.33		
Queue Length 95th (ft)	0	32	2	36		
Control Delay (s)	0.0	8.2	39.1	17.2		
Lane LOS		A	E	C		
Approach Delay (s)	0.0	8.2	17.6			
Approach LOS			C			
Intersection Summary						
Average Delay			4.7			
Intersection Capacity Utilization			69.6%	ICU Level of Service		C
Analysis Period (min)	15					

Intersection	
Intersection Delay, s/veh	14.6
Intersection LOS	B

Movement	EBU	EBL	EBT	WBU	WBT	WBR	SBU	SBL	SBR
Lane Configurations		↘	↕↕		↕	↘		↘↘	↘
Traffic Vol, veh/h	0	303	253	0	84	288	0	195	7
Future Vol, veh/h	0	303	253	0	84	288	0	195	7
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	329	275	0	91	313	0	212	8
Number of Lanes	0	1	2	0	1	1	0	2	1

Approach	EB	WB	SB
Opposing Approach	WB	EB	
Opposing Lanes	2	3	0
Conflicting Approach Left	SB		WB
Conflicting Lanes Left	3	0	2
Conflicting Approach Right		SB	EB
Conflicting Lanes Right	0	3	3
HCM Control Delay	15.7	14.3	12.1
HCM LOS	C	B	B

Lane	EBLn1	EBLn2	EBLn3	WBLn1	WBLn2	SBLn1	SBLn2	SBLn3
Vol Left, %	100%	0%	0%	0%	0%	100%	100%	0%
Vol Thru, %	0%	100%	100%	100%	0%	0%	0%	0%
Vol Right, %	0%	0%	0%	0%	100%	0%	0%	100%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	303	127	127	84	288	98	98	7
LT Vol	303	0	0	0	0	98	98	0
Through Vol	0	127	127	84	0	0	0	0
RT Vol	0	0	0	0	288	0	0	7
Lane Flow Rate	329	138	138	91	313	106	106	8
Geometry Grp	8	8	8	8	8	7	7	7
Degree of Util (X)	0.628	0.243	0.176	0.171	0.523	0.22	0.22	0.01
Departure Headway (Hd)	6.864	6.359	4.605	6.725	6.017	7.467	7.467	4.498
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cap	524	562	774	531	598	479	479	789
Service Time	4.626	4.12	2.365	4.492	3.783	5.232	5.232	2.261
HCM Lane V/C Ratio	0.628	0.246	0.178	0.171	0.523	0.221	0.221	0.01
HCM Control Delay	20.6	11.2	8.4	10.9	15.3	12.3	12.3	7.3
HCM Lane LOS	C	B	A	B	C	B	B	A
HCM 95th-tile Q	4.3	0.9	0.6	0.6	3	0.8	0.8	0

HCM Signalized Intersection Capacity Analysis
 48: Greenville Rd & Northfront Road/Altamont Pass Road

BART to Livermore Extension Project
 2025 Enhanced Bus PM



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↑	↑	↑	↑	↑
Traffic Volume (vph)	605	147	1	52	388	1039
Future Volume (vph)	605	147	1	52	388	1039
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	1863	1583	1770	1863	1770	1583
Flt Permitted	1.00	1.00	0.10	1.00	0.95	1.00
Satd. Flow (perm)	1863	1583	191	1863	1770	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	658	160	1	57	422	1129
RTOR Reduction (vph)	0	65	0	0	0	29
Lane Group Flow (vph)	658	95	1	57	422	1100
Turn Type	NA	Perm	Perm	NA	Prot	Perm
Protected Phases	4			8	2	
Permitted Phases		4	8			2
Actuated Green, G (s)	39.0	39.0	39.0	39.0	73.0	73.0
Effective Green, g (s)	39.0	39.0	39.0	39.0	73.0	73.0
Actuated g/C Ratio	0.32	0.32	0.32	0.32	0.61	0.61
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	605	514	62	605	1076	962
v/s Ratio Prot	c0.35			0.03	0.24	
v/s Ratio Perm		0.06	0.01			c0.69
v/c Ratio	1.09	0.18	0.02	0.09	0.39	1.14
Uniform Delay, d1	40.5	29.1	27.5	28.2	12.1	23.5
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	62.7	0.2	0.1	0.1	0.2	77.2
Delay (s)	103.2	29.2	27.6	28.3	12.3	100.7
Level of Service	F	C	C	C	B	F
Approach Delay (s)	88.7			28.3	76.7	
Approach LOS	F			C	E	

Intersection Summary

HCM 2000 Control Delay	79.6	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.12		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	102.8%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	416	112	242	995	67	81
Future Volume (vph)	416	112	242	995	67	81
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.2	5.2	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.88	0.97	0.95	0.95	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	3433	2787	3433	3539	3539	1583
Flt Permitted	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (perm)	3433	2787	3433	3539	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	452	122	263	1082	73	88
RTOR Reduction (vph)	0	101	0	0	0	56
Lane Group Flow (vph)	452	21	263	1082	73	32
Turn Type	Prot	Perm	Prot	NA	NA	Perm
Protected Phases	8		1	6	2	
Permitted Phases		8				2
Actuated Green, G (s)	6.5	6.5	3.0	18.1	11.1	11.1
Effective Green, g (s)	5.9	5.9	3.0	19.8	12.8	12.8
Actuated g/C Ratio	0.17	0.17	0.09	0.57	0.37	0.37
Clearance Time (s)	4.6	4.6	4.0	5.7	5.7	5.7
Vehicle Extension (s)	5.0	5.0	6.0	2.5	2.5	2.5
Lane Grp Cap (vph)	580	471	295	2007	1297	580
v/s Ratio Prot	c0.13		c0.08	c0.31	0.02	
v/s Ratio Perm		0.01				0.02
v/c Ratio	0.78	0.04	0.89	0.54	0.06	0.06
Uniform Delay, d1	13.9	12.1	15.8	4.7	7.1	7.1
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	7.6	0.1	29.1	0.2	0.0	0.0
Delay (s)	21.5	12.2	44.9	4.9	7.2	7.2
Level of Service	C	B	D	A	A	A
Approach Delay (s)	19.5			12.7	7.2	
Approach LOS	B			B	A	

Intersection Summary

HCM 2000 Control Delay	14.2	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.71		
Actuated Cycle Length (s)	34.9	Sum of lost time (s)	13.2
Intersection Capacity Utilization	47.0%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
50: Greenville Rd & Patterson Pass Rd



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	36	535	60	5	13	7	71	408	321	421	205	46
Future Volume (vph)	36	535	60	5	13	7	71	408	321	421	205	46
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.98		1.00	0.95		1.00	0.93		1.00	0.97	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1835		1770	1761		1770	1740		1770	1812	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	1835		1770	1761		1770	1740		1770	1812	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	39	582	65	5	14	8	77	443	349	458	223	50
RTOR Reduction (vph)	0	4	0	0	6	0	0	23	0	0	6	0
Lane Group Flow (vph)	39	643	0	5	16	0	77	769	0	458	267	0
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												
Actuated Green, G (s)	9.0	33.0		0.8	24.8		8.1	43.8		24.0	59.7	
Effective Green, g (s)	9.0	33.0		0.8	24.8		8.1	43.8		24.0	59.7	
Actuated g/C Ratio	0.08	0.28		0.01	0.21		0.07	0.37		0.20	0.51	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	135	514		12	371		121	648		361	919	
v/s Ratio Prot	c0.02	c0.35		0.00	0.01		0.04	c0.44		c0.26	0.15	
v/s Ratio Perm												
v/c Ratio	0.29	1.25		0.42	0.04		0.64	1.19		1.27	0.29	
Uniform Delay, d1	51.3	42.3		58.2	36.9		53.3	36.9		46.8	16.7	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	1.2	128.6		21.8	0.0		10.5	98.9		141.1	0.8	
Delay (s)	52.5	170.9		79.9	37.0		63.8	135.8		187.9	17.5	
Level of Service	D	F		E	D		E	F		F	B	
Approach Delay (s)		164.2			44.9			129.4			124.3	
Approach LOS		F			D			F			F	

Intersection Summary		
HCM 2000 Control Delay	137.1	HCM 2000 Level of Service F
HCM 2000 Volume to Capacity ratio	1.22	
Actuated Cycle Length (s)	117.6	Sum of lost time (s) 16.0
Intersection Capacity Utilization	106.2%	ICU Level of Service G
Analysis Period (min)	15	
c Critical Lane Group		

HCM Signalized Intersection Capacity Analysis
1: Dougherty Rd & Amador Valley Rd



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	84	506	391	719	1790	138
Future Volume (vph)	84	506	391	719	1790	138
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5	5.7	5.7	
Lane Util. Factor	1.00	1.00	0.97	0.91	0.91	
Frt	1.00	0.85	1.00	1.00	0.99	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1770	1583	3433	5085	5031	
Flt Permitted	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	1770	1583	3433	5085	5031	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	91	550	425	782	1946	150
RTOR Reduction (vph)	0	197	0	0	9	0
Lane Group Flow (vph)	91	353	425	782	2087	0
Turn Type	Perm	Perm	Prot	NA	NA	
Protected Phases			5	2	6	
Permitted Phases	4	4				
Actuated Green, G (s)	22.2	22.2	12.4	56.1	39.2	
Effective Green, g (s)	22.2	22.2	12.4	56.1	39.2	
Actuated g/C Ratio	0.25	0.25	0.14	0.63	0.44	
Clearance Time (s)	4.5	4.5	4.5	5.7	5.7	
Vehicle Extension (s)	1.8	1.8	2.0	4.0	4.0	
Lane Grp Cap (vph)	444	397	481	3223	2228	
v/s Ratio Prot			c0.12	0.15	c0.41	
v/s Ratio Perm	0.05	c0.22				
v/c Ratio	0.20	0.89	0.88	0.24	0.94	
Uniform Delay, d1	26.2	32.0	37.3	7.0	23.5	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.1	20.3	16.8	0.1	8.3	
Delay (s)	26.3	52.2	54.2	7.1	31.8	
Level of Service	C	D	D	A	C	
Approach Delay (s)	48.5			23.7	31.8	
Approach LOS	D			C	C	

Intersection Summary

HCM 2000 Control Delay	32.0	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.91		
Actuated Cycle Length (s)	88.5	Sum of lost time (s)	14.7
Intersection Capacity Utilization	77.5%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
2: Dougherty Rd & Dublin Blvd

BART to Livermore Extension Project
2025 BART + INP + Garage AM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	38	362	413	267	630	345	698	1028	128	686	1746	78
Future Volume (vph)	38	362	413	267	630	345	698	1028	128	686	1746	78
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	6.0	5.0	5.0	5.5	5.0	5.0	5.5	5.0	5.0	5.5	
Lane Util. Factor	0.97	0.91	0.88	0.94	0.91	1.00	0.94	0.91	0.88	0.97	0.86	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	3433	5085	2787	4990	5085	1583	4990	5085	2787	3433	6367	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	3433	5085	2787	4990	5085	1583	4990	5085	2787	3433	6367	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	41	393	449	290	685	375	759	1117	139	746	1898	85
RTOR Reduction (vph)	0	0	41	0	0	99	0	0	82	0	4	0
Lane Group Flow (vph)	41	393	408	290	685	276	759	1117	57	746	1979	0
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	
Protected Phases	5	2	3	1	6	7	3	8	1	7	4	
Permitted Phases			2			6			8			
Actuated Green, G (s)	8.7	22.6	38.6	15.0	29.4	54.7	16.0	33.8	48.8	25.3	43.1	
Effective Green, g (s)	8.7	22.6	38.6	15.0	29.4	54.7	16.0	33.8	48.8	25.3	43.1	
Actuated g/C Ratio	0.07	0.19	0.33	0.13	0.25	0.46	0.14	0.29	0.41	0.21	0.36	
Clearance Time (s)	5.0	6.0	5.0	5.0	5.5	5.0	5.0	5.5	5.0	5.0	5.5	
Vehicle Extension (s)	2.0	4.5	2.0	2.0	4.5	2.0	2.0	4.5	2.0	2.0	4.5	
Lane Grp Cap (vph)	252	972	910	633	1264	732	675	1454	1150	734	2321	
v/s Ratio Prot	0.01	0.08	0.06	c0.06	c0.13	0.08	0.15	0.22	0.01	c0.22	c0.31	
v/s Ratio Perm			0.09			0.09			0.01			
v/c Ratio	0.16	0.40	0.45	0.46	0.54	0.38	1.12	0.77	0.05	1.02	0.85	
Uniform Delay, d1	51.3	41.9	31.4	47.8	38.6	20.7	51.1	38.6	20.8	46.5	34.6	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.1	0.5	0.1	0.2	0.7	0.1	74.2	2.8	0.0	37.4	3.5	
Delay (s)	51.4	42.4	31.5	48.0	39.3	20.8	125.3	41.4	20.8	83.8	38.1	
Level of Service	D	D	C	D	D	C	F	D	C	F	D	
Approach Delay (s)		37.3			36.0			71.6			50.6	
Approach LOS		D			D			E			D	
Intersection Summary												
HCM 2000 Control Delay			52.2				HCM 2000 Level of Service				D	
HCM 2000 Volume to Capacity ratio			0.81									
Actuated Cycle Length (s)			118.2				Sum of lost time (s)				21.5	
Intersection Capacity Utilization			82.1%				ICU Level of Service				E	
Analysis Period (min)			15									

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
3: Dougherty Rd & I-580 WB Ramps

BART to Livermore Extension Project
2025 BART + INP + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↔↔		↔↔		↑↑↑			↑↑↑	↔
Traffic Volume (vph)	0	0	0	392	0	702	0	1275	0	0	1645	0
Future Volume (vph)	0	0	0	392	0	702	0	1275	0	0	1645	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0		4.0		4.0			4.0	
Lane Util. Factor				0.97		0.88		0.91			0.86	
Frt				1.00		0.85		1.00			1.00	
Flt Protected				0.95		1.00		1.00			1.00	
Satd. Flow (prot)				3433		2787		5085			4806	
Flt Permitted				0.95		1.00		1.00			1.00	
Satd. Flow (perm)				3433		2787		5085			4806	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	426	0	763	0	1386	0	0	1788	0
RTOR Reduction (vph)	0	0	0	0	0	35	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	426	0	728	0	1386	0	0	1788	0
Turn Type				Prot		Prot		NA			NA	Perm
Protected Phases				4		4		2			6	
Permitted Phases												6
Actuated Green, G (s)				15.1		15.1		24.1			24.1	
Effective Green, g (s)				16.5		16.5		25.5			25.5	
Actuated g/C Ratio				0.33		0.33		0.51			0.51	
Clearance Time (s)				5.4		5.4		5.4			5.4	
Vehicle Extension (s)				3.0		3.0		3.0			3.0	
Lane Grp Cap (vph)				1132		919		2593			2451	
v/s Ratio Prot				0.12		c0.26		0.27			c0.37	
v/s Ratio Perm												
v/c Ratio				0.38		0.79		0.53			0.73	
Uniform Delay, d1				12.8		15.2		8.3			9.6	
Progression Factor				1.00		1.00		0.67			1.00	
Incremental Delay, d2				0.2		4.7		0.7			1.9	
Delay (s)				13.0		19.9		6.3			11.5	
Level of Service				B		B		A			B	
Approach Delay (s)		0.0			17.5			6.3			11.5	
Approach LOS		A			B			A			B	
Intersection Summary												
HCM 2000 Control Delay				11.5							B	
HCM 2000 Volume to Capacity ratio				0.75								
Actuated Cycle Length (s)				50.0							8.0	
Intersection Capacity Utilization				55.9%							B	
Analysis Period (min)				15								

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 4: Hopyard Rd/Dougherty Rd & I-580 EB Ramps

BART to Livermore Extension Project
 2025 BART + INP + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗		↖↗					↑↑↑	↖		↑↑↑	↖
Traffic Volume (vph)	767	0	1513	0	0	0	0	753	0	0	1513	0
Future Volume (vph)	767	0	1513	0	0	0	0	753	0	0	1513	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0					4.0			4.0	
Lane Util. Factor	0.97		0.88					0.91			0.86	
Frt	1.00		0.85					1.00			1.00	
Flt Protected	0.95		1.00					1.00			1.00	
Satd. Flow (prot)	3433		2787					5085			4806	
Flt Permitted	0.95		1.00					1.00			1.00	
Satd. Flow (perm)	3433		2787					5085			4806	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	834	0	1645	0	0	0	0	818	0	0	1645	0
RTOR Reduction (vph)	0	0	11	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	834	0	1634	0	0	0	0	818	0	0	1645	0
Turn Type	Prot		Prot					NA	Free		NA	Perm
Protected Phases	4		4					2			6	
Permitted Phases									Free			6
Actuated Green, G (s)	54.6		54.6					34.6			34.6	
Effective Green, g (s)	56.0		56.0					36.0			36.0	
Actuated g/C Ratio	0.56		0.56					0.36			0.36	
Clearance Time (s)	5.4		5.4					5.4			5.4	
Vehicle Extension (s)	3.0		3.0					3.0			3.0	
Lane Grp Cap (vph)	1922		1560					1830			1730	
v/s Ratio Prot	0.24		c0.59					0.16			c0.34	
v/s Ratio Perm												
v/c Ratio	0.43		1.05					0.45			0.95	
Uniform Delay, d1	12.8		22.0					24.4			31.1	
Progression Factor	1.00		1.00					1.00			0.87	
Incremental Delay, d2	0.2		36.2					0.8			10.3	
Delay (s)	12.9		58.2					25.2			37.4	
Level of Service	B		E					C			D	
Approach Delay (s)		43.0			0.0			25.2			37.4	
Approach LOS		D			A			C			D	

Intersection Summary			
HCM 2000 Control Delay	38.2	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	1.01		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	88.8%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
5: Hopyard Rd & Owens Rd

BART to Livermore Extension Project
2025 BART + INP + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↔↗		↖	↗	↗	↖	↑↑↑	↗	↖↗	↑↑↗	
Traffic Volume (vph)	192	105	52	120	135	198	141	674	160	913	1617	546
Future Volume (vph)	192	105	52	120	135	198	141	674	160	913	1617	546
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	2.7	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	0.91	0.91		1.00	0.95	0.95	1.00	0.91	1.00	0.97	0.91	
Frt	1.00	0.97		1.00	0.95	0.85	1.00	1.00	0.85	1.00	0.96	
Flt Protected	0.95	0.98		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1610	3224		1770	1687	1504	1770	5085	1583	3433	4893	
Flt Permitted	0.95	0.98		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1610	3224		1770	1687	1504	1770	5085	1583	3433	4893	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	209	114	57	130	147	215	153	733	174	992	1758	593
RTOR Reduction (vph)	0	26	0	0	18	73	0	0	130	0	68	0
Lane Group Flow (vph)	115	239	0	130	196	75	153	733	44	992	2283	0
Turn Type	Split	NA		Split	NA	pm+ov	Prot	NA	Perm	Prot	NA	
Protected Phases	8	8		4	4	1	5	2		1	6	
Permitted Phases						4			2			
Actuated Green, G (s)	6.3	6.3		9.7	9.7	42.1	8.0	21.3	21.3	32.4	45.7	
Effective Green, g (s)	7.6	7.6		11.0	11.0	44.7	8.0	23.0	23.0	32.4	47.4	
Actuated g/C Ratio	0.08	0.08		0.12	0.12	0.50	0.09	0.26	0.26	0.36	0.53	
Clearance Time (s)	5.3	5.3		5.3	5.3	4.0	4.0	5.7	5.7	4.0	5.7	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	135	272		216	206	792	157	1299	404	1235	2576	
v/s Ratio Prot	0.07	c0.07		0.07	c0.12	0.04	c0.09	0.14		0.29	c0.47	
v/s Ratio Perm						0.01			0.03			
v/c Ratio	0.85	0.88		0.60	0.95	0.09	0.97	0.56	0.11	0.80	0.89	
Uniform Delay, d1	40.6	40.7		37.4	39.2	12.0	40.9	29.1	25.7	25.9	18.9	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	37.3	26.4		4.7	47.8	0.1	63.7	1.8	0.6	3.9	5.0	
Delay (s)	78.0	67.1		42.1	87.0	12.0	104.6	30.9	26.2	29.8	23.9	
Level of Service	E	E		D	F	B	F	C	C	C	C	
Approach Delay (s)		70.4			52.6			40.8			25.6	
Approach LOS		E			D			D			C	

Intersection Summary

HCM 2000 Control Delay	34.4	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.90		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	82.5%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
6: Hopyard Rd & Stoneridge Dr

BART to Livermore Extension Project
2025 BART + INP + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↖	↗↗↗	↘	↖↖	↗↗↗	↘	↖↖↖	↗↗	↘	↖↖	↗↗↗	↘
Traffic Volume (vph)	151	732	439	81	977	116	646	743	86	279	973	233
Future Volume (vph)	151	732	439	81	977	116	646	743	86	279	973	233
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.91	1.00	0.97	0.91	1.00	0.94	0.95	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5085	1583	3433	5085	1583	4990	3539	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5085	1583	3433	5085	1583	4990	3539	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	164	796	477	88	1062	126	702	808	93	303	1058	253
RTOR Reduction (vph)	0	0	223	0	0	91	0	0	67	0	0	121
Lane Group Flow (vph)	164	796	254	88	1062	35	702	808	26	303	1058	132
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8			2			6
Actuated Green, G (s)	4.0	17.5	17.5	3.2	16.7	16.7	8.0	17.0	17.0	7.0	16.0	16.0
Effective Green, g (s)	4.0	17.5	17.5	3.2	16.7	16.7	8.0	17.0	17.0	7.0	16.0	16.0
Actuated g/C Ratio	0.07	0.29	0.29	0.05	0.28	0.28	0.13	0.28	0.28	0.12	0.26	0.26
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	226	1466	456	180	1399	435	657	991	443	395	1340	417
v/s Ratio Prot	c0.05	0.16		0.03	c0.21		c0.14	c0.23		0.09	0.21	
v/s Ratio Perm			0.16			0.02			0.02			0.08
v/c Ratio	0.73	0.54	0.56	0.49	0.76	0.08	1.07	0.82	0.06	0.77	0.79	0.32
Uniform Delay, d1	27.8	18.2	18.3	28.0	20.2	16.3	26.4	20.4	16.0	26.1	20.8	18.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	11.0	0.4	1.5	2.1	2.4	0.1	54.8	5.3	0.1	8.7	3.2	0.4
Delay (s)	38.8	18.6	19.8	30.0	22.6	16.4	81.2	25.6	16.0	34.7	24.0	18.4
Level of Service	D	B	B	C	C	B	F	C	B	C	C	B
Approach Delay (s)		21.3			22.5			49.4			25.1	
Approach LOS		C			C			D			C	

Intersection Summary

HCM 2000 Control Delay	30.2	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.85		
Actuated Cycle Length (s)	60.7	Sum of lost time (s)	16.0
Intersection Capacity Utilization	67.6%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

7: Hopyard Rd & Las Positas Blvd

BART to Livermore Extension Project
2025 BART + INP + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↑↑	↖	↖↗	↑↑	↖	↖↗	↑↑↑	↖	↖↗	↑↑↑	↖
Traffic Volume (vph)	154	460	371	349	448	58	413	1169	364	110	1004	90
Future Volume (vph)	154	460	371	349	448	58	413	1169	364	110	1004	90
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.95	1.00	0.97	0.95	1.00	0.97	0.91	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	3433	3539	1583	3433	5085	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	3433	3539	1583	3433	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	167	500	403	379	487	63	449	1271	396	120	1091	98
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	72
Lane Group Flow (vph)	167	500	403	379	487	63	449	1271	396	120	1091	26
Turn Type	Prot	NA	Free	Prot	NA	Free	Prot	NA	Free	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1		6
Permitted Phases			Free			Free			Free			6
Actuated Green, G (s)	5.5	14.6	64.5	8.0	17.1	64.5	9.0	22.7	64.5	3.2	16.9	16.9
Effective Green, g (s)	5.5	14.6	64.5	8.0	17.1	64.5	9.0	22.7	64.5	3.2	16.9	16.9
Actuated g/C Ratio	0.09	0.23	1.00	0.12	0.27	1.00	0.14	0.35	1.00	0.05	0.26	0.26
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	292	801	1583	425	938	1583	479	1789	1583	170	1332	414
v/s Ratio Prot	0.05	c0.14		c0.11	0.14		c0.13	0.25		0.03	c0.21	
v/s Ratio Perm			c0.25			0.04			0.25			0.02
v/c Ratio	0.57	0.62	0.25	0.89	0.52	0.04	0.94	0.71	0.25	0.71	0.82	0.06
Uniform Delay, d1	28.4	22.5	0.0	27.8	20.2	0.0	27.5	18.1	0.0	30.2	22.4	17.9
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	2.7	1.5	0.4	20.3	0.5	0.0	26.0	1.4	0.4	12.5	4.1	0.1
Delay (s)	31.1	24.0	0.4	48.1	20.7	0.0	53.5	19.4	0.4	42.7	26.4	17.9
Level of Service	C	C	A	D	C	A	D	B	A	D	C	B
Approach Delay (s)		16.2			30.5			23.1			27.3	
Approach LOS		B			C			C			C	

































Intersection Summary

HCM 2000 Control Delay	24.0	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.79		
Actuated Cycle Length (s)	64.5	Sum of lost time (s)	16.0
Intersection Capacity Utilization	67.2%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
8: Willow Rd & Owens Rd

BART to Livermore Extension Project
2025 BART + INP + Garage AM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 	  		 	  			 		 	 	
Traffic Volume (vph)	208	360	236	89	329	112	86	105	0	88	87	104
Future Volume (vph)	208	360	236	89	329	112	86	105	0	88	87	104
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	5.3	4.0		5.3	4.0	4.0
Lane Util. Factor	0.97	0.91		0.97	0.91	1.00	1.00	0.95		1.00	1.00	1.00
Frt	1.00	0.94		1.00	1.00	0.85	1.00	1.00		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	4783		3433	5085	1583	1770	3539		1770	1863	1583
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.70	1.00		0.68	1.00	1.00
Satd. Flow (perm)	3433	4783		3433	5085	1583	1295	3539		1266	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	226	391	257	97	358	122	93	114	0	96	95	113
RTOR Reduction (vph)	0	107	0	0	0	59	0	0	0	0	0	95
Lane Group Flow (vph)	226	541	0	97	358	63	93	114	0	96	95	18
Turn Type	Prot	NA		Prot	NA	Perm	Perm	NA	Perm	Perm	NA	Perm
Protected Phases	1	6		5	2			4			8	
Permitted Phases						2	4		4	8		8
Actuated Green, G (s)	10.7	39.1		6.2	34.6	34.6	9.7	9.7		9.7	9.7	9.7
Effective Green, g (s)	10.7	40.8		6.2	36.3	36.3	9.7	11.0		9.7	11.0	11.0
Actuated g/C Ratio	0.15	0.58		0.09	0.52	0.52	0.14	0.16		0.14	0.16	0.16
Clearance Time (s)	4.0	5.7		4.0	5.7	5.7	5.3	5.3		5.3	5.3	5.3
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	524	2787		304	2636	820	179	556		175	292	248
v/s Ratio Prot	c0.07	c0.11		c0.03	0.07			0.03			0.05	
v/s Ratio Perm						0.04	0.07			c0.08		0.01
v/c Ratio	0.43	0.19		0.32	0.14	0.08	0.52	0.21		0.55	0.33	0.07
Uniform Delay, d1	26.9	6.9		29.9	8.7	8.5	28.0	25.7		28.1	26.2	25.1
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	0.6	0.2		0.6	0.1	0.2	2.5	0.2		3.5	0.7	0.1
Delay (s)	27.5	7.0		30.5	8.8	8.6	30.5	25.9		31.6	26.9	25.3
Level of Service	C	A		C	A	A	C	C		C	C	C
Approach Delay (s)		12.3			12.4			28.0			27.8	
Approach LOS		B			B			C			C	

Intersection Summary		
HCM 2000 Control Delay	16.4	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.30	B
Actuated Cycle Length (s)	70.0	Sum of lost time (s)
Intersection Capacity Utilization	37.1%	12.0
Analysis Period (min)	15	ICU Level of Service
		A

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 9: Hacienda Dr & Dublin Blvd

BART to Livermore Extension Project
 2025 BART + INP + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↖	↑↑↑	↗↗	↖↖	↑↑↑		↖↖↖	↑↑	↗↗	↖↖	↑↑↑	↗↗
Traffic Volume (vph)	73	335	94	271	744	79	158	633	115	12	390	132
Future Volume (vph)	73	335	94	271	744	79	158	633	115	12	390	132
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	6.0	5.0	4.5	6.0		5.0	6.0	6.0	4.5	5.5	5.5
Lane Util. Factor	0.97	0.91	0.88	0.97	0.91		0.94	0.95	0.88	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5085	2787	3433	5012		4990	3539	2787	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5085	2787	3433	5012		4990	3539	2787	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	79	364	102	295	809	86	172	688	125	13	424	143
RTOR Reduction (vph)	0	0	71	0	11	0	0	0	86	0	0	116
Lane Group Flow (vph)	79	364	31	295	884	0	172	688	39	13	424	27
Turn Type	Prot	NA	pm+ov	Prot	NA		Prot	NA	Perm	Prot	NA	Perm
Protected Phases	5	2	3	1	6		3	8		7	NA	4
Permitted Phases			2						8			4
Actuated Green, G (s)	4.9	12.1	22.4	17.2	24.4		10.3	23.5	23.5	0.6	13.8	13.8
Effective Green, g (s)	4.9	12.1	22.4	17.2	24.4		10.3	23.5	23.5	0.6	13.8	13.8
Actuated g/C Ratio	0.07	0.16	0.30	0.23	0.33		0.14	0.32	0.32	0.01	0.19	0.19
Clearance Time (s)	4.5	6.0	5.0	4.5	6.0		5.0	6.0	6.0	4.5	5.5	5.5
Vehicle Extension (s)	2.0	3.5	2.0	2.0	3.5		2.0	3.5	3.5	2.0	3.5	3.5
Lane Grp Cap (vph)	226	826	1026	793	1643		690	1117	880	27	943	293
v/s Ratio Prot	0.02	c0.07	0.00	0.09	c0.18		0.03	c0.19		0.00	c0.08	
v/s Ratio Perm			0.01						0.01			0.02
v/c Ratio	0.35	0.44	0.03	0.37	0.54		0.25	0.62	0.04	0.48	0.45	0.09
Uniform Delay, d1	33.2	28.1	18.3	24.1	20.4		28.6	21.6	17.7	36.7	26.9	25.1
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.3	0.4	0.0	0.1	0.4		0.1	1.1	0.0	4.9	0.4	0.2
Delay (s)	33.6	28.5	18.3	24.2	20.8		28.7	22.7	17.7	41.6	27.3	25.3
Level of Service	C	C	B	C	C		C	C	B	D	C	C
Approach Delay (s)		27.4			21.6			23.1			27.1	
Approach LOS		C			C			C			C	

Intersection Summary		
HCM 2000 Control Delay	24.0	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.60	C
Actuated Cycle Length (s)	74.4	Sum of lost time (s)
Intersection Capacity Utilization	57.8%	21.0
Analysis Period (min)	15	ICU Level of Service
		B

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 10: Hacienda Dr & Martinelli Blvd/Hacienda Crossings



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗	↘↙	↘↙	↗		↘↙↘	↖↖↖	↗	↘↙	↖↖↖	
Traffic Volume (vph)	10	8	174	110	12	8	243	869	113	17	727	48
Future Volume (vph)	10	8	174	110	12	8	243	869	113	17	727	48
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	3.0	3.0	5.5	3.0		3.5	3.0	3.0	5.0	3.5	
Lane Util. Factor	1.00	0.91	0.91	0.97	1.00		0.94	0.91	1.00	0.97	0.86	
Frt	1.00	0.90	0.85	1.00	0.94		1.00	1.00	0.85	1.00	0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1770	1523	2882	3433	1748		4990	5085	1583	3433	6348	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1770	1523	2882	3433	1748		4990	5085	1583	3433	6348	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	11	9	189	120	13	9	264	945	123	18	790	52
RTOR Reduction (vph)	0	14	129	0	6	0	0	0	55	0	8	0
Lane Group Flow (vph)	11	14	41	120	16	0	264	945	68	18	834	0
Turn Type	Prot	NA	Perm	Prot	NA		Prot	NA	pm+ov	Prot	NA	
Protected Phases	5	2		1	6		3	8	1	7	4	
Permitted Phases			2						8			
Actuated Green, G (s)	1.7	15.8	15.8	6.9	21.5		8.2	29.7	36.6	1.1	22.6	
Effective Green, g (s)	1.2	17.8	17.8	6.4	23.5		9.2	31.7	40.6	0.6	24.1	
Actuated g/C Ratio	0.02	0.24	0.24	0.09	0.32		0.13	0.43	0.56	0.01	0.33	
Clearance Time (s)	4.5	5.0	5.0	5.0	5.0		4.5	5.0	5.0	4.5	5.0	
Vehicle Extension (s)	3.0	4.0	4.0	2.0	4.0		3.0	4.0	2.0	3.0	4.0	
Lane Grp Cap (vph)	29	371	702	300	562		628	2208	945	28	2095	
v/s Ratio Prot	c0.01	0.01		c0.03	0.01		c0.05	c0.19	0.01	0.01	0.13	
v/s Ratio Perm			c0.01						0.03			
v/c Ratio	0.38	0.04	0.06	0.40	0.03		0.42	0.43	0.07	0.64	0.40	
Uniform Delay, d1	35.5	21.1	21.2	31.5	16.9		29.4	14.3	7.5	36.1	18.9	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	8.1	0.1	0.0	0.3	0.0		0.5	0.2	0.0	40.9	0.2	
Delay (s)	43.6	21.1	21.2	31.8	17.0		29.9	14.5	7.5	77.0	19.0	
Level of Service	D	C	C	C	B		C	B	A	E	B	
Approach Delay (s)		22.4			29.5			16.9			20.2	
Approach LOS		C			C			B			C	

Intersection Summary

HCM 2000 Control Delay	19.2	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.34		
Actuated Cycle Length (s)	73.0	Sum of lost time (s)	16.5
Intersection Capacity Utilization	42.6%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 11: Hacienda Dr & I-580 WB Ramps

BART to Livermore Extension Project
 2025 BART + INP + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↔		↔		↑↑↑			↑↑↑	↔
Traffic Volume (vph)	0	0	0	251	0	450	0	1066	183	0	605	416
Future Volume (vph)	0	0	0	251	0	450	0	1066	183	0	605	416
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0		4.0		4.0			4.0	4.0
Lane Util. Factor				0.97		0.88		0.91			0.86	0.86
Frt				1.00		0.85		0.98			0.96	0.85
Flt Protected				0.95		1.00		1.00			1.00	1.00
Satd. Flow (prot)				3433		2787		4974			4622	1362
Flt Permitted				0.95		1.00		1.00			1.00	1.00
Satd. Flow (perm)				3433		2787		4974			4622	1362
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	273	0	489	0	1159	199	0	658	452
RTOR Reduction (vph)	0	0	0	0	0	97	0	45	0	0	92	92
Lane Group Flow (vph)	0	0	0	273	0	392	0	1313	0	0	792	134
Turn Type				Prot		Prot		NA			NA	Perm
Protected Phases				4		4		2			6	
Permitted Phases												6
Actuated Green, G (s)				10.9		10.9		27.8			27.8	27.8
Effective Green, g (s)				12.3		12.3		29.7			29.7	29.7
Actuated g/C Ratio				0.25		0.25		0.59			0.59	0.59
Clearance Time (s)				5.4		5.4		5.9			5.9	5.9
Vehicle Extension (s)				3.0		3.0		3.0			3.0	3.0
Lane Grp Cap (vph)				844		685		2954			2745	809
v/s Ratio Prot				0.08		c0.14		c0.26			0.17	
v/s Ratio Perm												0.10
v/c Ratio				0.32		0.57		0.44			0.29	0.17
Uniform Delay, d1				15.4		16.5		5.6			5.0	4.6
Progression Factor				1.00		1.00		0.49			1.00	1.00
Incremental Delay, d2				0.2		1.2		0.5			0.3	0.4
Delay (s)				15.7		17.7		3.2			5.2	5.0
Level of Service				B		B		A			A	A
Approach Delay (s)		0.0			17.0			3.2			5.2	
Approach LOS		A			B			A			A	

Intersection Summary		
HCM 2000 Control Delay	7.1	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.48	A
Actuated Cycle Length (s)	50.0	Sum of lost time (s)
Intersection Capacity Utilization	47.1%	8.0
Analysis Period (min)	15	ICU Level of Service
		A

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 12: Hacienda Dr & I-580 EB Ramps

BART to Livermore Extension Project
 2025 BART + INP + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	751	0	1081	0	0	0	0	458	166	0	962	148
Future Volume (vph)	751	0	1081	0	0	0	0	458	166	0	962	148
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0					4.0	4.0		4.0	
Lane Util. Factor	0.97		0.88					0.86	0.86		0.91	
Frt	1.00		0.85					0.98	0.85		0.98	
Flt Protected	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (prot)	3433		2787					4733	1362		4984	
Flt Permitted	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (perm)	3433		2787					4733	1362		4984	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	816	0	1175	0	0	0	0	498	180	0	1046	161
RTOR Reduction (vph)	0	0	16	0	0	0	0	12	74	0	19	0
Lane Group Flow (vph)	816	0	1159	0	0	0	0	542	50	0	1188	0
Turn Type	Prot		Prot					NA	Perm		NA	
Protected Phases	4		4					2			6	
Permitted Phases									2			
Actuated Green, G (s)	50.0		50.0					38.7	38.7		38.7	
Effective Green, g (s)	51.4		51.4					40.6	40.6		40.6	
Actuated g/C Ratio	0.51		0.51					0.41	0.41		0.41	
Clearance Time (s)	5.4		5.4					5.9	5.9		5.9	
Vehicle Extension (s)	2.0		2.0					2.0	2.0		2.0	
Lane Grp Cap (vph)	1764		1432					1921	552		2023	
v/s Ratio Prot	0.24		c0.42					0.11			c0.24	
v/s Ratio Perm									0.04			
v/c Ratio	0.46		0.81					0.28	0.09		0.59	
Uniform Delay, d1	15.5		20.2					19.9	18.3		23.2	
Progression Factor	1.00		1.00					1.00	1.00		0.91	
Incremental Delay, d2	0.1		3.3					0.4	0.3		1.2	
Delay (s)	15.6		23.5					20.3	18.6		22.3	
Level of Service	B		C					C	B		C	
Approach Delay (s)		20.3			0.0			20.0			22.3	
Approach LOS		C			A			B			C	

Intersection Summary

HCM 2000 Control Delay	20.8	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.71		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	66.4%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
13: Hacienda Dr & Owens Rd

BART to Livermore Extension Project
2025 BART + INP + Garage AM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	46	123	14	124	334	204	32	222	154	566	914	536
Future Volume (vph)	46	123	14	124	334	204	32	222	154	566	914	536
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	2.3	4.0	4.0	2.3	4.0	4.0	2.7	4.0	4.0	2.7
Lane Util. Factor	0.97	0.91	1.00	0.97	0.91	1.00	0.97	0.91	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5085	1583	3433	5085	1583	3433	5085	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5085	1583	3433	5085	1583	3433	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	50	134	15	135	363	222	35	241	167	615	993	583
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	50	134	15	135	363	222	35	241	167	615	993	583
Turn Type	Prot	NA	Free	Prot	NA	Free	Prot	NA	Free	Prot	NA	Free
Protected Phases	1	6		5	2		7	4		3	8	
Permitted Phases			Free			Free			Free			Free
Actuated Green, G (s)	5.9	31.9	105.0	10.9	36.9	105.0	4.3	12.3	105.0	30.9	38.9	105.0
Effective Green, g (s)	5.9	33.6	105.0	10.9	38.6	105.0	4.3	13.6	105.0	30.9	40.2	105.0
Actuated g/C Ratio	0.06	0.32	1.00	0.10	0.37	1.00	0.04	0.13	1.00	0.29	0.38	1.00
Clearance Time (s)	4.0	5.7		4.0	5.7		4.0	5.3		4.0	5.3	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	192	1627	1583	356	1869	1583	140	658	1583	1010	1946	1583
v/s Ratio Prot	0.01	0.03		0.04	0.07		0.01	0.05		c0.18	c0.20	
v/s Ratio Perm			0.01			0.14			0.11			c0.37
v/c Ratio	0.26	0.08	0.01	0.38	0.19	0.14	0.25	0.37	0.11	0.61	0.51	0.37
Uniform Delay, d1	47.5	24.9	0.0	43.9	22.6	0.0	48.8	41.8	0.0	31.9	24.9	0.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.7	0.1	0.0	0.7	0.2	0.2	0.9	0.3	0.1	1.0	0.2	0.7
Delay (s)	48.2	25.0	0.0	44.6	22.8	0.2	49.7	42.1	0.1	32.9	25.1	0.7
Level of Service	D	C	A	D	C	A	D	D	A	C	C	A
Approach Delay (s)		29.0			19.9			26.9			20.8	
Approach LOS		C			B			C			C	

Intersection Summary		
HCM 2000 Control Delay	21.8	HCM 2000 Level of Service C
HCM 2000 Volume to Capacity ratio	0.52	
Actuated Cycle Length (s)	105.0	Sum of lost time (s) 16.0
Intersection Capacity Utilization	44.1%	ICU Level of Service A
Analysis Period (min)	15	

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 14: Tassajara Rd & Dublin Blvd

BART to Livermore Extension Project
 2025 BART + INP + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↖	↑↑	↗↗	↖↖↖	↑↑		↖↖↖	↑↑↑	↗	↖↖	↑↑↑	↗↗
Traffic Volume (vph)	93	149	158	464	592	39	224	512	144	25	1239	232
Future Volume (vph)	93	149	158	464	592	39	224	512	144	25	1239	232
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	6.0	6.0	5.0	6.0		5.0	6.0	6.0	5.0	6.0	6.0
Lane Util. Factor	0.97	0.95	0.88	0.94	0.95		0.94	0.91	1.00	0.97	0.86	0.88
Frt	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	2787	4990	3507		4990	5085	1583	3433	6408	2787
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	2787	4990	3507		4990	5085	1583	3433	6408	2787
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	101	162	172	504	643	42	243	557	157	27	1347	252
RTOR Reduction (vph)	0	0	132	0	4	0	0	0	95	0	0	167
Lane Group Flow (vph)	101	162	40	504	681	0	243	557	62	27	1347	85
Turn Type	Prot	NA	Perm	Prot	NA		Prot	NA	Perm	Prot	NA	Perm
Protected Phases	5	2		1	6		3	8		7	NA	4
Permitted Phases			2						8			4
Actuated Green, G (s)	16.2	29.8	29.8	18.0	31.6		16.2	51.3	51.3	8.4	43.5	43.5
Effective Green, g (s)	16.2	29.8	29.8	18.0	31.6		16.2	51.3	51.3	8.4	43.5	43.5
Actuated g/C Ratio	0.13	0.23	0.23	0.14	0.24		0.13	0.40	0.40	0.06	0.34	0.34
Clearance Time (s)	5.0	6.0	6.0	5.0	6.0		5.0	6.0	6.0	5.0	6.0	6.0
Vehicle Extension (s)	2.0	3.0	3.0	2.0	3.0		2.0	4.0	4.0	2.0	4.0	4.0
Lane Grp Cap (vph)	429	814	641	693	855		624	2014	627	222	2152	936
v/s Ratio Prot	0.03	0.05		c0.10	c0.19		c0.05	0.11		0.01	c0.21	
v/s Ratio Perm			0.01						0.04			0.03
v/c Ratio	0.24	0.20	0.06	0.73	0.80		0.39	0.28	0.10	0.12	0.63	0.09
Uniform Delay, d1	51.1	40.2	38.9	53.4	45.9		52.1	26.5	24.6	57.1	36.2	29.5
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.1	0.1	0.0	3.2	5.2		0.1	0.1	0.1	0.1	0.7	0.1
Delay (s)	51.2	40.3	39.0	56.6	51.1		52.2	26.6	24.7	57.2	36.8	29.5
Level of Service	D	D	D	E	D		D	C	C	E	D	C
Approach Delay (s)		42.3			53.5			32.8			36.0	
Approach LOS		D			D			C			D	

Intersection Summary		
HCM 2000 Control Delay	40.9	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.67	D
Actuated Cycle Length (s)	129.5	Sum of lost time (s)
Intersection Capacity Utilization	80.6%	22.0
Analysis Period (min)	15	ICU Level of Service
		D

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
15: Tassajara Rd & I-580 WB Ramps

BART to Livermore Extension Project
2025 BART + INP + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↔↔		↔↔		↑↑	↔		↑↑↔	↔
Traffic Volume (vph)	0	0	0	570	0	294	0	1037	468	0	931	935
Future Volume (vph)	0	0	0	570	0	294	0	1037	468	0	931	935
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0		4.0		4.0	4.0		4.0	4.0
Lane Util. Factor				0.97		0.88		0.95	1.00		0.86	0.86
Frt				1.00		0.85		1.00	0.85		0.95	0.85
Flt Protected				0.95		1.00		1.00	1.00		1.00	1.00
Satd. Flow (prot)				3433		2787		3539	1583		4565	1362
Flt Permitted				0.95		1.00		1.00	1.00		1.00	1.00
Satd. Flow (perm)				3433		2787		3539	1583		4565	1362
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	620	0	320	0	1127	509	0	1012	1016
RTOR Reduction (vph)	0	0	0	0	0	76	0	0	225	0	167	225
Lane Group Flow (vph)	0	0	0	620	0	244	0	1127	284	0	1353	283
Turn Type				Perm		Perm		NA	Perm		NA	Perm
Protected Phases								2			6	
Permitted Phases				8		8			2			6
Actuated Green, G (s)				14.1		14.1		27.9	27.9		27.9	27.9
Effective Green, g (s)				14.1		14.1		27.9	27.9		27.9	27.9
Actuated g/C Ratio				0.28		0.28		0.56	0.56		0.56	0.56
Clearance Time (s)				4.0		4.0		4.0	4.0		4.0	4.0
Vehicle Extension (s)				3.0		3.0		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)				968		785		1974	883		2547	759
v/s Ratio Prot								c0.32			0.30	
v/s Ratio Perm				c0.18		0.09			0.18			0.21
v/c Ratio				0.64		0.31		0.57	0.32		0.53	0.37
Uniform Delay, d1				15.7		14.1		7.2	6.0		6.9	6.2
Progression Factor				1.00		1.00		1.00	1.00		1.00	1.00
Incremental Delay, d2				1.5		0.2		1.2	1.0		0.8	1.4
Delay (s)				17.2		14.4		8.4	6.9		7.7	7.6
Level of Service				B		B		A	A		A	A
Approach Delay (s)		0.0			16.2			7.9			7.7	
Approach LOS		A			B			A			A	

Intersection Summary

HCM 2000 Control Delay	9.5	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.59		
Actuated Cycle Length (s)	50.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	51.6%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 16: Santa Rita Rd & I-580 EB Ramps/Pimilco Dr

BART to Livermore Extension Project
 2025 BART + INP + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	540	118	673	181	0	193	0	732	104	191	1252	0
Future Volume (vph)	540	118	673	181	0	193	0	732	104	191	1252	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0		4.0		4.0		4.0	4.0	
Lane Util. Factor	0.97	1.00	1.00	0.97		0.88		0.86		1.00	0.95	
Frt	1.00	1.00	0.85	1.00		0.85		0.98		1.00	1.00	
Flt Protected	0.95	1.00	1.00	0.95		1.00		1.00		0.95	1.00	
Satd. Flow (prot)	3433	1863	1583	3433		2787		6288		1770	3539	
Flt Permitted	0.95	1.00	1.00	0.95		1.00		1.00		0.95	1.00	
Satd. Flow (perm)	3433	1863	1583	3433		2787		6288		1770	3539	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	587	128	732	197	0	210	0	796	113	208	1361	0
RTOR Reduction (vph)	0	0	0	0	0	71	0	43	0	0	0	0
Lane Group Flow (vph)	587	128	732	197	0	139	0	866	0	208	1361	0
Turn Type	Perm	NA	Free	Prot		pm+ov		NA		Prot	NA	Perm
Protected Phases		4		3		1		2		1	6	
Permitted Phases	4		Free			3						6
Actuated Green, G (s)	14.8	14.8	60.0	4.7		13.3		15.9		8.6	28.5	
Effective Green, g (s)	14.8	14.8	60.0	4.7		13.3		15.9		8.6	28.5	
Actuated g/C Ratio	0.25	0.25	1.00	0.08		0.22		0.27		0.14	0.48	
Clearance Time (s)	4.0	4.0		4.0		4.0		4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0		3.0		3.0		3.0	3.0	
Lane Grp Cap (vph)	846	459	1583	268		617		1666		253	1681	
v/s Ratio Prot		0.07		0.06		0.03		0.14		0.12	c0.38	
v/s Ratio Perm	c0.17		c0.46			0.02						
v/c Ratio	0.69	0.28	0.46	0.74		0.23		0.52		0.82	0.81	
Uniform Delay, d1	20.5	18.3	0.0	27.0		19.1		18.8		25.0	13.4	
Progression Factor	1.00	1.00	1.00	1.00		1.00		1.00		1.00	1.00	
Incremental Delay, d2	2.5	0.3	1.0	10.0		0.2		1.2		18.9	4.3	
Delay (s)	23.0	18.6	1.0	37.0		19.3		20.0		43.9	17.8	
Level of Service	C	B	A	D		B		B		D	B	
Approach Delay (s)		11.5			27.9			20.0			21.2	
Approach LOS		B			C			B			C	

Intersection Summary		
HCM 2000 Control Delay	18.3	HCM 2000 Level of Service B
HCM 2000 Volume to Capacity ratio	0.85	
Actuated Cycle Length (s)	60.0	Sum of lost time (s) 16.0
Intersection Capacity Utilization	56.7%	ICU Level of Service B
Analysis Period (min)	15	

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 17: Santa Rita Rd & Valley Ave

BART to Livermore Extension Project
 2025 BART + INP + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔↔	↑↑	↗	↖	↑↑	↗	↔↔	↑↑		↔↔	↑↑	↗
Traffic Volume (vph)	187	221	78	178	329	829	95	489	74	568	915	155
Future Volume (vph)	187	221	78	178	329	829	95	489	74	568	915	155
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.97	0.95		0.97	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.98		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	3433	3470		3433	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	3433	3470		3433	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	203	240	85	193	358	901	103	532	80	617	995	168
RTOR Reduction (vph)	0	0	70	0	0	0	0	17	0	0	0	100
Lane Group Flow (vph)	203	240	15	193	358	901	103	595	0	617	995	68
Turn Type	Prot	NA	Perm	Prot	NA	Free	Prot	NA		Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1		6
Permitted Phases			4			Free						6
Actuated Green, G (s)	7.7	11.5	11.5	8.1	11.9	64.9	3.1	16.2		13.1	26.2	26.2
Effective Green, g (s)	7.7	11.5	11.5	8.1	11.9	64.9	3.1	16.2		13.1	26.2	26.2
Actuated g/C Ratio	0.12	0.18	0.18	0.12	0.18	1.00	0.05	0.25		0.20	0.40	0.40
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	407	627	280	220	648	1583	163	866		692	1428	639
v/s Ratio Prot	0.06	0.07		c0.11	0.10		0.03	0.17		c0.18	c0.28	
v/s Ratio Perm			0.01			c0.57						0.04
v/c Ratio	0.50	0.38	0.05	0.88	0.55	0.57	0.63	0.69		0.89	0.70	0.11
Uniform Delay, d1	26.8	23.6	22.2	27.9	24.1	0.0	30.3	22.1		25.2	16.1	12.1
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	1.0	0.4	0.1	30.0	1.0	1.5	7.8	2.3		13.8	1.5	0.1
Delay (s)	27.8	24.0	22.3	57.9	25.1	1.5	38.1	24.3		39.0	17.6	12.1
Level of Service	C	C	C	E	C	A	D	C		D	B	B
Approach Delay (s)		25.1			14.8			26.3			24.5	
Approach LOS		C			B			C			C	

Intersection Summary		
HCM 2000 Control Delay	21.7	HCM 2000 Level of Service C
HCM 2000 Volume to Capacity ratio	0.83	
Actuated Cycle Length (s)	64.9	Sum of lost time (s) 16.0
Intersection Capacity Utilization	61.4%	ICU Level of Service B
Analysis Period (min)	15	

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 18: Bernal Ave/Valley Ave & Stanley Blvd

BART to Livermore Extension Project
 2025 BART + INP + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↕	↖	↖↗	↕↖	↖	↖	↕	↖	↖↗	↕↖	↖
Traffic Volume (vph)	206	202	52	250	895	954	173	477	106	139	344	116
Future Volume (vph)	206	202	52	250	895	954	173	477	106	139	344	116
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.95	1.00	0.97	0.91	0.91	1.00	0.95	1.00	0.97	0.95	0.95
Frt	1.00	1.00	0.85	1.00	0.96	0.85	1.00	1.00	0.85	1.00	0.96	0.96
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	3433	3238	1441	1770	3539	1583	3433	3405	3405
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	3433	3238	1441	1770	3539	1583	3433	3405	3405
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	224	220	57	272	973	1037	188	518	115	151	374	126
RTOR Reduction (vph)	0	0	28	0	47	28	0	0	92	0	38	0
Lane Group Flow (vph)	224	220	29	272	1341	594	188	518	23	151	462	0
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	
Protected Phases	7	4	5	3	8	1	5	2		1	6	
Permitted Phases			4			8			2			
Actuated Green, G (s)	7.0	33.1	44.7	11.0	37.1	46.9	11.6	17.9	17.9	9.8	16.1	
Effective Green, g (s)	7.0	33.1	44.7	11.0	37.1	46.9	11.6	17.9	17.9	9.8	16.1	
Actuated g/C Ratio	0.08	0.38	0.51	0.13	0.42	0.53	0.13	0.20	0.20	0.11	0.18	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	273	1334	878	430	1368	835	233	721	322	383	624	
v/s Ratio Prot	c0.07	0.06	0.00	0.08	c0.41	0.08	c0.11	c0.15		0.04	0.14	
v/s Ratio Perm			0.01			0.33			0.01			
v/c Ratio	0.82	0.16	0.03	0.63	0.98	0.71	0.81	0.72	0.07	0.39	0.74	
Uniform Delay, d1	39.8	18.2	10.8	36.5	25.0	15.4	37.0	32.6	28.2	36.2	33.9	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	17.6	0.1	0.0	3.0	19.7	2.9	18.2	3.4	0.1	0.7	4.7	
Delay (s)	57.4	18.2	10.8	39.5	44.7	18.2	55.2	36.0	28.3	36.9	38.6	
Level of Service	E	B	B	D	D	B	E	D	C	D	D	
Approach Delay (s)		34.9			36.9			39.3			38.2	
Approach LOS		C			D			D			D	

Intersection Summary			
HCM 2000 Control Delay	37.3	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.89		
Actuated Cycle Length (s)	87.8	Sum of lost time (s)	16.0
Intersection Capacity Utilization	76.9%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

19: Fallon Rd & Dublin Blvd

BART to Livermore Extension Project

2025 BART + INP + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↑↑↑	↖↗	↖↗↘	↑↑↑	↖	↖↗	↑↑↑	↖↗	↖↗	↑↑↑	↖
Traffic Volume (vph)	46	50	82	227	706	288	686	289	30	57	723	279
Future Volume (vph)	46	50	82	227	706	288	686	289	30	57	723	279
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.3	5.3	5.3	4.0	4.0	4.0	5.3	4.9	4.9	5.3	4.9	4.9
Lane Util. Factor	0.97	0.91	0.88	0.94	0.91	1.00	0.97	0.91	0.88	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3090	4577	2508	4491	4577	1425	3090	4577	2508	3090	4577	1425
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3090	4577	2508	4491	4577	1425	3090	4577	2508	3090	4577	1425
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	50	54	89	247	767	313	746	314	33	62	786	303
RTOR Reduction (vph)	0	0	34	0	0	229	0	0	17	0	0	148
Lane Group Flow (vph)	50	54	55	247	767	84	746	314	16	62	786	155
Turn Type	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	5	2	3	1	6		3	8		7	4	
Permitted Phases			2			6			8			4
Actuated Green, G (s)	4.6	24.6	56.3	12.1	32.1	32.1	31.7	59.0	59.0	4.8	32.1	32.1
Effective Green, g (s)	4.6	24.6	56.3	12.1	32.1	32.1	31.7	59.0	59.0	4.8	32.1	32.1
Actuated g/C Ratio	0.04	0.21	0.47	0.10	0.27	0.27	0.26	0.49	0.49	0.04	0.27	0.27
Clearance Time (s)	5.3	5.3	5.3	4.0	4.0	4.0	5.3	4.9	4.9	5.3	4.9	4.9
Vehicle Extension (s)	2.0	4.0	2.0	2.0	2.0	2.0	2.0	4.0	4.0	2.0	4.0	4.0
Lane Grp Cap (vph)	118	938	1176	452	1224	381	816	2250	1233	123	1224	381
v/s Ratio Prot	c0.02	0.01	0.01	0.05	c0.17		c0.24	0.07		0.02	c0.17	
v/s Ratio Perm			0.01			0.06			0.01			0.11
v/c Ratio	0.42	0.06	0.05	0.55	0.63	0.22	0.91	0.14	0.01	0.50	0.64	0.41
Uniform Delay, d1	56.4	38.4	17.3	51.3	38.7	34.2	42.8	16.6	15.6	56.4	38.9	36.1
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.9	0.1	0.0	0.7	2.4	1.3	14.4	0.0	0.0	1.2	1.3	1.0
Delay (s)	57.3	38.5	17.3	52.1	41.1	35.5	57.2	16.7	15.6	57.6	40.2	37.1
Level of Service	E	D	B	D	D	D	E	B	B	E	D	D
Approach Delay (s)		33.6			41.8			44.3			40.3	
Approach LOS		C			D			D			D	

Intersection Summary

HCM 2000 Control Delay	41.7	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.71		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	19.5
Intersection Capacity Utilization	71.7%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 20: El Charro Rd/Fallon Rd & I-580 WB Ramps

BART to Livermore Extension Project
 2025 BART + INP + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↖	↖	↖↖		↖	↖		↗↗	↗
Traffic Volume (vph)	0	0	0	183	0	610	0	553	478	0	532	399
Future Volume (vph)	0	0	0	183	0	610	0	553	478	0	532	399
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0	4.0	4.0		4.0	4.0		4.0	4.0
Lane Util. Factor				0.95	0.95	0.88		0.95	0.95		0.95	1.00
Frt				1.00	1.00	0.85		0.99	0.85		1.00	0.85
Flt Protected				0.95	0.95	1.00		1.00	1.00		1.00	1.00
Satd. Flow (prot)				1681	1681	2787		1748	1504		3539	1583
Flt Permitted				0.95	0.95	1.00		1.00	1.00		1.00	1.00
Satd. Flow (perm)				1681	1681	2787		1748	1504		3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	199	0	663	0	601	520	0	578	434
RTOR Reduction (vph)	0	0	0	0	0	371	0	5	177	0	0	164
Lane Group Flow (vph)	0	0	0	101	98	292	0	648	291	0	578	270
Turn Type				Perm	NA	Perm		NA	Perm		NA	Perm
Protected Phases					8			2			6	
Permitted Phases				8		8			2			6
Actuated Green, G (s)				11.4	11.4	11.4		31.1	31.1		31.1	31.1
Effective Green, g (s)				10.9	10.9	10.9		31.1	31.1		31.1	31.1
Actuated g/C Ratio				0.22	0.22	0.22		0.62	0.62		0.62	0.62
Clearance Time (s)				3.5	3.5	3.5		4.0	4.0		4.0	4.0
Vehicle Extension (s)				2.0	2.0	2.0		2.0	2.0		2.0	2.0
Lane Grp Cap (vph)				366	366	607		1087	935		2201	984
v/s Ratio Prot								c0.37			0.16	
v/s Ratio Perm				0.06	0.06	c0.10			0.19			0.17
v/c Ratio				0.28	0.27	0.48		0.60	0.31		0.26	0.27
Uniform Delay, d1				16.3	16.2	17.1		5.7	4.4		4.3	4.3
Progression Factor				1.00	1.00	1.00		0.68	0.24		1.00	1.00
Incremental Delay, d2				0.1	0.1	0.2		2.3	0.8		0.3	0.7
Delay (s)				16.4	16.4	17.3		6.2	1.9		4.6	5.0
Level of Service				B	B	B		A	A		A	A
Approach Delay (s)		0.0			17.1			4.4			4.7	
Approach LOS		A			B			A			A	

Intersection Summary

HCM 2000 Control Delay	8.2	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.57		
Actuated Cycle Length (s)	50.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	66.8%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
21: El Charro Rd & I-580 EB Ramps

BART to Livermore Extension Project
2025 BART + INP + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔		↔					↕	↗		↕	↗
Traffic Volume (vph)	245	0	408	0	0	0	0	763	146	0	387	0
Future Volume (vph)	245	0	408	0	0	0	0	763	146	0	387	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0					4.0	4.0		4.0	
Lane Util. Factor	0.97		0.88					0.91	0.91		0.91	
Frt	1.00		0.85					1.00	0.85		1.00	
Flt Protected	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (prot)	3433		2787					3379	1441		3390	
Flt Permitted	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (perm)	3433		2787					3379	1441		3390	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	266	0	443	0	0	0	0	829	159	0	421	0
RTOR Reduction (vph)	0	0	370	0	0	0	0	2	45	0	0	0
Lane Group Flow (vph)	266	0	73	0	0	0	0	846	95	0	421	0
Turn Type	Prot		Perm					NA	Perm		NA	Perm
Protected Phases	4							2			6	
Permitted Phases			4						2			6
Actuated Green, G (s)	8.2		8.2					33.8	33.8		33.8	
Effective Green, g (s)	8.2		8.2					33.8	33.8		33.8	
Actuated g/C Ratio	0.16		0.16					0.68	0.68		0.68	
Clearance Time (s)	4.0		4.0					4.0	4.0		4.0	
Vehicle Extension (s)	2.0		2.0					3.0	3.0		3.0	
Lane Grp Cap (vph)	563		457					2284	974		2291	
v/s Ratio Prot	c0.08							c0.25			0.12	
v/s Ratio Perm			0.03						0.07			
v/c Ratio	0.47		0.16					0.37	0.10		0.18	
Uniform Delay, d1	18.9		17.9					3.5	2.8		3.0	
Progression Factor	1.00		1.00					1.00	1.00		1.05	
Incremental Delay, d2	0.2		0.1					0.5	0.2		0.2	
Delay (s)	19.2		18.0					4.0	3.0		3.3	
Level of Service	B		B					A	A		A	
Approach Delay (s)		18.4			0.0			3.8			3.3	
Approach LOS		B			A			A			A	

Intersection Summary

HCM 2000 Control Delay	8.6	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.39		
Actuated Cycle Length (s)	50.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	36.3%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 22: El Charro Rd & Stoneridge Dr/Jack London Blvd

BART to Livermore Extension Project
 2025 BART + INP + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔↔↔	↑↑	↔	↔	↑↑	↔↔	↔	↑↑		↔↔↔	↑	↔↔
Traffic Volume (vph)	145	103	8	16	594	634	7	97	3	218	90	172
Future Volume (vph)	145	103	8	16	594	634	7	97	3	218	90	172
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	0.94	0.95	1.00	1.00	0.95	0.88	1.00	0.95		0.94	1.00	0.88
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	4491	3185	1425	1593	3185	2508	1593	3172		4491	1676	2508
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	4491	3185	1425	1593	3185	2508	1593	3172		4491	1676	2508
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	158	112	9	17	646	689	8	105	3	237	98	187
RTOR Reduction (vph)	0	0	6	0	0	345	0	3	0	0	0	126
Lane Group Flow (vph)	158	112	3	17	646	345	8	105	0	237	98	61
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Prot	NA		Prot	NA	Perm
Protected Phases	7	4		3	8	1	5	2		1	6	
Permitted Phases			4			8						6
Actuated Green, G (s)	5.3	21.2	21.2	0.7	16.6	28.6	0.7	7.3		12.0	18.6	18.6
Effective Green, g (s)	5.3	21.2	21.2	0.7	16.6	28.6	0.7	7.3		12.0	18.6	18.6
Actuated g/C Ratio	0.09	0.37	0.37	0.01	0.29	0.50	0.01	0.13		0.21	0.33	0.33
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	416	1180	528	19	924	1429	19	404		942	544	815
v/s Ratio Prot	c0.04	0.04		0.01	c0.20	c0.05	0.01	c0.03		0.05	0.06	
v/s Ratio Perm			0.00			0.09						0.02
v/c Ratio	0.38	0.09	0.01	0.89	0.70	0.24	0.42	0.26		0.25	0.18	0.07
Uniform Delay, d1	24.4	11.7	11.4	28.2	18.1	8.1	28.0	22.5		18.9	13.8	13.3
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	0.6	0.0	0.0	155.2	2.3	0.1	14.4	0.3		0.1	0.2	0.0
Delay (s)	25.0	11.8	11.4	183.4	20.4	8.2	42.4	22.9		19.0	14.0	13.4
Level of Service	C	B	B	F	C	A	D	C		B	B	B
Approach Delay (s)		19.2			16.2			24.2			16.0	
Approach LOS		B			B			C			B	

Intersection Summary		
HCM 2000 Control Delay	17.0	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.46	B
Actuated Cycle Length (s)	57.2	Sum of lost time (s)
Intersection Capacity Utilization	42.9%	16.0
Analysis Period (min)	15	ICU Level of Service
		A

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 24: Airway Blvd/Driveway & N Canyons Pkwy

BART to Livermore Extension Project
 2025 BART + INP + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑	↑	↑↑	↑	↑		↑	↑↑		↑	
Traffic Volume (vph)	0	64	77	695	384	0	746	0	883	0	0	0
Future Volume (vph)	0	64	77	695	384	0	746	0	883	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0	4.0	4.0			4.4	4.0			
Lane Util. Factor		0.95	1.00	0.97	1.00			1.00	0.88			
Frt		1.00	0.85	1.00	1.00			1.00	0.85			
Flt Protected		1.00	1.00	0.95	1.00			0.95	1.00			
Satd. Flow (prot)		3539	1583	3433	1863			1770	2787			
Flt Permitted		1.00	1.00	0.95	1.00			0.95	1.00			
Satd. Flow (perm)		3539	1583	3433	1863			1770	2787			
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	70	84	755	417	0	811	0	960	0	0	0
RTOR Reduction (vph)	0	0	74	0	0	0	0	0	112	0	0	0
Lane Group Flow (vph)	0	70	10	755	417	0	0	811	848	0	0	0
Turn Type		NA	Perm	Prot	NA	Perm	Split	NA	pm+ov			
Protected Phases		2		1	6		8	8	1	4	4	
Permitted Phases			2			6			8			
Actuated Green, G (s)		15.2	15.2	24.1	45.3			84.5	108.6			
Effective Green, g (s)		17.2	17.2	26.1	47.3			84.3	112.6			
Actuated g/C Ratio		0.12	0.12	0.19	0.34			0.60	0.80			
Clearance Time (s)		6.0	6.0	6.0	6.0			4.2	6.0			
Vehicle Extension (s)		3.0	3.0	3.0	3.0			3.0	3.0			
Lane Grp Cap (vph)		434	194	640	629			1065	2241			
v/s Ratio Prot		0.02		c0.22	c0.22			c0.46	0.07			
v/s Ratio Perm			0.01						0.23			
v/c Ratio		0.16	0.05	1.18	0.66			0.76	0.38			
Uniform Delay, d1		54.9	54.2	57.0	39.5			20.5	3.9			
Progression Factor		1.00	1.00	1.00	1.00			1.05	1.14			
Incremental Delay, d2		0.8	0.5	96.4	5.4			2.8	0.1			
Delay (s)		55.7	54.7	153.3	45.0			24.3	4.5			
Level of Service		E	D	F	D			C	A			
Approach Delay (s)		55.2			114.8			13.6			0.0	
Approach LOS		E			F			B			A	

Intersection Summary			
HCM 2000 Control Delay	53.9	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.87		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	16.4
Intersection Capacity Utilization	74.8%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
25: Airway Blvd & I-580 WB Ramps

BART to Livermore Extension Project
2025 BART + INP + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↙	↖	↗		↑↑	↗		↑↑↑	
Traffic Volume (vph)	0	0	0	73	45	543	0	1188	343	0	306	551
Future Volume (vph)	0	0	0	73	45	543	0	1188	343	0	306	551
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0	4.0	4.0		4.0	4.0		4.0	
Lane Util. Factor				0.95	0.95	0.88		0.95	1.00		0.91	
Frt				1.00	1.00	0.85		1.00	0.85		0.90	
Flt Protected				0.95	0.98	1.00		1.00	1.00		1.00	
Satd. Flow (prot)				1681	1732	2787		3539	1583		4595	
Flt Permitted				0.95	0.98	1.00		1.00	1.00		1.00	
Satd. Flow (perm)				1681	1732	2787		3539	1583		4595	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	79	49	590	0	1291	373	0	333	599
RTOR Reduction (vph)	0	0	0	0	0	88	0	0	102	0	163	0
Lane Group Flow (vph)	0	0	0	42	86	502	0	1291	271	0	769	0
Turn Type				Split	NA	Perm		NA	Perm		NA	
Protected Phases				8	8			2			6	
Permitted Phases						8			2			
Actuated Green, G (s)				30.4	30.4	30.4		100.3	100.3		100.3	
Effective Green, g (s)				30.4	30.4	30.4		101.6	101.6		101.6	
Actuated g/C Ratio				0.22	0.22	0.22		0.73	0.73		0.73	
Clearance Time (s)				4.0	4.0	4.0		5.3	5.3		5.3	
Vehicle Extension (s)				2.0	2.0	2.0		4.0	4.0		4.0	
Lane Grp Cap (vph)				365	376	605		2568	1148		3334	
v/s Ratio Prot				0.02	0.05			c0.36			0.17	
v/s Ratio Perm						c0.18			0.17			
v/c Ratio				0.12	0.23	0.83		0.50	0.24		0.23	
Uniform Delay, d1				44.0	45.1	52.3		8.3	6.4		6.3	
Progression Factor				1.00	1.00	1.00		0.46	0.12		2.17	
Incremental Delay, d2				0.1	0.1	9.0		0.6	0.4		0.0	
Delay (s)				44.1	45.3	61.4		4.5	1.2		13.8	
Level of Service				D	D	E		A	A		B	
Approach Delay (s)		0.0			58.4			3.7			13.8	
Approach LOS		A			E			A			B	

Intersection Summary			
HCM 2000 Control Delay	18.4	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.58		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	58.5%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 26: Airway Blvd & I-580 EB Ramps/Kitty Hawk Rd

BART to Livermore Extension Project
 2025 BART + INP + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔↔	↑	↔	↔	↑	↔	↔	↕↕		↔	↕↕	
Traffic Volume (vph)	660	201	301	34	36	87	31	504	161	69	173	151
Future Volume (vph)	660	201	301	34	36	87	31	504	161	69	173	151
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.4	4.4	4.4	4.0	4.0		4.0	4.0	
Lane Util. Factor	0.97	1.00	1.00	1.00	1.00	1.00	1.00	0.95		1.00	0.95	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.96		1.00	0.93	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	3433	1863	1583	1770	1863	1583	1770	3411		1770	3292	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	3433	1863	1583	1770	1863	1583	1770	3411		1770	3292	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	717	218	327	37	39	95	34	548	175	75	188	164
RTOR Reduction (vph)	0	0	243	0	0	80	0	18	0	0	95	0
Lane Group Flow (vph)	717	218	84	37	39	15	34	705	0	75	257	0
Turn Type	Split	NA	Perm	Split	NA	pm+ov	Prot	NA		Prot	NA	
Protected Phases	7	7		8	8	1	5	2		1	6	
Permitted Phases			7			8						
Actuated Green, G (s)	36.1	36.1	36.1	11.2	11.2	22.8	18.0	63.8		11.6	57.9	
Effective Green, g (s)	36.1	36.1	36.1	10.8	10.8	22.0	17.5	65.1		11.6	59.2	
Actuated g/C Ratio	0.26	0.26	0.26	0.08	0.08	0.16	0.12	0.46		0.08	0.42	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	3.5	5.3		4.0	5.3	
Vehicle Extension (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	3.5		2.0	4.0	
Lane Grp Cap (vph)	885	480	408	136	143	298	221	1586		146	1392	
v/s Ratio Prot	c0.21	0.12		0.02	c0.02	0.00	0.02	c0.21		c0.04	0.08	
v/s Ratio Perm			0.05			0.01						
v/c Ratio	0.81	0.45	0.21	0.27	0.27	0.05	0.15	0.44		0.51	0.18	
Uniform Delay, d1	48.7	43.7	40.7	60.9	60.9	50.1	54.6	25.3		61.5	25.3	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.23	0.91	
Incremental Delay, d2	5.4	0.2	0.1	0.4	0.4	0.0	0.1	0.9		1.3	0.3	
Delay (s)	54.1	43.9	40.8	61.3	61.3	50.1	54.8	26.2		77.2	23.2	
Level of Service	D	D	D	E	E	D	D	C		E	C	
Approach Delay (s)		48.9			55.1			27.4			32.7	
Approach LOS		D			E			C			C	

Intersection Summary

HCM 2000 Control Delay	40.5	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.54		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	16.8
Intersection Capacity Utilization	61.5%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 27: Collier Canyon Rd & N Canyons Pkwy/Portola Ave

BART to Livermore Extension Project
 2025 BART + INP + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	201	237	81	170	832	60	12	1	29	99	16	192
Future Volume (vph)	201	237	81	170	832	60	12	1	29	99	16	192
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	5.2	5.2
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.85		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	1770	1592		1770	1863	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	1770	1592		1770	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	218	258	88	185	904	65	13	1	32	108	17	209
RTOR Reduction (vph)	0	0	61	0	0	40	0	28	0	0	0	156
Lane Group Flow (vph)	218	258	27	185	904	25	13	5	0	108	17	53
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA		Prot	NA	Perm
Protected Phases	1	6		5	2		3	8		7	NA	4
Permitted Phases			6			2						4
Actuated Green, G (s)	4.2	17.3	17.3	9.5	22.6	22.6	0.6	5.8		10.6	16.2	16.2
Effective Green, g (s)	4.2	18.6	18.6	9.5	23.9	23.9	0.6	6.8		10.6	15.6	15.6
Actuated g/C Ratio	0.07	0.30	0.30	0.15	0.39	0.39	0.01	0.11		0.17	0.25	0.25
Clearance Time (s)	4.0	5.3	5.3	4.0	5.3	5.3	4.0	5.0		4.0	4.6	4.6
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	234	1070	478	273	1375	615	17	176		305	472	401
v/s Ratio Prot	c0.06	0.07		c0.10	c0.26		0.01	0.00		c0.06	0.01	
v/s Ratio Perm			0.02			0.02						c0.03
v/c Ratio	0.93	0.24	0.06	0.68	0.66	0.04	0.76	0.03		0.35	0.04	0.13
Uniform Delay, d1	28.5	16.1	15.2	24.6	15.4	11.7	30.4	24.4		22.4	17.3	17.7
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	40.3	0.1	0.0	6.5	1.1	0.0	106.9	0.1		0.7	0.0	0.2
Delay (s)	68.8	16.3	15.3	31.1	16.6	11.7	137.2	24.5		23.1	17.3	17.9
Level of Service	E	B	B	C	B	B	F	C		C	B	B
Approach Delay (s)		36.4			18.6			56.3			19.5	
Approach LOS		D			B			E			B	

Intersection Summary

HCM 2000 Control Delay	24.4	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.57		
Actuated Cycle Length (s)	61.5	Sum of lost time (s)	17.2
Intersection Capacity Utilization	51.9%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
28: Isabel Ave/Campus Hill Dr & Portola Ave

BART to Livermore Extension Project
2025 BART + INP + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	1	188	251	601	594	145	480	296	80	62	221	2
Future Volume (vph)	1	188	251	601	594	145	480	296	80	62	221	2
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	5.8	5.8
Lane Util. Factor	1.00	0.95	0.88	0.94	0.95		0.97	0.95	1.00	1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	0.97		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3539	2787	4990	3435		3433	3539	1583	1770	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	3539	2787	4990	3435		3433	3539	1583	1770	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	1	204	273	653	646	158	522	322	87	67	240	2
RTOR Reduction (vph)	0	0	212	0	14	0	0	0	60	0	0	2
Lane Group Flow (vph)	1	204	61	653	790	0	522	322	27	67	240	0
Turn Type	Prot	NA	Perm	Prot	NA		Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4						2			6
Actuated Green, G (s)	1.5	18.3	18.3	17.1	33.9		20.2	25.8	25.8	7.5	13.5	13.5
Effective Green, g (s)	1.5	19.6	19.6	17.1	35.2		20.2	27.1	27.1	7.5	12.6	12.6
Actuated g/C Ratio	0.02	0.22	0.22	0.20	0.40		0.23	0.31	0.31	0.09	0.14	0.14
Clearance Time (s)	4.0	5.3	5.3	4.0	5.3		4.0	5.3	5.3	4.0	4.9	4.9
Vehicle Extension (s)	2.0	3.0	3.0	2.0	3.0		2.0	3.0	3.0	2.0	3.0	3.0
Lane Grp Cap (vph)	30	794	625	977	1385		794	1098	491	152	510	228
v/s Ratio Prot	0.00	0.06		c0.13	c0.23		c0.15	0.09		0.04	c0.07	
v/s Ratio Perm			0.02						0.02			0.00
v/c Ratio	0.03	0.26	0.10	0.67	0.57		0.66	0.29	0.06	0.44	0.47	0.00
Uniform Delay, d1	42.2	27.9	26.8	32.5	20.2		30.4	22.8	21.1	37.9	34.3	32.0
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.2	0.2	0.1	1.4	0.6		1.5	0.1	0.0	0.7	0.7	0.0
Delay (s)	42.4	28.0	26.9	33.8	20.8		31.9	23.0	21.2	38.7	35.0	32.0
Level of Service	D	C	C	C	C		C	C	C	D	C	C
Approach Delay (s)		27.4			26.6			27.8			35.8	
Approach LOS		C			C			C			D	

Intersection Summary		
HCM 2000 Control Delay	28.0	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.62	C
Actuated Cycle Length (s)	87.3	Sum of lost time (s)
Intersection Capacity Utilization	67.1%	17.8
Analysis Period (min)	15	ICU Level of Service
		C

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
29: Isabel Ave & I-580 WB Ramps

BART to Livermore Extension Project
2025 BART + INP + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↔↔		↗		↕↕	↗↗		↕↕	↗
Traffic Volume (vph)	0	0	0	1278	0	405	0	493	0	0	505	579
Future Volume (vph)	0	0	0	1278	0	405	0	493	0	0	505	579
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0		4.0		5.6			5.6	5.6
Lane Util. Factor				0.97		1.00		0.95			0.95	1.00
Frt				1.00		0.85		1.00			1.00	0.85
Flt Protected				0.95		1.00		1.00			1.00	1.00
Satd. Flow (prot)				3433		1583		3539			3539	1583
Flt Permitted				0.95		1.00		1.00			1.00	1.00
Satd. Flow (perm)				3433		1583		3539			3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	1389	0	440	0	536	0	0	549	629
RTOR Reduction (vph)	0	0	0	0	0	76	0	0	0	0	0	382
Lane Group Flow (vph)	0	0	0	1389	0	364	0	536	0	0	549	247
Turn Type				Prot		Prot		NA	Free		NA	Prot
Protected Phases				8		8		2			6	6
Permitted Phases									Free			
Actuated Green, G (s)				32.9		32.9		28.3			28.3	28.3
Effective Green, g (s)				32.9		32.9		27.5			27.5	27.5
Actuated g/C Ratio				0.47		0.47		0.39			0.39	0.39
Clearance Time (s)				4.0		4.0		4.8			4.8	4.8
Vehicle Extension (s)				2.0		2.0		4.0			4.0	4.0
Lane Grp Cap (vph)				1613		744		1390			1390	621
v/s Ratio Prot				c0.40		0.23		0.15			0.16	c0.16
v/s Ratio Perm												
v/c Ratio				0.86		0.49		0.39			0.39	0.40
Uniform Delay, d1				16.5		12.8		15.2			15.3	15.3
Progression Factor				1.00		1.00		0.78			1.00	1.00
Incremental Delay, d2				4.8		0.2		0.8			0.3	0.6
Delay (s)				21.3		12.9		12.6			15.5	15.9
Level of Service				C		B		B			B	B
Approach Delay (s)		0.0			19.3			12.6			15.7	
Approach LOS		A			B			B			B	























Intersection Summary

HCM 2000 Control Delay	17.1	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.65		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	9.6
Intersection Capacity Utilization	58.4%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
30: Isabel Ave & I-580 EB Ramps

BART to Livermore Extension Project
2025 BART + INP + Garage AM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 		 					 			 	
Traffic Volume (vph)	196	0	388	0	0	0	0	730	639	0	1609	268
Future Volume (vph)	196	0	388	0	0	0	0	730	639	0	1609	268
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0					4.0	4.0		4.0	4.0
Lane Util. Factor	0.97		0.88					0.95	1.00		0.95	1.00
Frt	1.00		0.85					1.00	0.85		1.00	0.85
Flt Protected	0.95		1.00					1.00	1.00		1.00	1.00
Satd. Flow (prot)	3433		2787					3539	1583		3539	1583
Flt Permitted	0.95		1.00					1.00	1.00		1.00	1.00
Satd. Flow (perm)	3433		2787					3539	1583		3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	213	0	422	0	0	0	0	793	695	0	1749	291
RTOR Reduction (vph)	0	0	47	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	213	0	375	0	0	0	0	793	695	0	1749	291
Turn Type	Prot		Perm					NA	Free		NA	Free
Protected Phases	4							2			6	
Permitted Phases			4						Free			Free
Actuated Green, G (s)	12.8		12.8					48.2	70.0		48.2	70.0
Effective Green, g (s)	12.8		12.8					49.2	70.0		49.2	70.0
Actuated g/C Ratio	0.18		0.18					0.70	1.00		0.70	1.00
Clearance Time (s)	4.0		4.0					5.0			5.0	
Vehicle Extension (s)	2.0		2.0					4.0			4.0	
Lane Grp Cap (vph)	627		509					2487	1583		2487	1583
v/s Ratio Prot	0.06							0.22			c0.49	
v/s Ratio Perm			c0.13						0.44			0.18
v/c Ratio	0.34		0.74					0.32	0.44		0.70	0.18
Uniform Delay, d1	24.9		27.0					4.0	0.0		6.1	0.0
Progression Factor	1.00		1.00					1.00	1.00		0.69	1.00
Incremental Delay, d2	0.1		4.8					0.1	0.9		1.3	0.2
Delay (s)	25.0		31.8					4.1	0.9		5.5	0.2
Level of Service	C		C					A	A		A	A
Approach Delay (s)		29.5			0.0			2.6			4.8	
Approach LOS		C			A			A			A	
Intersection Summary												
HCM 2000 Control Delay			7.8									A
HCM 2000 Volume to Capacity ratio			0.71									
Actuated Cycle Length (s)			70.0								8.0	
Intersection Capacity Utilization			64.7%									C
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis
 31: Isabel Ave & Airway Blvd

BART to Livermore Extension Project
 2025 BART + INP + Garage AM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	120	328	180	230	220	318	1162	257	1001	1142	15
Future Volume (vph)	0	120	328	180	230	220	318	1162	257	1001	1142	15
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.2	5.6	5.2	5.2	5.6	4.0	4.0	4.0	4.0	4.0	5.0
Lane Util. Factor		1.00	1.00	1.00	1.00	1.00	1.00	0.91	1.00	0.97	0.91	1.00
Frt		1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1863	1583	1770	1863	1583	1770	5085	1583	3433	5085	1583
Flt Permitted		1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)		1863	1583	1770	1863	1583	1770	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	130	357	196	250	239	346	1263	279	1088	1241	16
RTOR Reduction (vph)	0	0	105	0	0	101	0	0	206	0	0	10
Lane Group Flow (vph)	0	130	252	196	250	138	346	1263	73	1088	1241	6
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4	5	3	8	1	5	2		1	6	
Permitted Phases			4			8			2			6
Actuated Green, G (s)		11.4	26.4	11.4	27.4	51.4	15.0	22.0	22.0	24.0	31.0	31.0
Effective Green, g (s)		10.8	25.2	10.8	26.8	50.2	16.0	23.0	23.0	25.0	32.0	31.0
Actuated g/C Ratio		0.12	0.29	0.12	0.30	0.57	0.18	0.26	0.26	0.28	0.36	0.35
Clearance Time (s)		4.6	5.0	4.6	4.6	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Extension (s)		3.0	3.0	3.0	3.0	3.0	3.0	5.0	5.0	3.0	5.0	5.0
Lane Grp Cap (vph)		228	453	217	567	903	321	1329	413	975	1849	557
v/s Ratio Prot		c0.07	0.09	c0.11	0.13	0.04	0.20	c0.25		c0.32	0.24	
v/s Ratio Perm			0.07			0.05			0.05			0.00
v/c Ratio		0.57	0.56	0.90	0.44	0.15	1.08	0.95	0.18	1.12	0.67	0.01
Uniform Delay, d1		36.4	26.7	38.1	24.6	8.9	36.0	31.9	25.2	31.5	23.6	18.5
Progression Factor		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2		3.4	1.5	35.7	0.5	0.1	72.5	14.8	0.4	66.2	1.3	0.0
Delay (s)		39.8	28.1	73.8	25.1	9.0	108.5	46.7	25.6	97.7	24.8	18.5
Level of Service		D	C	E	C	A	F	D	C	F	C	B
Approach Delay (s)		31.3			33.4			54.9			58.6	
Approach LOS		C			C			D			E	

Intersection Summary			
HCM 2000 Control Delay	51.7	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.97		
Actuated Cycle Length (s)	88.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	78.6%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 32: Isabel Ave & Jack London Blvd

BART to Livermore Extension Project
 2025 BART + INP + Garage AM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	28	51	55	219	736	322	352	929	98	160	1254	286
Future Volume (vph)	28	51	55	219	736	322	352	929	98	160	1254	286
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.97	0.91	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	3433	5085	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	3433	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	30	55	60	238	800	350	383	1010	107	174	1363	311
RTOR Reduction (vph)	0	0	51	0	0	64	0	0	67	0	0	115
Lane Group Flow (vph)	30	55	9	238	800	286	383	1010	40	174	1363	196
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8	1	5	2		1	NA	6
Permitted Phases			4			8			2			6
Actuated Green, G (s)	3.8	15.3	15.3	18.0	29.5	39.8	14.4	38.0	38.0	10.3	33.9	33.9
Effective Green, g (s)	3.8	15.3	15.3	18.0	29.5	39.8	14.4	38.0	38.0	10.3	33.9	33.9
Actuated g/C Ratio	0.04	0.15	0.15	0.18	0.29	0.39	0.14	0.37	0.37	0.10	0.33	0.33
Clearance Time (s)	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	126	526	235	309	1015	694	480	1879	585	343	1676	522
v/s Ratio Prot	0.01	0.02		c0.13	c0.23	0.04	c0.11	c0.20		0.05	c0.27	
v/s Ratio Perm			0.01			0.14			0.02			0.12
v/c Ratio	0.24	0.10	0.04	0.77	0.79	0.41	0.80	0.54	0.07	0.51	0.81	0.37
Uniform Delay, d1	48.1	37.8	37.5	40.4	33.8	23.0	42.8	25.5	20.9	43.8	31.6	26.3
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.0	0.1	0.1	11.2	4.1	0.4	9.0	0.3	0.0	1.2	3.1	0.5
Delay (s)	49.1	37.9	37.5	51.7	37.9	23.4	51.8	25.8	21.0	45.0	34.7	26.8
Level of Service	D	D	D	D	D	C	D	C	C	D	C	C
Approach Delay (s)		40.1			36.6			32.1			34.3	
Approach LOS		D			D			C			C	

Intersection Summary

HCM 2000 Control Delay	34.5	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.82		
Actuated Cycle Length (s)	102.8	Sum of lost time (s)	21.2
Intersection Capacity Utilization	67.9%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
33: Isabel Ave Connector & Stanley Blvd



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑	↑	↑↓	↑↑	↑↓	↑↓
Traffic Volume (vph)	338	162	319	1948	386	210
Future Volume (vph)	338	162	319	1948	386	210
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	3.8	4.0	4.0	4.0	2.5
Lane Util. Factor	0.95	1.00	0.97	0.95	0.97	0.88
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	3539	1583	3433	3539	3433	2787
Flt Permitted	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (perm)	3539	1583	3433	3539	3433	2787
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	367	176	347	2117	420	228
RTOR Reduction (vph)	0	17	0	0	0	145
Lane Group Flow (vph)	367	159	347	2117	420	83
Turn Type	NA	pm+ov	Prot	NA	Prot	pm+ov
Protected Phases	2	8	1	6	8	1
Permitted Phases		2				8
Actuated Green, G (s)	38.0	51.9	11.9	53.9	13.9	25.8
Effective Green, g (s)	39.7	55.3	11.9	55.6	15.4	28.8
Actuated g/C Ratio	0.50	0.70	0.15	0.70	0.19	0.36
Clearance Time (s)	5.7	5.5	4.0	5.7	5.5	4.0
Vehicle Extension (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Grp Cap (vph)	1778	1108	517	2490	669	1016
v/s Ratio Prot	0.10	0.03	0.10	c0.60	c0.12	0.01
v/s Ratio Perm		0.07				0.02
v/c Ratio	0.21	0.14	0.67	0.85	0.63	0.08
Uniform Delay, d1	10.9	4.0	31.7	8.6	29.2	16.4
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.0	0.0	2.7	2.9	1.3	0.0
Delay (s)	10.9	4.0	34.4	11.5	30.5	16.5
Level of Service	B	A	C	B	C	B
Approach Delay (s)	8.7			14.7	25.6	
Approach LOS	A			B	C	

Intersection Summary

HCM 2000 Control Delay	15.7	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.85		
Actuated Cycle Length (s)	79.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	71.5%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 34: Murrieta Blvd/Driveway & Portola Ave

BART to Livermore Extension Project
 2025 BART + INP + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗		↖	↗		↖	↗	↗		↗	
Traffic Volume (vph)	0	542	98	269	1671	1	190	6	146	1	3	0
Future Volume (vph)	0	542	98	269	1671	1	190	6	146	1	3	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.8		4.0	5.8		5.2	5.2	5.2		4.0	
Lane Util. Factor		0.95		1.00	0.95		0.95	0.95	1.00		1.00	
Frt		0.98		1.00	1.00		1.00	1.00	0.85		1.00	
Flt Protected		1.00		0.95	1.00		0.95	0.96	1.00		0.99	
Satd. Flow (prot)		3458		1770	3539		1681	1691	1583		1840	
Flt Permitted		1.00		0.95	1.00		0.95	0.96	1.00		0.99	
Satd. Flow (perm)		3458		1770	3539		1681	1691	1583		1840	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	589	107	292	1816	1	207	7	159	1	3	0
RTOR Reduction (vph)	0	16	0	0	0	0	0	0	139	0	0	0
Lane Group Flow (vph)	0	680	0	292	1817	0	108	106	20	0	4	0
Turn Type	Prot	NA		Prot	NA		Split	NA	Perm		Split	NA
Protected Phases	5	2		1	6		8	8			4	4
Permitted Phases									8			
Actuated Green, G (s)		25.7		10.1	39.8		8.3	8.3	8.3		0.7	
Effective Green, g (s)		24.8		10.1	38.9		7.7	7.7	7.7		0.7	
Actuated g/C Ratio		0.40		0.16	0.62		0.12	0.12	0.12		0.01	
Clearance Time (s)		4.9		4.0	4.9		4.6	4.6	4.6		4.0	
Vehicle Extension (s)		2.0		2.0	2.0		2.0	2.0	2.0		2.0	
Lane Grp Cap (vph)		1376		286	2209		207	209	195		20	
v/s Ratio Prot		0.20		c0.17	c0.51		c0.06	0.06			c0.00	
v/s Ratio Perm									0.01			
v/c Ratio		0.49		1.02	0.82		0.52	0.51	0.10		0.20	
Uniform Delay, d1		14.1		26.1	9.0		25.6	25.5	24.2		30.5	
Progression Factor		1.00		1.00	1.00		1.00	1.00	1.00		1.00	
Incremental Delay, d2		0.1		58.7	2.5		1.1	0.7	0.1		1.8	
Delay (s)		14.2		84.8	11.5		26.7	26.2	24.3		32.3	
Level of Service		B		F	B		C	C	C		C	
Approach Delay (s)		14.2			21.7			25.5			32.3	
Approach LOS		B			C			C			C	

Intersection Summary		
HCM 2000 Control Delay	20.5	HCM 2000 Level of Service C
HCM 2000 Volume to Capacity ratio	0.85	
Actuated Cycle Length (s)	62.3	Sum of lost time (s) 19.0
Intersection Capacity Utilization	74.1%	ICU Level of Service D
Analysis Period (min)	15	

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 35: Murrieta Blvd & Jack London Blvd



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	77	263	624	205	247	166
Future Volume (vph)	77	263	624	205	247	166
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00	1.00	0.95	0.91	
Frt	1.00	0.85	1.00	1.00	0.94	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1770	1583	1770	3539	4779	
Flt Permitted	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	1770	1583	1770	3539	4779	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	84	286	678	223	268	180
RTOR Reduction (vph)	0	244	0	0	150	0
Lane Group Flow (vph)	84	42	678	223	298	0
Turn Type	Prot	Perm	Prot	NA	NA	
Protected Phases	4		5	2	6	
Permitted Phases		4				
Actuated Green, G (s)	8.5	8.5	27.4	40.9	9.5	
Effective Green, g (s)	8.5	8.5	27.4	40.9	9.5	
Actuated g/C Ratio	0.15	0.15	0.48	0.71	0.17	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	262	234	844	2521	790	
v/s Ratio Prot	c0.05		c0.38	0.06	c0.06	
v/s Ratio Perm		0.03				
v/c Ratio	0.32	0.18	0.80	0.09	0.38	
Uniform Delay, d1	21.9	21.4	12.7	2.5	21.3	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.7	0.4	5.6	0.0	0.3	
Delay (s)	22.6	21.8	18.3	2.5	21.6	
Level of Service	C	C	B	A	C	
Approach Delay (s)	22.0			14.4	21.6	
Approach LOS	C			B	C	

Intersection Summary

HCM 2000 Control Delay	17.9	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.62		
Actuated Cycle Length (s)	57.4	Sum of lost time (s)	12.0
Intersection Capacity Utilization	57.3%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 36: Murrieta Blvd & Stanley Blvd

BART to Livermore Extension Project
 2025 BART + INP + Garage AM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	213	438	224	17	821	113	432	334	8	154	224	451
Future Volume (vph)	213	438	224	17	821	113	432	334	8	154	224	451
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.9	4.9	4.0	4.9	4.9	4.9	4.9		4.9	4.9	4.0
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.97	0.95		1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	3433	3526		1770	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	3433	3526		1770	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	232	476	243	18	892	123	470	363	9	167	243	490
RTOR Reduction (vph)	0	0	159	0	0	70	0	2	0	0	0	90
Lane Group Flow (vph)	232	476	84	18	892	53	470	370	0	167	243	400
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Prot	NA		Prot	NA	Perm
Protected Phases	7	4		3	8	1	5	2		1		6
Permitted Phases			4			8						6
Actuated Green, G (s)	6.0	28.9	28.9	1.6	24.5	36.6	12.9	22.6		12.1	21.8	21.8
Effective Green, g (s)	6.0	28.0	28.0	1.6	23.6	34.8	12.0	21.7		11.2	20.9	21.8
Actuated g/C Ratio	0.07	0.34	0.34	0.02	0.29	0.43	0.15	0.27		0.14	0.26	0.27
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	253	1220	545	34	1028	773	507	942		244	910	424
v/s Ratio Prot	c0.07	0.13		0.01	c0.25	0.01	c0.14	0.10		0.09	0.07	
v/s Ratio Perm			0.05			0.02						c0.25
v/c Ratio	0.92	0.39	0.15	0.53	0.87	0.07	0.93	0.39		0.68	0.27	0.94
Uniform Delay, d1	37.4	20.1	18.4	39.4	27.3	13.7	34.2	24.4		33.3	24.0	29.1
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	34.8	0.2	0.1	14.1	7.9	0.0	23.1	0.3		7.7	0.2	29.6
Delay (s)	72.2	20.3	18.5	53.5	35.2	13.7	57.3	24.6		41.0	24.2	58.7
Level of Service	E	C	B	D	D	B	E	C		D	C	E
Approach Delay (s)		32.5			32.9			42.8			46.1	
Approach LOS		C			C			D			D	

Intersection Summary		
HCM 2000 Control Delay	38.3	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.92	D
Actuated Cycle Length (s)	81.2	Sum of lost time (s)
Intersection Capacity Utilization	74.4%	18.7
Analysis Period (min)	15	ICU Level of Service
		D

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
37: Livermore Ave & I-580 WB Ramps

BART to Livermore Extension Project
2025 BART + INP + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↖	↔		↗	↑			↕	
Traffic Volume (vph)	0	0	0	472	89	28	443	79	0	0	151	0
Future Volume (vph)	0	0	0	472	89	28	443	79	0	0	151	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)					4.0		4.0	4.0			4.0	
Lane Util. Factor					0.95		0.97	1.00			0.95	
Frt					0.99		1.00	1.00			1.00	
Flt Protected					0.96		0.95	1.00			1.00	
Satd. Flow (prot)					1689		3433	1863			3539	
Flt Permitted					0.96		0.95	1.00			1.00	
Satd. Flow (perm)					1689		3433	1863			3539	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	513	97	30	482	86	0	0	164	0
RTOR Reduction (vph)	0	0	0	0	3	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	0	637	0	482	86	0	0	164	0
Turn Type				Split	NA		Prot	NA			NA	
Protected Phases				8	8		5	2			6	
Permitted Phases												
Actuated Green, G (s)					24.6		11.9	25.7			10.3	
Effective Green, g (s)					24.6		11.4	27.4			12.0	
Actuated g/C Ratio					0.41		0.19	0.46			0.20	
Clearance Time (s)					4.0		3.5	5.7			5.7	
Vehicle Extension (s)					2.0		2.0	2.5			2.5	
Lane Grp Cap (vph)					692		652	850			707	
v/s Ratio Prot					c0.38		c0.14	0.05			c0.05	
v/s Ratio Perm												
v/c Ratio					0.92		0.74	0.10			0.23	
Uniform Delay, d1					16.8		22.9	9.3			20.1	
Progression Factor					1.00		0.61	0.28			1.00	
Incremental Delay, d2					17.4		3.2	0.2			0.8	
Delay (s)					34.1		17.3	2.8			20.9	
Level of Service					C		B	A			C	
Approach Delay (s)		0.0			34.1			15.1			20.9	
Approach LOS		A			C			B			C	

Intersection Summary

HCM 2000 Control Delay	24.7	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.70		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	50.0%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
38: Livermore Ave & I-580 EB Ramps



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕	↗					↕		↘	↕	
Traffic Volume (vph)	11	1	582	0	0	0	0	510	308	25	605	0
Future Volume (vph)	11	1	582	0	0	0	0	510	308	25	605	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0					4.0		4.0	4.0	
Lane Util. Factor		0.95	0.95					0.95		1.00	0.95	
Frt		0.86	0.85					0.94		1.00	1.00	
Flt Protected		1.00	1.00					1.00		0.95	1.00	
Satd. Flow (prot)		1512	1504					3339		1770	3539	
Flt Permitted		1.00	1.00					1.00		0.95	1.00	
Satd. Flow (perm)		1512	1504					3339		1770	3539	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	12	1	633	0	0	0	0	554	335	27	658	0
RTOR Reduction (vph)	0	146	146	0	0	0	0	133	0	0	0	0
Lane Group Flow (vph)	0	177	177	0	0	0	0	756	0	27	658	0
Turn Type	Prot	NA	Perm					NA		Prot	NA	
Protected Phases	7	4						2		1	6	
Permitted Phases			4									
Actuated Green, G (s)		19.7	19.7					25.7		2.6	31.3	
Effective Green, g (s)		19.7	19.7					26.7		1.6	32.3	
Actuated g/C Ratio		0.33	0.33					0.44		0.03	0.54	
Clearance Time (s)		4.0	4.0					5.0		3.0	5.0	
Vehicle Extension (s)		2.0	2.0					2.5		2.0	2.5	
Lane Grp Cap (vph)		496	493					1485		47	1905	
v/s Ratio Prot								c0.23		0.02	c0.19	
v/s Ratio Perm		0.12	c0.12									
v/c Ratio		0.36	0.36					0.51		0.57	0.35	
Uniform Delay, d1		15.3	15.3					11.9		28.9	7.9	
Progression Factor		1.00	1.00					1.00		1.08	0.25	
Incremental Delay, d2		0.2	0.2					1.3		6.9	0.3	
Delay (s)		15.5	15.5					13.2		38.0	2.3	
Level of Service		B	B					B		D	A	
Approach Delay (s)		15.5			0.0			13.2			3.7	
Approach LOS		B			A			B			A	
































Intersection Summary

HCM 2000 Control Delay	10.9	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.45		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	50.0%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 39: Livermore Ave & Portola Ave

BART to Livermore Extension Project
 2025 BART + INP + Garage AM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 	 	 	 	 	 	 	 		 		
Traffic Volume (vph)	323	293	106	23	794	67	335	433	63	106	568	504
Future Volume (vph)	323	293	106	23	794	67	335	433	63	106	568	504
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	5.3	4.0	4.0	5.3	4.0	5.8		4.0	5.8	4.9
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	1.00	0.95		1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.98		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	1770	3472		1770	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	1770	3472		1770	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	351	318	115	25	863	73	364	471	68	115	617	548
RTOR Reduction (vph)	0	0	71	0	0	52	0	10	0	0	0	87
Lane Group Flow (vph)	351	318	44	25	863	21	364	529	0	115	617	461
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA		Prot	NA	pm+ov
Protected Phases	3	8		7	4		1	6		5	2	3
Permitted Phases			8			4						2
Actuated Green, G (s)	13.8	42.4	42.4	2.8	31.4	31.4	23.2	36.4		12.0	25.2	39.0
Effective Green, g (s)	13.8	43.7	42.4	2.8	32.7	31.4	23.2	35.5		12.0	24.3	37.2
Actuated g/C Ratio	0.12	0.39	0.38	0.03	0.29	0.28	0.21	0.32		0.11	0.22	0.33
Clearance Time (s)	4.0	5.3	5.3	4.0	5.3	5.3	4.0	4.9		4.0	4.9	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	423	1383	600	44	1035	444	367	1102		189	769	526
v/s Ratio Prot	c0.10	0.09		0.01	c0.24		c0.21	0.15		0.06	0.17	c0.10
v/s Ratio Perm			0.03			0.01						0.19
v/c Ratio	0.83	0.23	0.07	0.57	0.83	0.05	0.99	0.48		0.61	0.80	0.88
Uniform Delay, d1	47.9	22.8	22.2	53.9	37.0	29.3	44.2	30.7		47.7	41.5	35.1
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	12.7	0.1	0.1	15.7	5.9	0.0	44.6	0.3		5.5	6.0	15.2
Delay (s)	60.5	22.9	22.2	69.6	42.9	29.3	88.8	31.1		53.1	47.5	50.3
Level of Service	E	C	C	E	D	C	F	C		D	D	D
Approach Delay (s)		39.6			42.6			54.3			49.2	
Approach LOS		D			D			D			D	

Intersection Summary

HCM 2000 Control Delay	46.9	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.89		
Actuated Cycle Length (s)	111.8	Sum of lost time (s)	18.7
Intersection Capacity Utilization	82.5%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
40: First St/Springtown Blvd & I-580 WB Ramps

BART to Livermore Extension Project
2025 BART + INP + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations			↗↗			↗	↗↗	↑			↖↖	↖
Traffic Volume (vph)	0	0	476	0	0	0	342	375	0	0	827	619
Future Volume (vph)	0	0	476	0	0	0	342	375	0	0	827	619
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)			4.0				4.0	4.0			5.0	5.0
Lane Util. Factor			0.88				0.97	1.00			0.95	1.00
Frt			0.85				1.00	1.00			1.00	0.85
Flt Protected			1.00				0.95	1.00			1.00	1.00
Satd. Flow (prot)			2787				3433	1863			3539	1583
Flt Permitted			1.00				0.95	1.00			1.00	1.00
Satd. Flow (perm)			2787				3433	1863			3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	517	0	0	0	372	408	0	0	899	673
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	72
Lane Group Flow (vph)	0	0	517	0	0	0	372	408	0	0	899	601
Turn Type			Over			Free	Prot	NA			NA	Perm
Protected Phases			5				5	2			6	
Permitted Phases						Free						6
Actuated Green, G (s)			16.9				16.9	70.0			45.1	45.1
Effective Green, g (s)			16.4				16.4	70.0			44.6	44.6
Actuated g/C Ratio			0.23				0.23	1.00			0.64	0.64
Clearance Time (s)			3.5				3.5	4.0			4.5	4.5
Vehicle Extension (s)			2.0				2.0	0.2			4.0	4.0
Lane Grp Cap (vph)			652				804	1863			2254	1008
v/s Ratio Prot			c0.19				0.11	0.22			0.25	
v/s Ratio Perm												c0.38
v/c Ratio			0.79				0.46	0.22			0.40	0.60
Uniform Delay, d1			25.2				23.0	0.0			6.2	7.4
Progression Factor			1.00				0.91	1.00			1.00	1.00
Incremental Delay, d2			6.1				0.1	0.3			0.2	1.1
Delay (s)			31.4				21.1	0.3			6.3	8.5
Level of Service			C				C	A			A	A
Approach Delay (s)		31.4			0.0			10.2			7.3	
Approach LOS		C			A			B			A	

Intersection Summary		
HCM 2000 Control Delay	12.4	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.65	B
Actuated Cycle Length (s)	70.0	Sum of lost time (s)
Intersection Capacity Utilization	55.6%	9.0
Analysis Period (min)	15	ICU Level of Service
		B

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 41: First St & I-580 EB Ramps

BART to Livermore Extension Project
 2025 BART + INP + Garage AM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations													
Traffic Volume (vph)	96	1	338	0	0	0	0	628	287	65	1256	0	
Future Volume (vph)	96	1	338	0	0	0	0	628	287	65	1256	0	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)		4.0	4.0					5.0	5.0	4.0	5.0		
Lane Util. Factor		1.00	0.88					0.95	1.00	1.00	0.95		
Frt		1.00	0.85					1.00	0.85	1.00	1.00		
Flt Protected		0.95	1.00					1.00	1.00	0.95	1.00		
Satd. Flow (prot)		1775	2787					3539	1583	1770	3539		
Flt Permitted		0.95	1.00					1.00	1.00	0.95	1.00		
Satd. Flow (perm)		1775	2787					3539	1583	1770	3539		
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	
Adj. Flow (vph)	104	1	367	0	0	0	0	683	312	71	1365	0	
RTOR Reduction (vph)	0	0	95	0	0	0	0	0	129	0	0	0	
Lane Group Flow (vph)	0	105	272	0	0	0	0	683	183	71	1365	0	
Turn Type	Perm	NA	Perm					NA	Perm	Prot	NA		
Protected Phases		4						2		1	6		
Permitted Phases	4		4						2				
Actuated Green, G (s)		11.5	11.5					41.6	41.6	5.9	50.5		
Effective Green, g (s)		11.0	11.0					41.1	41.1	4.9	50.0		
Actuated g/C Ratio		0.16	0.16					0.59	0.59	0.07	0.71		
Clearance Time (s)		3.5	3.5					4.5	4.5	3.0	4.5		
Vehicle Extension (s)		2.5	2.5					4.0	4.0	2.0	4.0		
Lane Grp Cap (vph)		278	437					2077	929	123	2527		
v/s Ratio Prot								0.19		0.04	c0.39		
v/s Ratio Perm		0.06	c0.10						0.12				
v/c Ratio		0.38	0.62					0.33	0.20	0.58	0.54		
Uniform Delay, d1		26.4	27.6					7.4	6.7	31.5	4.7		
Progression Factor		1.00	1.00					1.00	1.00	1.16	0.54		
Incremental Delay, d2		0.6	2.4					0.4	0.5	3.6	0.7		
Delay (s)		27.1	29.9					7.8	7.2	40.3	3.3		
Level of Service		C	C					A	A	D	A		
Approach Delay (s)		29.3			0.0			7.6			5.1		
Approach LOS		C			A			A			A		
Intersection Summary													
HCM 2000 Control Delay			9.9									HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio			0.59										
Actuated Cycle Length (s)			70.0									Sum of lost time (s)	13.0
Intersection Capacity Utilization			54.0%									ICU Level of Service	A
Analysis Period (min)			15										

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
42: 1st St & Mines Rd

BART to Livermore Extension Project
2025 BART + INP + Garage AM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	32	70	43	566	108	329	18	825	308	211	1273	20
Future Volume (vph)	32	70	43	566	108	329	18	825	308	211	1273	20
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		0.97	1.00	1.00	1.00	0.91		0.97	0.91	
Frt	1.00	0.94		1.00	1.00	0.85	1.00	0.96		1.00	1.00	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1756		3433	1863	1583	1770	4878		3433	5073	
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	1756		3433	1863	1583	1770	4878		3433	5073	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	35	76	47	615	117	358	20	897	335	229	1384	22
RTOR Reduction (vph)	0	36	0	0	0	79	0	88	0	0	2	0
Lane Group Flow (vph)	35	87	0	615	117	279	20	1144	0	229	1404	0
Turn Type	Prot	NA		Prot	NA	pm+ov	Prot	NA		Prot	NA	
Protected Phases	7	4		3	8	1	5	2		1	6	
Permitted Phases						8						
Actuated Green, G (s)	1.8	8.5		13.2	19.9	25.0	0.7	22.6		5.1	27.0	
Effective Green, g (s)	1.8	8.5		13.2	19.9	25.0	0.7	22.6		5.1	27.0	
Actuated g/C Ratio	0.03	0.13		0.20	0.30	0.38	0.01	0.35		0.08	0.41	
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	48	228		692	566	701	18	1685		267	2094	
v/s Ratio Prot	0.02	0.05		c0.18	0.06	c0.03	0.01	0.23		c0.07	c0.28	
v/s Ratio Perm						0.15						
v/c Ratio	0.73	0.38		0.89	0.21	0.40	1.11	0.68		0.86	0.67	
Uniform Delay, d1	31.6	26.0		25.4	16.9	14.7	32.4	18.3		29.8	15.6	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	42.5	1.1		13.3	0.2	0.4	250.0	1.1		22.8	0.9	
Delay (s)	74.1	27.1		38.7	17.1	15.1	282.4	19.4		52.6	16.4	
Level of Service	E	C		D	B	B	F	B		D	B	
Approach Delay (s)		37.5			28.6			23.6			21.5	
Approach LOS		D			C			C			C	



















Intersection Summary

HCM 2000 Control Delay	24.6	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.77		
Actuated Cycle Length (s)	65.4	Sum of lost time (s)	16.0
Intersection Capacity Utilization	61.7%	ICU Level of Service	B
Analysis Period (min)	15		



















c Critical Lane Group

HCM Unsignalized Intersection Capacity Analysis
43: Vasco Rd & I-580 WB Ramps

BART to Livermore Extension Project
2025 BART + INP + Garage AM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	0	0	166	0	847	0	0	1546	0
Future Volume (Veh/h)	0	0	0	0	0	166	0	847	0	0	1546	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	0	0	0	180	0	921	0	0	1680	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage (veh)												
Upstream signal (ft)											487	
pX, platoon unblocked												
vC, conflicting volume	2320	2601	1680	2601	2601	460	1680			921		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	2320	2601	1680	2601	2601	460	1680			921		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	100	100	67	100			100		
cM capacity (veh/h)	13	24	84	12	24	548	377			737		
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	SB 1	SB 2					
Volume Total	0	180	460	460	0	1680	0					
Volume Left	0	0	0	0	0	0	0					
Volume Right	0	180	0	0	0	0	0					
cSH	1700	548	1700	1700	1700	1700	1700					
Volume to Capacity	0.00	0.33	0.27	0.27	0.00	0.99	0.00					
Queue Length 95th (ft)	0	36	0	0	0	0	0					
Control Delay (s)	0.0	14.8	0.0	0.0	0.0	0.0	0.0					
Lane LOS	A	B										
Approach Delay (s)	0.0	14.8	0.0			0.0						
Approach LOS	A	B										
Intersection Summary												
Average Delay			1.0									
Intersection Capacity Utilization			84.7%	ICU Level of Service	E							
Analysis Period (min)			15									

HCM Unsignalized Intersection Capacity Analysis
 44: Vasco Rd & I-580 EB Ramps

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	0	0	0	0	1194	0	73	1760	0
Future Volume (Veh/h)	0	0	0	0	0	0	0	1194	0	73	1760	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	0	0	0	0	0	1298	0	79	1913	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	2720	3369	1913	3369	3369	649	1913			1298		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	2720	3369	1913	3369	3369	649	1913			1298		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	100	100	100	100			85		
cM capacity (veh/h)	9	6	58	3	6	412	306			530		
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2						
Volume Total	0	0	865	433	79	1913						
Volume Left	0	0	0	0	79	0						
Volume Right	0	0	0	0	0	0						
cSH	1700	1700	1700	1700	530	1700						
Volume to Capacity	0.00	0.00	0.51	0.25	0.15	1.13						
Queue Length 95th (ft)	0	0	0	0	13	0						
Control Delay (s)	0.0	0.0	0.0	0.0	13.0	0.0						
Lane LOS	A	A			B							
Approach Delay (s)	0.0	0.0	0.0		0.5							
Approach LOS	A	A										
Intersection Summary												
Average Delay			0.3									
Intersection Capacity Utilization			96.0%	ICU Level of Service	F							
Analysis Period (min)			15									

HCM Signalized Intersection Capacity Analysis
45: Vasco Rd & East Ave

BART to Livermore Extension Project
2025 BART + INP + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	280	325	50	7	17	13	63	252	181	231	284	279
Future Volume (vph)	280	325	50	7	17	13	63	252	181	231	284	279
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	0.95		0.97	1.00	1.00
Frt	1.00	0.98		1.00	0.93		1.00	0.94		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	3469		1770	3307		1770	3317		3433	1863	1583
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1770	3469		1770	3307		1770	3317		3433	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	304	353	54	8	18	14	68	274	197	251	309	303
RTOR Reduction (vph)	0	21	0	0	13	0	0	145	0	0	0	204
Lane Group Flow (vph)	304	386	0	8	19	0	68	326	0	251	309	99
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												6
Actuated Green, G (s)	12.3	14.4		0.6	2.7		2.2	13.1		5.2	16.1	16.1
Effective Green, g (s)	12.3	14.4		0.6	2.7		2.2	13.1		5.2	16.1	16.1
Actuated g/C Ratio	0.25	0.29		0.01	0.05		0.04	0.27		0.11	0.33	0.33
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	441	1013		21	181		78	881		362	608	516
v/s Ratio Prot	c0.17	c0.11		0.00	0.01		0.04	0.10		c0.07	c0.17	
v/s Ratio Perm												0.06
v/c Ratio	0.69	0.38		0.38	0.10		0.87	0.37		0.69	0.51	0.19
Uniform Delay, d1	16.8	13.9		24.2	22.1		23.4	14.7		21.3	13.4	11.9
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	4.5	0.2		11.2	0.3		60.6	0.3		5.7	0.7	0.2
Delay (s)	21.2	14.1		35.3	22.4		84.0	15.0		26.9	14.1	12.1
Level of Service	C	B		D	C		F	B		C	B	B
Approach Delay (s)		17.2			25.0			23.7			17.1	
Approach LOS		B			C			C			B	

Intersection Summary

HCM 2000 Control Delay	18.9	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.64		
Actuated Cycle Length (s)	49.3	Sum of lost time (s)	16.0
Intersection Capacity Utilization	51.5%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Unsignalized Intersection Capacity Analysis
 46: I-580 WB Ramps & Northfront Rd/Northfront Road



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	117	225	1314	122	66	540
Future Volume (Veh/h)	117	225	1314	122	66	540
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	127	245	1428	133	72	587
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage (veh)						
Upstream signal (ft)	1007					
pX, platoon unblocked					0.50	
vC, conflicting volume			127	3238 250		
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			127	4991	250	
tC, single (s)			4.1	6.4	6.2	
tC, 2 stage (s)						
tF (s)			2.2	3.5	3.3	
p0 queue free %			2	0	26	
cM capacity (veh/h)			1459	0	789	

Direction, Lane #	EB 1	WB 1	NB 1	NB 2
Volume Total	372	1561	72	587
Volume Left	0	1428	72	0
Volume Right	245	0	0	587
cSH	1700	1459	0	789
Volume to Capacity	0.22	0.98	9887.79	0.74
Queue Length 95th (ft)	0	532	Err	171
Control Delay (s)	0.0	36.0	Err	21.6
Lane LOS		E	F	C
Approach Delay (s)	0.0	36.0	1111.7	
Approach LOS			F	

Intersection Summary			
Average Delay	304.3		
Intersection Capacity Utilization	112.8%	ICU Level of Service	H
Analysis Period (min)	15		

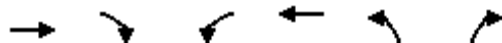
Intersection	
Intersection Delay, s/veh	10
Intersection LOS	A

Movement	EBU	EBL	EBT	WBU	WBT	WBR	SBU	SBL	SBR
Lane Configurations		↘	↗↗		↗	↘		↘↘	↗
Traffic Vol, veh/h	0	43	26	0	166	103	0	306	83
Future Vol, veh/h	0	43	26	0	166	103	0	306	83
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	47	28	0	180	112	0	333	90
Number of Lanes	0	1	2	0	1	1	0	2	1

Approach	EB	WB	SB
Opposing Approach	WB	EB	
Opposing Lanes	2	3	0
Conflicting Approach Left	SB		WB
Conflicting Lanes Left	3	0	2
Conflicting Approach Right		SB	EB
Conflicting Lanes Right	0	3	3
HCM Control Delay	9.5	10.2	9.9
HCM LOS	A	B	A

Lane	EBLn1	EBLn2	EBLn3	WBLn1	WBLn2	SBLn1	SBLn2	SBLn3
Vol Left, %	100%	0%	0%	0%	0%	100%	100%	0%
Vol Thru, %	0%	100%	100%	100%	0%	0%	0%	0%
Vol Right, %	0%	0%	0%	0%	100%	0%	0%	100%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	43	13	13	166	103	153	153	83
LT Vol	43	0	0	0	0	153	153	0
Through Vol	0	13	13	166	0	0	0	0
RT Vol	0	0	0	0	103	0	0	83
Lane Flow Rate	47	14	14	180	112	166	166	90
Geometry Grp	8	8	8	8	8	7	7	7
Degree of Util (X)	0.089	0.025	0.018	0.292	0.159	0.275	0.275	0.075
Departure Headway (Hd)	6.871	6.365	4.612	5.824	5.118	5.948	5.948	3.012
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cap	524	566	781	612	693	600	600	1166
Service Time	4.571	4.065	2.312	3.612	2.906	3.728	3.728	0.791
HCM Lane V/C Ratio	0.09	0.025	0.018	0.294	0.162	0.277	0.277	0.077
HCM Control Delay	10.2	9.2	7.4	11	8.9	11	11	6
HCM Lane LOS	B	A	A	B	A	B	B	A
HCM 95th-tile Q	0.3	0.1	0.1	1.2	0.6	1.1	1.1	0.2

HCM Signalized Intersection Capacity Analysis
 48: Greenville Rd & Northfront Road/Altamont Pass Road



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↗	↖	↑	↘	↗
Traffic Volume (vph)	4	652	270	864	589	63
Future Volume (vph)	4	652	270	864	589	63
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	1863	1583	1770	1863	1770	1583
Flt Permitted	1.00	1.00	0.76	1.00	0.95	1.00
Satd. Flow (perm)	1863	1583	1407	1863	1770	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	4	709	293	939	640	68
RTOR Reduction (vph)	0	328	0	0	0	23
Lane Group Flow (vph)	4	381	293	939	640	45
Turn Type	NA	Perm	Perm	NA	Prot	Perm
Protected Phases	4			8	2	
Permitted Phases		4	8			2
Actuated Green, G (s)	60.4	60.4	60.4	60.4	43.9	43.9
Effective Green, g (s)	60.4	60.4	60.4	60.4	43.9	43.9
Actuated g/C Ratio	0.54	0.54	0.54	0.54	0.39	0.39
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	1002	851	756	1002	691	618
v/s Ratio Prot	0.00			c0.50	c0.36	
v/s Ratio Perm		0.24	0.21			0.03
v/c Ratio	0.00	0.45	0.39	0.94	0.93	0.07
Uniform Delay, d1	12.0	15.8	15.2	24.2	32.7	21.4
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.0	0.4	0.3	15.4	18.4	0.1
Delay (s)	12.0	16.2	15.5	39.6	51.0	21.5
Level of Service	B	B	B	D	D	C
Approach Delay (s)	16.2			33.8	48.2	
Approach LOS	B			C	D	

Intersection Summary

HCM 2000 Control Delay	32.9	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.93		
Actuated Cycle Length (s)	112.3	Sum of lost time (s)	8.0
Intersection Capacity Utilization	84.8%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
49: Greenville Rd & Southfront Rd



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	115	230	133	531	741	124
Future Volume (vph)	115	230	133	531	741	124
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.2	5.2	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.88	0.97	0.95	0.95	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	3433	2787	3433	3539	3539	1583
Flt Permitted	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (perm)	3433	2787	3433	3539	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	125	250	145	577	805	135
RTOR Reduction (vph)	0	219	0	0	0	71
Lane Group Flow (vph)	125	31	145	577	805	64
Turn Type	Prot	Perm	Prot	NA	NA	Perm
Protected Phases	8		1	6	2	
Permitted Phases		8				2
Actuated Green, G (s)	5.7	5.7	3.1	24.5	17.4	17.4
Effective Green, g (s)	5.1	5.1	3.1	26.2	19.1	19.1
Actuated g/C Ratio	0.13	0.13	0.08	0.65	0.47	0.47
Clearance Time (s)	4.6	4.6	4.0	5.7	5.7	5.7
Vehicle Extension (s)	5.0	5.0	6.0	2.5	2.5	2.5
Lane Grp Cap (vph)	432	350	262	2289	1669	746
v/s Ratio Prot	c0.04		c0.04	0.16	c0.23	
v/s Ratio Perm		0.01				0.04
v/c Ratio	0.29	0.09	0.55	0.25	0.48	0.09
Uniform Delay, d1	16.1	15.6	18.0	3.0	7.3	5.9
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.8	0.2	5.4	0.0	0.2	0.0
Delay (s)	16.8	15.9	23.4	3.1	7.5	5.9
Level of Service	B	B	C	A	A	A
Approach Delay (s)	16.2			7.1	7.3	
Approach LOS	B			A	A	

Intersection Summary

HCM 2000 Control Delay	8.9	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.45		
Actuated Cycle Length (s)	40.5	Sum of lost time (s)	13.2
Intersection Capacity Utilization	38.6%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
50: Greenville Rd & Patterson Pass Rd

BART to Livermore Extension Project
2025 BART + INP + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	14	0	12	217	419	584	10	146	0	0	356	60
Future Volume (vph)	14	0	12	217	419	584	10	146	0	0	356	60
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0			4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00			1.00	
Frt	1.00	0.85		1.00	0.91		1.00	1.00			0.98	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00			1.00	
Satd. Flow (prot)	1770	1583		1770	1700		1770	1863			1823	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00			1.00	
Satd. Flow (perm)	1770	1583		1770	1700		1770	1863			1823	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	15	0	13	236	455	635	11	159	0	0	387	65
RTOR Reduction (vph)	0	11	0	0	39	0	0	0	0	0	5	0
Lane Group Flow (vph)	15	2	0	236	1051	0	11	159	0	0	447	0
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												
Actuated Green, G (s)	1.5	19.4		49.3	67.2		0.7	33.8			29.1	
Effective Green, g (s)	1.5	19.4		49.3	67.2		0.7	33.8			29.1	
Actuated g/C Ratio	0.01	0.17		0.43	0.59		0.01	0.30			0.25	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0			4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0			3.0	
Lane Grp Cap (vph)	23	268		762	997		10	549			463	
v/s Ratio Prot	c0.01	0.00		0.13	c0.62		c0.01	0.09			c0.25	
v/s Ratio Perm												
v/c Ratio	0.65	0.01		0.31	1.05		1.10	0.29			0.96	
Uniform Delay, d1	56.2	39.5		21.4	23.6		56.9	31.1			42.2	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00			1.00	
Incremental Delay, d2	50.9	0.0		0.2	43.8		321.8	1.3			34.0	
Delay (s)	107.2	39.6		21.7	67.5		378.7	32.4			76.2	
Level of Service	F	D		C	E		F	C			E	
Approach Delay (s)		75.8			59.3			54.8			76.2	
Approach LOS		E			E			D			E	

Intersection Summary

HCM 2000 Control Delay	63.0	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.02		
Actuated Cycle Length (s)	114.5	Sum of lost time (s)	16.0
Intersection Capacity Utilization	86.9%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
1: Dougherty Rd & Amador Valley Rd

BART to Livermore Extension Project
2025 BART + INP + Garage PM



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	329	462	622	1967	1084	207
Future Volume (vph)	329	462	622	1967	1084	207
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5	5.7	5.7	
Lane Util. Factor	1.00	1.00	0.97	0.91	0.91	
Frt	1.00	0.85	1.00	1.00	0.98	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1770	1583	3433	5085	4963	
Flt Permitted	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	1770	1583	3433	5085	4963	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	358	502	676	2138	1178	225
RTOR Reduction (vph)	0	228	0	0	28	0
Lane Group Flow (vph)	358	274	676	2138	1375	0
Turn Type	Perm	Perm	Prot	NA	NA	
Protected Phases			5	2	6	
Permitted Phases	4	4				
Actuated Green, G (s)	21.0	21.0	13.6	55.3	37.2	
Effective Green, g (s)	21.0	21.0	13.6	55.3	37.2	
Actuated g/C Ratio	0.24	0.24	0.16	0.64	0.43	
Clearance Time (s)	4.5	4.5	4.5	5.7	5.7	
Vehicle Extension (s)	1.8	1.8	2.0	4.0	4.0	
Lane Grp Cap (vph)	429	384	539	3250	2134	
v/s Ratio Prot			c0.20	c0.42	0.28	
v/s Ratio Perm	c0.20	0.17				
v/c Ratio	0.83	0.71	1.25	0.66	0.64	
Uniform Delay, d1	31.1	30.0	36.5	9.7	19.4	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	12.6	5.2	129.0	0.5	0.8	
Delay (s)	43.7	35.2	165.4	10.3	20.2	
Level of Service	D	D	F	B	C	
Approach Delay (s)	38.7			47.5	20.2	
Approach LOS	D			D	C	











































Intersection Summary

HCM 2000 Control Delay	38.5	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.84		
Actuated Cycle Length (s)	86.5	Sum of lost time (s)	14.7
Intersection Capacity Utilization	73.8%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
2: Dougherty Rd & Dublin Blvd

BART to Livermore Extension Project
2025 BART + INP + Garage PM

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations	 	  	 	  	  	 	  	  	 	 	  	 	
Traffic Volume (vph)	82	1001	884	552	845	716	812	1852	297	633	1247	36	
Future Volume (vph)	82	1001	884	552	845	716	812	1852	297	633	1247	36	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)	5.0	6.0	5.0	5.0	5.5	5.0	5.0	5.5	5.0	5.0	5.5		
Lane Util. Factor	0.97	0.91	0.88	0.94	0.91	1.00	0.94	0.91	0.88	0.97	0.86		
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00		
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		
Satd. Flow (prot)	3433	5085	2787	4990	5085	1583	4990	5085	2787	3433	6381		
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		
Satd. Flow (perm)	3433	5085	2787	4990	5085	1583	4990	5085	2787	3433	6381		
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	
Adj. Flow (vph)	89	1088	961	600	918	778	883	2013	323	688	1355	39	
RTOR Reduction (vph)	0	0	36	0	0	61	0	0	34	0	3	0	
Lane Group Flow (vph)	89	1088	925	600	918	717	883	2013	289	688	1391	0	
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA		
Protected Phases	5	2	3	1	6	7	3	8	1	7	4		
Permitted Phases			2			6			8				
Actuated Green, G (s)	15.0	34.1	54.0	18.3	37.9	51.9	19.9	45.0	63.3	14.0	39.1		
Effective Green, g (s)	15.0	34.1	54.0	18.3	37.9	51.9	19.9	45.0	63.3	14.0	39.1		
Actuated g/C Ratio	0.11	0.26	0.41	0.14	0.29	0.39	0.15	0.34	0.48	0.11	0.29		
Clearance Time (s)	5.0	6.0	5.0	5.0	5.5	5.0	5.0	5.5	5.0	5.0	5.5		
Vehicle Extension (s)	2.0	4.5	2.0	2.0	4.5	2.0	2.0	4.5	2.0	2.0	4.5		
Lane Grp Cap (vph)	387	1304	1132	687	1450	618	747	1721	1327	361	1877		
v/s Ratio Prot	0.03	0.21	0.12	c0.12	0.18	c0.12	c0.18	c0.40	0.03	c0.20	0.22		
v/s Ratio Perm			0.21			0.33			0.07				
v/c Ratio	0.23	0.83	0.82	0.87	0.63	1.16	1.18	1.17	0.22	1.91	0.74		
Uniform Delay, d1	53.7	46.7	35.1	56.2	41.4	40.5	56.5	44.0	20.3	59.5	42.3		
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		
Incremental Delay, d2	0.1	5.2	4.4	11.5	1.1	89.2	95.4	83.0	0.0	417.9	1.8		
Delay (s)	53.8	51.9	39.5	67.7	42.6	129.7	151.9	126.9	20.4	477.3	44.2		
Level of Service	D	D	D	E	D	F	F	F	C	F	D		
Approach Delay (s)		46.4			78.7			123.1			187.3		
Approach LOS		D			E			F			F		
Intersection Summary													
HCM 2000 Control Delay			109.5			HCM 2000 Level of Service			F				
HCM 2000 Volume to Capacity ratio			1.25										
Actuated Cycle Length (s)			132.9	Sum of lost time (s)					21.5				
Intersection Capacity Utilization			105.5%	ICU Level of Service			G						
Analysis Period (min)			15										

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
3: Dougherty Rd & I-580 WB Ramps

BART to Livermore Extension Project
2025 BART + INP + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations				↔↔		↔↔		↑↑↑			↑↑↑	↔	
Traffic Volume (vph)	0	0	0	312	0	640	0	2350	0	0	1603	0	
Future Volume (vph)	0	0	0	312	0	640	0	2350	0	0	1603	0	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)				4.0		4.0		4.0			4.0		
Lane Util. Factor				0.97		0.88		0.91			0.86		
Frt				1.00		0.85		1.00			1.00		
Flt Protected				0.95		1.00		1.00			1.00		
Satd. Flow (prot)				3433		2787		5085			4806		
Flt Permitted				0.95		1.00		1.00			1.00		
Satd. Flow (perm)				3433		2787		5085			4806		
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	
Adj. Flow (vph)	0	0	0	339	0	696	0	2554	0	0	1742	0	
RTOR Reduction (vph)	0	0	0	0	0	17	0	0	0	0	0	0	
Lane Group Flow (vph)	0	0	0	339	0	679	0	2554	0	0	1742	0	
Turn Type				Prot		Prot		NA			NA	Perm	
Protected Phases				4		4		2			6		
Permitted Phases												6	
Actuated Green, G (s)				30.8		30.8		68.4			68.4		
Effective Green, g (s)				32.2		32.2		69.8			69.8		
Actuated g/C Ratio				0.29		0.29		0.63			0.63		
Clearance Time (s)				5.4		5.4		5.4			5.4		
Vehicle Extension (s)				3.0		3.0		3.0			3.0		
Lane Grp Cap (vph)				1004		815		3226			3049		
v/s Ratio Prot				0.10		c0.24		c0.50			0.36		
v/s Ratio Perm													
v/c Ratio				0.34		0.83		0.79			0.57		
Uniform Delay, d1				30.5		36.4		14.8			11.5		
Progression Factor				1.00		1.00		0.85			1.00		
Incremental Delay, d2				0.2		7.3		0.7			0.8		
Delay (s)				30.7		43.7		13.3			12.3		
Level of Service				C		D		B			B		
Approach Delay (s)		0.0			39.5			13.3			12.3		
Approach LOS		A			D			B			B		
Intersection Summary													
HCM 2000 Control Delay			18.0		HCM 2000 Level of Service						B		
HCM 2000 Volume to Capacity ratio			0.80										
Actuated Cycle Length (s)			110.0		Sum of lost time (s)						8.0		
Intersection Capacity Utilization			74.5%		ICU Level of Service						D		
Analysis Period (min)			15										
c Critical Lane Group													

HCM Signalized Intersection Capacity Analysis
 4: Hopyard Rd/Dougherty Rd & I-580 EB Ramps

BART to Livermore Extension Project
 2025 BART + INP + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔↔		↔↔					↑↑↑	↔		↑↑↑	↔
Traffic Volume (vph)	1100	0	848	0	0	0	0	2468	0	0	1149	0
Future Volume (vph)	1100	0	848	0	0	0	0	2468	0	0	1149	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0					4.0			4.0	
Lane Util. Factor	0.97		0.88					0.91			0.86	
Frt	1.00		0.85					1.00			1.00	
Flt Protected	0.95		1.00					1.00			1.00	
Satd. Flow (prot)	3433		2787					5085			4806	
Flt Permitted	0.95		1.00					1.00			1.00	
Satd. Flow (perm)	3433		2787					5085			4806	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	1196	0	922	0	0	0	0	2683	0	0	1249	0
RTOR Reduction (vph)	0	0	59	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	1196	0	863	0	0	0	0	2683	0	0	1249	0
Turn Type	Prot		Prot					NA	Free		NA	Perm
Protected Phases	4		4					2			6	
Permitted Phases									Free			6
Actuated Green, G (s)	39.6		39.6					59.6			59.6	
Effective Green, g (s)	41.0		41.0					61.0			61.0	
Actuated g/C Ratio	0.37		0.37					0.55			0.55	
Clearance Time (s)	5.4		5.4					5.4			5.4	
Vehicle Extension (s)	3.0		3.0					3.0			3.0	
Lane Grp Cap (vph)	1279		1038					2819			2665	
v/s Ratio Prot	c0.35		0.31					c0.53			0.26	
v/s Ratio Perm												
v/c Ratio	0.94		0.83					0.95			0.47	
Uniform Delay, d1	33.2		31.4					23.1			14.7	
Progression Factor	1.00		1.00					1.00			1.78	
Incremental Delay, d2	12.6		5.8					8.9			0.5	
Delay (s)	45.8		37.1					32.0			26.7	
Level of Service	D		D					C			C	
Approach Delay (s)		42.0			0.0			32.0			26.7	
Approach LOS		D			A			C			C	

Intersection Summary		
HCM 2000 Control Delay	34.4	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.94	C
Actuated Cycle Length (s)	110.0	Sum of lost time (s)
Intersection Capacity Utilization	85.7%	8.0
Analysis Period (min)	15	ICU Level of Service
		E

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
5: Hopyard Rd & Owens Rd

BART to Livermore Extension Project
2025 BART + INP + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↖↗		↖	↖	↖	↖	↖↗↘	↖	↖↗	↖↗↘	
Traffic Volume (vph)	361	246	305	562	294	297	273	896	264	332	1478	233
Future Volume (vph)	361	246	305	562	294	297	273	896	264	332	1478	233
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	2.7	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	0.91	0.91		1.00	0.95	0.95	1.00	0.91	1.00	0.97	0.91	
Frt	1.00	0.94		1.00	0.96	0.85	1.00	1.00	0.85	1.00	0.98	
Flt Protected	0.95	0.99		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1610	3137		1770	1706	1504	1770	5085	1583	3433	4982	
Flt Permitted	0.95	0.99		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1610	3137		1770	1706	1504	1770	5085	1583	3433	4982	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	392	267	332	611	320	323	297	974	287	361	1607	253
RTOR Reduction (vph)	0	91	0	0	8	34	0	0	206	0	15	0
Lane Group Flow (vph)	216	684	0	611	412	189	297	974	81	361	1845	0
Turn Type	Split	NA		Split	NA	pm+ov	Prot	NA	Perm	Prot	NA	
Protected Phases	8	8		4	4	1	5	2		1	6	
Permitted Phases						4			2			
Actuated Green, G (s)	20.7	20.7		34.7	34.7	61.3	18.0	37.7	37.7	26.6	46.3	
Effective Green, g (s)	22.0	22.0		36.0	36.0	63.9	18.0	39.4	39.4	26.6	48.0	
Actuated g/C Ratio	0.16	0.16		0.26	0.26	0.46	0.13	0.28	0.28	0.19	0.34	
Clearance Time (s)	5.3	5.3		5.3	5.3	4.0	4.0	5.7	5.7	4.0	5.7	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	253	492		455	438	715	227	1431	445	652	1708	
v/s Ratio Prot	0.13	c0.22		c0.35	0.24	0.05	c0.17	0.19		0.11	c0.37	
v/s Ratio Perm						0.07			0.05			
v/c Ratio	0.85	1.39		1.34	0.94	0.26	1.31	0.68	0.18	0.55	1.08	
Uniform Delay, d1	57.4	59.0		52.0	50.9	23.5	61.0	44.7	38.1	51.3	46.0	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	23.3	187.8		168.5	28.4	0.2	166.8	2.6	0.9	1.0	47.0	
Delay (s)	80.7	246.8		220.5	79.4	23.7	227.8	47.3	39.0	52.3	93.0	
Level of Service	F	F		F	E	C	F	D	D	D	F	
Approach Delay (s)		210.6			138.2			80.2			86.4	
Approach LOS		F			F			F			F	

Intersection Summary

HCM 2000 Control Delay	116.0	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.24		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	111.4%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

6: Hopyard Rd & Stoneridge Dr

BART to Livermore Extension Project
2025 BART + INP + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	273	1357	706	117	1313	189	595	829	99	294	888	198
Future Volume (vph)	273	1357	706	117	1313	189	595	829	99	294	888	198
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.91	1.00	0.97	0.91	1.00	0.94	0.95	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5085	1583	3433	5085	1583	4990	3539	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5085	1583	3433	5085	1583	4990	3539	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	297	1475	767	127	1427	205	647	901	108	320	965	215
RTOR Reduction (vph)	0	0	174	0	0	136	0	0	77	0	0	120
Lane Group Flow (vph)	297	1475	593	127	1427	69	647	901	31	320	965	95
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8			2			6
Actuated Green, G (s)	9.0	35.0	35.0	4.0	30.0	30.0	13.0	25.6	25.6	9.0	21.6	21.6
Effective Green, g (s)	9.0	35.0	35.0	4.0	30.0	30.0	13.0	25.6	25.6	9.0	21.6	21.6
Actuated g/C Ratio	0.10	0.39	0.39	0.04	0.33	0.33	0.15	0.29	0.29	0.10	0.24	0.24
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	344	1986	618	153	1702	530	723	1011	452	344	1225	381
v/s Ratio Prot	c0.09	0.29		0.04	0.28		c0.13	c0.25		0.09	0.19	
v/s Ratio Perm			c0.37			0.04			0.02			0.06
v/c Ratio	0.86	0.74	0.96	0.83	0.84	0.13	0.89	0.89	0.07	0.93	0.79	0.25
Uniform Delay, d1	39.7	23.4	26.6	42.5	27.6	20.7	37.6	30.7	23.3	40.0	31.9	27.5
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	19.5	1.5	26.0	30.0	3.8	0.1	13.6	10.0	0.1	31.1	3.4	0.3
Delay (s)	59.2	25.0	52.6	72.5	31.4	20.8	51.2	40.6	23.4	71.1	35.3	27.8
Level of Service	E	C	D	E	C	C	D	D	C	E	D	C
Approach Delay (s)		37.3			33.1			43.6			41.9	
Approach LOS		D			C			D			D	

























Intersection Summary

HCM 2000 Control Delay	38.6	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.97		
Actuated Cycle Length (s)	89.6	Sum of lost time (s)	16.0
Intersection Capacity Utilization	77.8%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 7: Hopyard Rd & Las Positas Blvd

BART to Livermore Extension Project
 2025 BART + INP + Garage PM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	100	246	420	536	409	51	344	939	241	72	1389	74
Future Volume (vph)	100	246	420	536	409	51	344	939	241	72	1389	74
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.95	1.00	0.97	0.95	1.00	0.97	0.91	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	3433	3539	1583	3433	5085	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	3433	3539	1583	3433	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	109	267	457	583	445	55	374	1021	262	78	1510	80
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	53
Lane Group Flow (vph)	109	267	457	583	445	55	374	1021	262	78	1510	27
Turn Type	Prot	NA	Free	Prot	NA	Free	Prot	NA	Free	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1		6
Permitted Phases			Free			Free			Free			6
Actuated Green, G (s)	4.0	11.8	76.7	14.0	21.8	76.7	9.0	30.9	76.7	4.0	25.9	25.9
Effective Green, g (s)	4.0	11.8	76.7	14.0	21.8	76.7	9.0	30.9	76.7	4.0	25.9	25.9
Actuated g/C Ratio	0.05	0.15	1.00	0.18	0.28	1.00	0.12	0.40	1.00	0.05	0.34	0.34
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	179	544	1583	626	1005	1583	402	2048	1583	179	1717	534
v/s Ratio Prot	0.03	0.08		c0.17	c0.13		c0.11	0.20		0.02	c0.30	
v/s Ratio Perm			0.29			0.03			0.17			0.02
v/c Ratio	0.61	0.49	0.29	0.93	0.44	0.03	0.93	0.50	0.17	0.44	0.88	0.05
Uniform Delay, d1	35.6	29.7	0.0	30.9	22.5	0.0	33.5	17.1	0.0	35.3	23.9	17.1
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	5.8	0.7	0.5	20.7	0.3	0.0	28.0	0.2	0.2	1.7	5.5	0.0
Delay (s)	41.3	30.4	0.5	51.6	22.8	0.0	61.6	17.3	0.2	37.0	29.4	17.2
Level of Service	D	C	A	D	C	A	E	B	A	D	C	B
Approach Delay (s)		15.4			37.1			24.6			29.2	
Approach LOS		B			D			C			C	

Intersection Summary			
HCM 2000 Control Delay	27.2	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.83		
Actuated Cycle Length (s)	76.7	Sum of lost time (s)	16.0
Intersection Capacity Utilization	72.1%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

8: Willow Rd & Owens Rd

BART to Livermore Extension Project

2025 BART + INP + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↖↗↘		↖↗	↖↗↘	↖	↖	↖↗	↖	↖	↖	↖
Traffic Volume (vph)	94	612	172	103	623	80	165	76	0	191	81	160
Future Volume (vph)	94	612	172	103	623	80	165	76	0	191	81	160
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	5.3	4.0		5.3	4.0	4.0
Lane Util. Factor	0.97	0.91		0.97	0.91	1.00	1.00	0.95		1.00	1.00	1.00
Frt	1.00	0.97		1.00	1.00	0.85	1.00	1.00		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	4918		3433	5085	1583	1770	3539		1770	1863	1583
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.69	1.00		0.70	1.00	1.00
Satd. Flow (perm)	3433	4918		3433	5085	1583	1284	3539		1304	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	102	665	187	112	677	87	179	83	0	208	88	174
RTOR Reduction (vph)	0	31	0	0	0	38	0	0	0	0	0	134
Lane Group Flow (vph)	102	821	0	112	677	49	179	83	0	208	88	40
Turn Type	Prot	NA		Prot	NA	Perm	Perm	NA	Perm	Perm	NA	Perm
Protected Phases	1	6		5	2			4				8
Permitted Phases						2	4		4	8		8
Actuated Green, G (s)	10.8	62.2		9.0	60.4	60.4	23.8	23.8		23.8	23.8	23.8
Effective Green, g (s)	10.8	63.9		9.0	62.1	62.1	23.8	25.1		23.8	25.1	25.1
Actuated g/C Ratio	0.10	0.58		0.08	0.56	0.56	0.22	0.23		0.22	0.23	0.23
Clearance Time (s)	4.0	5.7		4.0	5.7	5.7	5.3	5.3		5.3	5.3	5.3
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	337	2856		280	2870	893	277	807		282	425	361
v/s Ratio Prot	0.03	c0.17		c0.03	0.13			0.02			0.05	
v/s Ratio Perm						0.03	0.14			c0.16		0.03
v/c Ratio	0.30	0.29		0.40	0.24	0.06	0.65	0.10		0.74	0.21	0.11
Uniform Delay, d1	46.1	11.6		47.9	12.0	10.8	39.3	33.6		40.2	34.4	33.6
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	0.5	0.3		0.9	0.2	0.1	5.1	0.1		9.7	0.2	0.1
Delay (s)	46.6	11.9		48.9	12.2	10.9	44.4	33.6		49.8	34.6	33.7
Level of Service	D	B		D	B	B	D	C		D	C	C
Approach Delay (s)		15.6			16.8			41.0			41.0	
Approach LOS		B			B			D			D	

Intersection Summary

HCM 2000 Control Delay	23.2	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.40		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	46.2%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 9: Hacienda Dr & Dublin Blvd

BART to Livermore Extension Project
 2025 BART + INP + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↑↑↑	↖↗	↖↗	↑↑↑		↖↗	↑↑	↖↗	↖↗	↑↑↑	↖↗
Traffic Volume (vph)	51	1014	126	226	490	35	218	580	455	43	629	168
Future Volume (vph)	51	1014	126	226	490	35	218	580	455	43	629	168
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	6.0	5.0	4.5	6.0		5.0	6.0	6.0	4.5	5.5	5.5
Lane Util. Factor	0.97	0.91	0.88	0.97	0.91		0.94	0.95	0.88	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5085	2787	3433	5035		4990	3539	2787	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5085	2787	3433	5035		4990	3539	2787	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	55	1102	137	246	533	38	237	630	495	47	684	183
RTOR Reduction (vph)	0	0	64	0	7	0	0	0	234	0	0	141
Lane Group Flow (vph)	55	1102	73	246	564	0	237	630	261	47	684	42
Turn Type	Prot	NA	pm+ov	Prot	NA		Prot	NA	Perm	Prot	NA	Perm
Protected Phases	5	2	3	1	6		3	8		7	NA	4
Permitted Phases			2						8			4
Actuated Green, G (s)	4.1	29.5	40.2	10.8	36.2		10.7	29.4	29.4	2.8	21.5	21.5
Effective Green, g (s)	4.1	29.5	40.2	10.8	36.2		10.7	29.4	29.4	2.8	21.5	21.5
Actuated g/C Ratio	0.04	0.32	0.43	0.12	0.39		0.11	0.31	0.31	0.03	0.23	0.23
Clearance Time (s)	4.5	6.0	5.0	4.5	6.0		5.0	6.0	6.0	4.5	5.5	5.5
Vehicle Extension (s)	2.0	3.5	2.0	2.0	3.5		2.0	3.5	3.5	2.0	3.5	3.5
Lane Grp Cap (vph)	150	1604	1347	396	1949		571	1112	876	102	1169	364
v/s Ratio Prot	0.02	c0.22	0.01	c0.07	0.11		0.05	c0.18		0.01	c0.13	
v/s Ratio Perm			0.02						0.09			0.03
v/c Ratio	0.37	0.69	0.05	0.62	0.29		0.42	0.57	0.30	0.46	0.59	0.12
Uniform Delay, d1	43.4	28.0	15.6	39.4	19.8		38.5	26.7	24.2	44.6	32.0	28.5
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.6	1.3	0.0	2.2	0.1		0.2	0.7	0.2	1.2	0.8	0.2
Delay (s)	44.0	29.3	15.6	41.6	19.9		38.7	27.5	24.5	45.8	32.8	28.6
Level of Service	D	C	B	D	B		D	C	C	D	C	C
Approach Delay (s)		28.4			26.4			28.3			32.7	
Approach LOS		C			C			C			C	

Intersection Summary		
HCM 2000 Control Delay	28.9	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.64	C
Actuated Cycle Length (s)	93.5	Sum of lost time (s)
Intersection Capacity Utilization	63.1%	21.0
Analysis Period (min)	15	ICU Level of Service
		B

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 10: Hacienda Dr & Martinelli Blvd/Hacienda Crossings

BART to Livermore Extension Project
 2025 BART + INP + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗	↘	↙	↘		↖	↗	↘	↙	↘	↙
Traffic Volume (vph)	24	52	382	293	32	22	341	1237	462	63	911	62
Future Volume (vph)	24	52	382	293	32	22	341	1237	462	63	911	62
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	3.0	3.0	5.5	3.0		3.5	3.0	3.0	5.0	3.5	
Lane Util. Factor	1.00	0.91	0.91	0.97	1.00		0.94	0.91	1.00	0.97	0.86	
Frt	1.00	0.94	0.85	1.00	0.94		1.00	1.00	0.85	1.00	0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1770	1587	2882	3433	1749		4990	5085	1583	3433	6347	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1770	1587	2882	3433	1749		4990	5085	1583	3433	6347	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	26	57	415	318	35	24	371	1345	502	68	990	67
RTOR Reduction (vph)	0	27	202	0	17	0	0	0	212	0	8	0
Lane Group Flow (vph)	26	72	171	318	42	0	371	1345	290	68	1049	0
Turn Type	Prot	NA	Perm	Prot	NA		Prot	NA	pm+ov	Prot	NA	
Protected Phases	5	2		1	6		3	8	1	7	4	
Permitted Phases			2						8			
Actuated Green, G (s)	7.5	16.7	16.7	12.3	22.0		8.7	34.3	46.6	4.7	30.3	
Effective Green, g (s)	7.0	18.7	18.7	11.8	24.0		9.7	36.3	50.6	4.2	31.8	
Actuated g/C Ratio	0.08	0.21	0.21	0.13	0.27		0.11	0.41	0.58	0.05	0.36	
Clearance Time (s)	4.5	5.0	5.0	5.0	5.0		4.5	5.0	5.0	4.5	5.0	
Vehicle Extension (s)	3.0	4.0	4.0	2.0	4.0		3.0	4.0	2.0	3.0	4.0	
Lane Grp Cap (vph)	141	339	615	462	479		553	2109	969	164	2306	
v/s Ratio Prot	0.01	0.05		c0.09	0.02		c0.07	c0.26	0.05	0.02	0.17	
v/s Ratio Perm			c0.06						0.13			
v/c Ratio	0.18	0.21	0.28	0.69	0.09		0.67	0.64	0.30	0.41	0.45	
Uniform Delay, d1	37.6	28.3	28.8	36.1	23.6		37.4	20.4	9.4	40.5	21.2	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.6	0.4	0.3	3.4	0.1		3.2	0.7	0.1	1.7	0.2	
Delay (s)	38.2	28.8	29.1	39.5	23.7		40.6	21.1	9.5	42.2	21.4	
Level of Service	D	C	C	D	C		D	C	A	D	C	
Approach Delay (s)		29.5			37.0			21.7			22.7	
Approach LOS		C			D			C			C	

Intersection Summary

HCM 2000 Control Delay	24.3	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.59		
Actuated Cycle Length (s)	87.5	Sum of lost time (s)	16.5
Intersection Capacity Utilization	62.2%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 11: Hacienda Dr & I-580 WB Ramps

BART to Livermore Extension Project
 2025 BART + INP + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↔↔		↔↔		↑↑↑			↑↑↑	↔
Traffic Volume (vph)	0	0	0	346	0	291	0	1493	750	0	803	757
Future Volume (vph)	0	0	0	346	0	291	0	1493	750	0	803	757
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0		4.0		4.0			4.0	4.0
Lane Util. Factor				0.97		0.88		0.91			0.86	0.86
Frt				1.00		0.85		0.95			0.95	0.85
Flt Protected				0.95		1.00		1.00			1.00	1.00
Satd. Flow (prot)				3433		2787		4830			4575	1362
Flt Permitted				0.95		1.00		1.00			1.00	1.00
Satd. Flow (perm)				3433		2787		4830			4575	1362
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	376	0	316	0	1623	815	0	873	823
RTOR Reduction (vph)	0	0	0	0	0	54	0	162	0	0	142	141
Lane Group Flow (vph)	0	0	0	376	0	262	0	2276	0	0	1143	270
Turn Type				Prot		Prot		NA			NA	Perm
Protected Phases				4		4		2			6	
Permitted Phases												6
Actuated Green, G (s)				9.5		9.5		34.2			34.2	34.2
Effective Green, g (s)				10.9		10.9		36.1			36.1	36.1
Actuated g/C Ratio				0.20		0.20		0.66			0.66	0.66
Clearance Time (s)				5.4		5.4		5.9			5.9	5.9
Vehicle Extension (s)				3.0		3.0		3.0			3.0	3.0
Lane Grp Cap (vph)				680		552		3170			3002	893
v/s Ratio Prot				c0.11		0.09		c0.47			0.25	
v/s Ratio Perm												0.20
v/c Ratio				0.55		0.48		0.72			0.38	0.30
Uniform Delay, d1				19.9		19.5		6.1			4.3	4.1
Progression Factor				1.00		1.00		0.73			1.00	1.00
Incremental Delay, d2				1.0		0.6		1.0			0.4	0.9
Delay (s)				20.8		20.2		5.4			4.7	4.9
Level of Service				C		C		A			A	A
Approach Delay (s)		0.0			20.5			5.4			4.8	
Approach LOS		A			C			A			A	

Intersection Summary			
HCM 2000 Control Delay	7.4	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.68		
Actuated Cycle Length (s)	55.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	62.5%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 12: Hacienda Dr & I-580 EB Ramps

BART to Livermore Extension Project
 2025 BART + INP + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗		↖↗					↖↗↘	↖		↖↗↘	
Traffic Volume (vph)	886	0	436	0	0	0	0	1541	808	0	742	313
Future Volume (vph)	886	0	436	0	0	0	0	1541	808	0	742	313
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0					4.0	4.0		4.0	
Lane Util. Factor	0.97		0.88					0.86	0.86		0.91	
Frt	1.00		0.85					0.98	0.85		0.96	
Flt Protected	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (prot)	3433		2787					4705	1362		4859	
Flt Permitted	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (perm)	3433		2787					4705	1362		4859	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	963	0	474	0	0	0	0	1675	878	0	807	340
RTOR Reduction (vph)	0	0	174	0	0	0	0	17	251	0	62	0
Lane Group Flow (vph)	963	0	300	0	0	0	0	1930	355	0	1085	0
Turn Type	Prot		Prot					NA	Perm		NA	
Protected Phases	4		4					2			6	
Permitted Phases									2			
Actuated Green, G (s)	36.2		36.2					62.5	62.5		62.5	
Effective Green, g (s)	37.6		37.6					64.4	64.4		64.4	
Actuated g/C Ratio	0.34		0.34					0.59	0.59		0.59	
Clearance Time (s)	5.4		5.4					5.9	5.9		5.9	
Vehicle Extension (s)	2.0		2.0					2.0	2.0		2.0	
Lane Grp Cap (vph)	1173		952					2754	797		2844	
v/s Ratio Prot	c0.28		0.11					c0.41			0.22	
v/s Ratio Perm									0.26			
v/c Ratio	0.82		0.31					0.70	0.45		0.38	
Uniform Delay, d1	33.1		26.7					16.0	12.8		12.2	
Progression Factor	1.00		1.00					1.00	1.00		0.83	
Incremental Delay, d2	4.5		0.1					1.5	1.8		0.4	
Delay (s)	37.6		26.8					17.5	14.6		10.4	
Level of Service	D		C					B	B		B	
Approach Delay (s)		34.0			0.0			16.8			10.4	
Approach LOS		C			A			B			B	

Intersection Summary		
HCM 2000 Control Delay	20.2	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.74	C
Actuated Cycle Length (s)	110.0	Sum of lost time (s)
Intersection Capacity Utilization	67.7%	8.0
Analysis Period (min)	15	ICU Level of Service
		C

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
13: Hacienda Dr & Owens Rd

BART to Livermore Extension Project
2025 BART + INP + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↑↑↑	↖	↖↗	↑↑↑	↖	↖↗	↑↑↑	↖	↖↗	↑↑↑	↖
Traffic Volume (vph)	645	752	52	122	303	729	36	962	290	450	462	250
Future Volume (vph)	645	752	52	122	303	729	36	962	290	450	462	250
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	2.3	4.0	4.0	2.3	4.0	4.0	2.7	4.0	4.0	2.7
Lane Util. Factor	0.97	0.91	1.00	0.97	0.91	1.00	0.97	0.91	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5085	1583	3433	5085	1583	3433	5085	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5085	1583	3433	5085	1583	3433	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	701	817	57	133	329	792	39	1046	315	489	502	272
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	701	817	57	133	329	792	39	1046	315	489	502	272
Turn Type	Prot	NA	Free	Prot	NA	Free	Prot	NA	Free	Prot	NA	Free
Protected Phases	1	6		5	2		7	4		3	8	
Permitted Phases			Free			Free			Free			Free
Actuated Green, G (s)	36.9	40.3	115.0	7.8	11.2	115.0	3.7	31.8	115.0	16.1	44.2	115.0
Effective Green, g (s)	36.9	42.0	115.0	7.8	12.9	115.0	3.7	33.1	115.0	16.1	45.5	115.0
Actuated g/C Ratio	0.32	0.37	1.00	0.07	0.11	1.00	0.03	0.29	1.00	0.14	0.40	1.00
Clearance Time (s)	4.0	5.7		4.0	5.7		4.0	5.3		4.0	5.3	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	1101	1857	1583	232	570	1583	110	1463	1583	480	2011	1583
v/s Ratio Prot	c0.20	0.16		0.04	0.06		0.01	c0.21		c0.14	0.10	
v/s Ratio Perm			0.04			c0.50			0.20			0.17
v/c Ratio	0.64	0.44	0.04	0.57	0.58	0.50	0.35	0.71	0.20	1.02	0.25	0.17
Uniform Delay, d1	33.3	27.6	0.0	52.0	48.5	0.0	54.5	36.7	0.0	49.5	23.3	0.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.2	0.8	0.0	3.4	4.2	1.1	2.0	1.7	0.3	45.9	0.1	0.2
Delay (s)	34.5	28.4	0.0	55.4	52.7	1.1	56.4	38.4	0.3	95.3	23.4	0.2
Level of Service	C	C	A	E	D	A	E	D	A	F	C	A
Approach Delay (s)		30.1			20.4			30.3			46.3	
Approach LOS		C			C			C			D	

Intersection Summary

HCM 2000 Control Delay	31.7	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.73		
Actuated Cycle Length (s)	115.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	69.0%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 14: Tassajara Rd & Dublin Blvd

BART to Livermore Extension Project
 2025 BART + INP + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↑↑	↖↗	↖↗↘	↑↓		↖↗↘	↑↑↑	↖	↖↗	↑↑↑	↖↗
Traffic Volume (vph)	250	765	450	245	294	20	380	873	471	28	785	138
Future Volume (vph)	250	765	450	245	294	20	380	873	471	28	785	138
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	6.0	6.0	5.0	6.0		5.0	6.0	6.0	5.0	6.0	6.0
Lane Util. Factor	0.97	0.95	0.88	0.94	0.95		0.94	0.91	1.00	0.97	0.86	0.88
Frt	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	2787	4990	3505		4990	5085	1583	3433	6408	2787
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	2787	4990	3505		4990	5085	1583	3433	6408	2787
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	272	832	489	266	320	22	413	949	512	30	853	150
RTOR Reduction (vph)	0	0	288	0	3	0	0	0	257	0	0	109
Lane Group Flow (vph)	272	832	201	266	339	0	413	949	255	30	853	41
Turn Type	Prot	NA	Perm	Prot	NA		Prot	NA	Perm	Prot	NA	Perm
Protected Phases	5	2		1	6		3	8		7		4
Permitted Phases			2						8			4
Actuated Green, G (s)	17.0	40.3	40.3	16.4	39.7		17.1	45.3	45.3	8.1	36.3	36.3
Effective Green, g (s)	17.0	40.3	40.3	16.4	39.7		17.1	45.3	45.3	8.1	36.3	36.3
Actuated g/C Ratio	0.13	0.31	0.31	0.12	0.30		0.13	0.34	0.34	0.06	0.27	0.27
Clearance Time (s)	5.0	6.0	6.0	5.0	6.0		5.0	6.0	6.0	5.0	6.0	6.0
Vehicle Extension (s)	2.0	3.0	3.0	2.0	3.0		2.0	4.0	4.0	2.0	4.0	4.0
Lane Grp Cap (vph)	441	1079	850	619	1053		645	1743	542	210	1760	765
v/s Ratio Prot	c0.08	c0.24		0.05	0.10		c0.08	c0.19		0.01	0.13	
v/s Ratio Perm			0.07						0.16			0.01
v/c Ratio	0.62	0.77	0.24	0.43	0.32		0.64	0.54	0.47	0.14	0.48	0.05
Uniform Delay, d1	54.5	41.7	34.4	53.5	35.8		54.6	35.1	34.0	58.7	40.1	35.3
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.8	3.5	0.1	0.2	0.2		1.6	0.4	0.9	0.1	0.3	0.0
Delay (s)	56.3	45.2	34.5	53.7	35.9		56.2	35.5	34.9	58.8	40.4	35.3
Level of Service	E	D	C	D	D		E	D	C	E	D	D
Approach Delay (s)		43.8			43.7			39.9			40.2	
Approach LOS		D			D			D			D	

Intersection Summary			
HCM 2000 Control Delay	41.6	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.67		
Actuated Cycle Length (s)	132.1	Sum of lost time (s)	22.0
Intersection Capacity Utilization	82.2%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
15: Tassajara Rd & I-580 WB Ramps

BART to Livermore Extension Project
2025 BART + INP + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↔↔		↔↔		↑↑	↔		↑↑↔	↔
Traffic Volume (vph)	0	0	0	486	0	236	0	1341	643	0	1156	614
Future Volume (vph)	0	0	0	486	0	236	0	1341	643	0	1156	614
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0		4.0		4.0	4.0		4.0	4.0
Lane Util. Factor				0.97		0.88		0.95	1.00		0.86	0.86
Frt				1.00		0.85		1.00	0.85		0.98	0.85
Flt Protected				0.95		1.00		1.00	1.00		1.00	1.00
Satd. Flow (prot)				3433		2787		3539	1583		4693	1362
Flt Permitted				0.95		1.00		1.00	1.00		1.00	1.00
Satd. Flow (perm)				3433		2787		3539	1583		4693	1362
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	528	0	257	0	1458	699	0	1257	667
RTOR Reduction (vph)	0	0	0	0	0	44	0	0	275	0	40	170
Lane Group Flow (vph)	0	0	0	528	0	213	0	1458	424	0	1450	264
Turn Type				Perm		Perm		NA	Perm		NA	Perm
Protected Phases								2			6	
Permitted Phases				8		8			2			6
Actuated Green, G (s)				13.6		13.6		33.4	33.4		33.4	33.4
Effective Green, g (s)				13.6		13.6		33.4	33.4		33.4	33.4
Actuated g/C Ratio				0.25		0.25		0.61	0.61		0.61	0.61
Clearance Time (s)				4.0		4.0		4.0	4.0		4.0	4.0
Vehicle Extension (s)				3.0		3.0		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)				848		689		2149	961		2849	827
v/s Ratio Prot								c0.41			0.31	
v/s Ratio Perm				c0.15		0.08			0.27			0.19
v/c Ratio				0.62		0.31		0.68	0.44		0.51	0.32
Uniform Delay, d1				18.4		16.9		7.2	5.8		6.1	5.3
Progression Factor				1.00		1.00		1.00	1.00		1.00	1.00
Incremental Delay, d2				1.4		0.3		1.7	1.5		0.7	1.0
Delay (s)				19.8		17.1		9.0	7.3		6.8	6.3
Level of Service				B		B		A	A		A	A
Approach Delay (s)		0.0			19.0			8.4			6.7	
Approach LOS		A			B			A			A	

Intersection Summary			
HCM 2000 Control Delay	9.4	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.66		
Actuated Cycle Length (s)	55.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	57.6%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 16: Santa Rita Rd & I-580 EB Ramps/Pimilco Dr

BART to Livermore Extension Project
 2025 BART + INP + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	388	90	234	143	0	315	0	1177	178	318	949	0
Future Volume (vph)	388	90	234	143	0	315	0	1177	178	318	949	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0		4.0		4.0		4.0	4.0	
Lane Util. Factor	0.97	1.00	1.00	0.97		0.88		0.86		1.00	0.95	
Frt	1.00	1.00	0.85	1.00		0.85		0.98		1.00	1.00	
Flt Protected	0.95	1.00	1.00	0.95		1.00		1.00		0.95	1.00	
Satd. Flow (prot)	3433	1863	1583	3433		2787		6282		1770	3539	
Flt Permitted	0.95	1.00	1.00	0.95		1.00		1.00		0.95	1.00	
Satd. Flow (perm)	3433	1863	1583	3433		2787		6282		1770	3539	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	422	98	254	155	0	342	0	1279	193	346	1032	0
RTOR Reduction (vph)	0	0	94	0	0	34	0	22	0	0	0	0
Lane Group Flow (vph)	422	98	160	155	0	308	0	1450	0	346	1032	0
Turn Type	Perm	NA	Perm	Prot		pm+ov		NA		Prot	NA	Perm
Protected Phases		4		3		1		2		1	6	
Permitted Phases	4		4			3						6
Actuated Green, G (s)	19.6	19.6	19.6	7.9		34.4		40.0		26.5	70.5	
Effective Green, g (s)	19.6	19.6	19.6	7.9		34.4		40.0		26.5	70.5	
Actuated g/C Ratio	0.18	0.18	0.18	0.07		0.31		0.36		0.24	0.64	
Clearance Time (s)	4.0	4.0	4.0	4.0		4.0		4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0		3.0		3.0		3.0	3.0	
Lane Grp Cap (vph)	611	331	282	246		871		2284		426	2268	
v/s Ratio Prot		0.05		c0.05		0.09		c0.23		c0.20	0.29	
v/s Ratio Perm	c0.12		0.10			0.03						
v/c Ratio	0.69	0.30	0.57	0.63		0.35		0.64		0.81	0.46	
Uniform Delay, d1	42.4	39.2	41.3	49.6		29.2		29.0		39.4	10.0	
Progression Factor	1.00	1.00	1.00	1.00		1.00		1.00		1.00	1.00	
Incremental Delay, d2	3.4	0.5	2.6	5.2		0.2		1.4		11.2	0.7	
Delay (s)	45.7	39.7	44.0	54.8		29.5		30.3		50.6	10.7	
Level of Service	D	D	D	D		C		C		D	B	
Approach Delay (s)		44.4			37.4			30.3			20.7	
Approach LOS		D			D			C			C	

Intersection Summary		
HCM 2000 Control Delay	30.6	HCM 2000 Level of Service C
HCM 2000 Volume to Capacity ratio	0.70	
Actuated Cycle Length (s)	110.0	Sum of lost time (s) 16.0
Intersection Capacity Utilization	59.8%	ICU Level of Service B
Analysis Period (min)	15	

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 17: Santa Rita Rd & Valley Ave

BART to Livermore Extension Project
 2025 BART + INP + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	350	477	115	130	310	768	156	796	138	1019	1120	244
Future Volume (vph)	350	477	115	130	310	768	156	796	138	1019	1120	244
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.97	0.95		0.97	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.98		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	3433	3461		3433	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	3433	3461		3433	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	380	518	125	141	337	835	170	865	150	1108	1217	265
RTOR Reduction (vph)	0	0	103	0	0	0	0	14	0	0	0	133
Lane Group Flow (vph)	380	518	22	141	337	835	170	1001	0	1108	1217	132
Turn Type	Prot	NA	Perm	Prot	NA	Free	Prot	NA		Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1		6
Permitted Phases			4			Free						6
Actuated Green, G (s)	11.0	17.4	17.4	9.0	15.4	99.4	8.7	27.0		30.0	48.3	48.3
Effective Green, g (s)	11.0	17.4	17.4	9.0	15.4	99.4	8.7	27.0		30.0	48.3	48.3
Actuated g/C Ratio	0.11	0.18	0.18	0.09	0.15	1.00	0.09	0.27		0.30	0.49	0.49
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	379	619	277	160	548	1583	300	940		1036	1719	769
v/s Ratio Prot	c0.11	c0.15		0.08	0.10		0.05	c0.29		c0.32	0.34	
v/s Ratio Perm			0.01			c0.53						0.08
v/c Ratio	1.00	0.84	0.08	0.88	0.61	0.53	0.57	1.07		1.07	0.71	0.17
Uniform Delay, d1	44.2	39.6	34.3	44.7	39.2	0.0	43.5	36.2		34.7	20.0	14.3
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	46.9	9.6	0.1	39.0	2.1	1.3	2.4	48.3		48.5	1.4	0.1
Delay (s)	91.1	49.2	34.4	83.7	41.3	1.3	46.0	84.5		83.2	21.4	14.4
Level of Service	F	D	C	F	D	A	D	F		F	C	B
Approach Delay (s)		63.0			20.4			79.0			47.1	
Approach LOS		E			C			E			D	

Intersection Summary

HCM 2000 Control Delay	50.2	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	1.04		
Actuated Cycle Length (s)	99.4	Sum of lost time (s)	16.0
Intersection Capacity Utilization	89.2%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
18: Bernal Ave/Valley Ave & Stanley Blvd

BART to Livermore Extension Project
2025 BART + INP + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↑↑	↖	↖↗	↑↔	↖	↖	↑↑	↖	↖↗	↑↔	
Traffic Volume (vph)	204	838	59	102	234	343	86	327	302	822	552	120
Future Volume (vph)	204	838	59	102	234	343	86	327	302	822	552	120
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	0.97	0.95	1.00	0.97	0.91	0.91	1.00	0.95	1.00	0.97	0.95	
Frt	1.00	1.00	0.85	1.00	0.94	0.85	1.00	1.00	0.85	1.00	0.97	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	3433	3539	1583	3433	3183	1441	1770	3539	1583	3433	3445	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	3433	3539	1583	3433	3183	1441	1770	3539	1583	3433	3445	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	222	911	64	111	254	373	93	355	328	893	600	130
RTOR Reduction (vph)	0	0	40	0	114	52	0	0	168	0	20	0
Lane Group Flow (vph)	222	911	24	111	315	146	93	355	160	893	710	0
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	
Protected Phases	7	4	5	3	8	1	5	2		1	6	
Permitted Phases			4			8			2			
Actuated Green, G (s)	9.4	25.2	32.6	4.0	19.8	44.9	7.4	15.7	15.7	25.1	33.4	
Effective Green, g (s)	9.4	25.2	32.6	4.0	19.8	44.9	7.4	15.7	15.7	25.1	33.4	
Actuated g/C Ratio	0.11	0.29	0.38	0.05	0.23	0.52	0.09	0.18	0.18	0.29	0.39	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	375	1037	673	159	732	819	152	646	288	1001	1337	
v/s Ratio Prot	c0.06	c0.26	0.00	0.03	0.10	0.05	0.05	0.10		c0.26	c0.21	
v/s Ratio Perm			0.01			0.05			0.10			
v/c Ratio	0.59	0.88	0.04	0.70	0.43	0.18	0.61	0.55	0.55	0.89	0.53	
Uniform Delay, d1	36.5	28.9	16.8	40.4	28.3	10.8	37.9	31.9	32.0	29.2	20.3	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	2.5	8.6	0.0	12.6	0.4	0.1	7.1	1.0	2.3	10.1	0.4	
Delay (s)	39.0	37.5	16.8	53.0	28.7	10.9	45.0	32.9	34.3	39.3	20.7	
Level of Service	D	D	B	D	C	B	D	C	C	D	C	
Approach Delay (s)		36.7			27.6			34.9			30.9	
Approach LOS		D			C			C			C	

Intersection Summary

HCM 2000 Control Delay	32.7	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.82		
Actuated Cycle Length (s)	86.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	75.3%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
19: Fallon Rd & Dublin Blvd

BART to Livermore Extension Project
2025 BART + INP + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↑↑↑	↖↗	↖↗↘	↑↑↑	↖	↖↗	↑↑↑	↖↗	↖↗	↑↑↑	↖
Traffic Volume (vph)	197	481	394	48	17	55	195	642	150	96	601	26
Future Volume (vph)	197	481	394	48	17	55	195	642	150	96	601	26
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.3	5.3	5.3	4.0	4.0	4.0	5.3	4.9	4.9	5.3	4.9	4.9
Lane Util. Factor	0.97	0.91	0.88	0.94	0.91	1.00	0.97	0.91	0.88	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3090	4577	2508	4491	4577	1425	3090	4577	2508	3090	4577	1425
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3090	4577	2508	4491	4577	1425	3090	4577	2508	3090	4577	1425
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	214	523	428	52	18	60	212	698	163	104	653	28
RTOR Reduction (vph)	0	0	131	0	0	57	0	0	105	0	0	20
Lane Group Flow (vph)	214	523	297	52	18	3	212	698	58	104	653	8
Turn Type	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	5	2	3	1	6		3	8		7	NA	4
Permitted Phases			2			6			8			4
Actuated Green, G (s)	16.2	16.9	26.5	3.0	3.7	3.7	9.6	24.6	24.6	5.7	20.7	20.7
Effective Green, g (s)	16.2	16.9	26.5	3.0	3.7	3.7	9.6	24.6	24.6	5.7	20.7	20.7
Actuated g/C Ratio	0.23	0.24	0.38	0.04	0.05	0.05	0.14	0.35	0.35	0.08	0.30	0.30
Clearance Time (s)	5.3	5.3	5.3	4.0	4.0	4.0	5.3	4.9	4.9	5.3	4.9	4.9
Vehicle Extension (s)	2.0	4.0	2.0	2.0	2.0	2.0	2.0	4.0	4.0	2.0	4.0	4.0
Lane Grp Cap (vph)	718	1109	953	193	242	75	425	1615	885	252	1359	423
v/s Ratio Prot	c0.07	c0.11	0.04	0.01	0.00		c0.07	c0.15		0.03	0.14	
v/s Ratio Perm			0.08			0.00			0.02			0.01
v/c Ratio	0.30	0.47	0.31	0.27	0.07	0.04	0.50	0.43	0.07	0.41	0.48	0.02
Uniform Delay, d1	22.1	22.6	15.2	32.3	31.4	31.3	27.8	17.2	14.9	30.4	20.1	17.3
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.1	0.4	0.1	0.3	0.0	0.1	0.3	0.3	0.0	0.4	0.4	0.0
Delay (s)	22.1	23.0	15.3	32.6	31.4	31.4	28.2	17.5	15.0	30.8	20.5	17.4
Level of Service	C	C	B	C	C	C	C	B	B	C	C	B
Approach Delay (s)		20.0			31.9			19.2			21.7	
Approach LOS		C			C			B			C	

Intersection Summary		
HCM 2000 Control Delay	20.6	HCM 2000 Level of Service C
HCM 2000 Volume to Capacity ratio	0.48	
Actuated Cycle Length (s)	69.7	Sum of lost time (s) 19.5
Intersection Capacity Utilization	46.1%	ICU Level of Service A
Analysis Period (min)	15	

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 20: El Charro Rd/Fallon Rd & I-580 WB Ramps

BART to Livermore Extension Project
 2025 BART + INP + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↖	↖	↖↖		↖	↖		↗↗	↖
Traffic Volume (vph)	0	0	0	274	0	444	0	666	245	0	857	372
Future Volume (vph)	0	0	0	274	0	444	0	666	245	0	857	372
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0	4.0	4.0		4.0	4.0		4.0	4.0
Lane Util. Factor				0.95	0.95	0.88		0.95	0.95		0.95	1.00
Frt				1.00	1.00	0.85		0.99	0.85		1.00	0.85
Flt Protected				0.95	0.95	1.00		1.00	1.00		1.00	1.00
Satd. Flow (prot)				1681	1681	2787		1760	1504		3539	1583
Flt Permitted				0.95	0.95	1.00		1.00	1.00		1.00	1.00
Satd. Flow (perm)				1681	1681	2787		1760	1504		3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	298	0	483	0	724	266	0	932	404
RTOR Reduction (vph)	0	0	0	0	0	350	0	2	80	0	0	135
Lane Group Flow (vph)	0	0	0	152	146	133	0	749	159	0	932	269
Turn Type				Perm	NA	Perm		NA	Perm		NA	Perm
Protected Phases					8			2			6	
Permitted Phases				8		8			2			6
Actuated Green, G (s)				10.9	10.9	10.9		36.6	36.6		36.6	36.6
Effective Green, g (s)				10.4	10.4	10.4		36.6	36.6		36.6	36.6
Actuated g/C Ratio				0.19	0.19	0.19		0.67	0.67		0.67	0.67
Clearance Time (s)				3.5	3.5	3.5		4.0	4.0		4.0	4.0
Vehicle Extension (s)				2.0	2.0	2.0		2.0	2.0		2.0	2.0
Lane Grp Cap (vph)				317	317	526		1171	1000		2355	1053
v/s Ratio Prot								c0.43			0.26	
v/s Ratio Perm				c0.09	0.09	0.05			0.11			0.17
v/c Ratio				0.48	0.46	0.25		0.64	0.16		0.40	0.26
Uniform Delay, d1				19.9	19.8	19.0		5.4	3.4		4.2	3.7
Progression Factor				1.00	1.00	1.00		1.03	2.28		1.00	1.00
Incremental Delay, d2				0.4	0.4	0.1		2.5	0.3		0.5	0.6
Delay (s)				20.3	20.2	19.1		8.0	8.2		4.7	4.3
Level of Service				C	C	B		A	A		A	A
Approach Delay (s)		0.0			19.5			8.0			4.6	
Approach LOS		A			B			A			A	

Intersection Summary			
HCM 2000 Control Delay	9.4	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.60		
Actuated Cycle Length (s)	55.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	62.2%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 21: El Charro Rd & I-580 EB Ramps

BART to Livermore Extension Project
 2025 BART + INP + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔↔		↔↔					↕↕	↔		↕↕	↔
Traffic Volume (vph)	321	0	357	0	0	0	0	916	281	0	870	0
Future Volume (vph)	321	0	357	0	0	0	0	916	281	0	870	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0					4.0	4.0		4.0	
Lane Util. Factor	0.97		0.88					0.91	0.91		0.91	
Frt	1.00		0.85					0.99	0.85		1.00	
Flt Protected	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (prot)	3433		2787					3372	1441		3390	
Flt Permitted	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (perm)	3433		2787					3372	1441		3390	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	349	0	388	0	0	0	0	996	305	0	946	0
RTOR Reduction (vph)	0	0	185	0	0	0	0	4	87	0	0	0
Lane Group Flow (vph)	349	0	204	0	0	0	0	1029	181	0	946	0
Turn Type	Prot		Perm					NA	Perm		NA	Perm
Protected Phases	4							2			6	
Permitted Phases			4						2			6
Actuated Green, G (s)	9.9		9.9					37.1	37.1		37.1	
Effective Green, g (s)	9.9		9.9					37.1	37.1		37.1	
Actuated g/C Ratio	0.18		0.18					0.67	0.67		0.67	
Clearance Time (s)	4.0		4.0					4.0	4.0		4.0	
Vehicle Extension (s)	2.0		2.0					3.0	3.0		3.0	
Lane Grp Cap (vph)	617		501					2274	972		2286	
v/s Ratio Prot	c0.10							c0.31			0.28	
v/s Ratio Perm			0.07						0.13			
v/c Ratio	0.57		0.41					0.45	0.19		0.41	
Uniform Delay, d1	20.6		19.9					4.2	3.3		4.0	
Progression Factor	1.00		1.00					1.00	1.00		0.73	
Incremental Delay, d2	0.7		0.2					0.7	0.4		0.5	
Delay (s)	21.3		20.1					4.8	3.8		3.5	
Level of Service	C		C					A	A		A	
Approach Delay (s)		20.7			0.0			4.6			3.5	
Approach LOS		C			A			A			A	

Intersection Summary

HCM 2000 Control Delay	8.2	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.48		
Actuated Cycle Length (s)	55.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	44.1%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 22: El Charro Rd & Stoneridge Dr/Jack London Blvd

BART to Livermore Extension Project
 2025 BART + INP + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔↔↔	↑↑	↗	↖	↑↑	↗↗	↖	↑↑		↖↖↖	↑	↗↗
Traffic Volume (vph)	257	541	3	3	316	480	2	34	3	744	26	139
Future Volume (vph)	257	541	3	3	316	480	2	34	3	744	26	139
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	0.94	0.95	1.00	1.00	0.95	0.88	1.00	0.95		0.94	1.00	0.88
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	4491	3185	1425	1593	3185	2508	1593	3149		4491	1676	2508
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	4491	3185	1425	1593	3185	2508	1593	3149		4491	1676	2508
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	279	588	3	3	343	522	2	37	3	809	28	151
RTOR Reduction (vph)	0	0	2	0	0	240	0	3	0	0	0	92
Lane Group Flow (vph)	279	588	1	3	343	282	2	37	0	809	28	59
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Prot	NA		Prot	NA	Perm
Protected Phases	7	4		3	8	1	5	2		1	6	
Permitted Phases			4			8						6
Actuated Green, G (s)	8.5	23.2	23.2	0.7	15.4	36.1	0.7	6.3		20.7	26.3	26.3
Effective Green, g (s)	8.5	23.2	23.2	0.7	15.4	36.1	0.7	6.3		20.7	26.3	26.3
Actuated g/C Ratio	0.13	0.35	0.35	0.01	0.23	0.54	0.01	0.09		0.31	0.39	0.39
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	570	1104	494	16	733	1353	16	296		1389	658	985
v/s Ratio Prot	0.06	c0.18		0.00	c0.11	0.06	0.00	c0.01		c0.18	0.02	
v/s Ratio Perm			0.00			0.05						0.02
v/c Ratio	0.49	0.53	0.00	0.19	0.47	0.21	0.12	0.13		0.58	0.04	0.06
Uniform Delay, d1	27.2	17.5	14.3	32.8	22.2	8.0	32.8	27.8		19.5	12.5	12.6
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	0.7	0.5	0.0	5.6	0.5	0.1	3.5	0.2		0.6	0.0	0.0
Delay (s)	27.8	18.0	14.3	38.4	22.7	8.1	36.3	28.0		20.1	12.6	12.6
Level of Service	C	B	B	D	C	A	D	C		C	B	B
Approach Delay (s)		21.1			13.9			28.4			18.7	
Approach LOS		C			B			C			B	

Intersection Summary

HCM 2000 Control Delay	18.1	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.52		
Actuated Cycle Length (s)	66.9	Sum of lost time (s)	16.0
Intersection Capacity Utilization	52.3%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 24: Airway Blvd/Driveway & N Canyons Pkwy

BART to Livermore Extension Project
 2025 BART + INP + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑	↗	↘↗	↑	↗		↖	↗↖		↕	
Traffic Volume (vph)	0	393	281	825	66	0	55	0	744	0	0	0
Future Volume (vph)	0	393	281	825	66	0	55	0	744	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0	4.0	4.0			4.4	4.0			
Lane Util. Factor		0.95	1.00	0.97	1.00			1.00	0.88			
Frt		1.00	0.85	1.00	1.00			1.00	0.85			
Flt Protected		1.00	1.00	0.95	1.00			0.95	1.00			
Satd. Flow (prot)		3539	1583	3433	1863			1770	2787			
Flt Permitted		1.00	1.00	0.95	1.00			0.95	1.00			
Satd. Flow (perm)		3539	1583	3433	1863			1770	2787			
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	427	305	897	72	0	60	0	809	0	0	0
RTOR Reduction (vph)	0	0	220	0	0	0	0	0	370	0	0	0
Lane Group Flow (vph)	0	427	85	897	72	0	0	60	439	0	0	0
Turn Type		NA	Perm	Prot	NA	Perm	Split	NA	pm+ov			
Protected Phases		2		1	6		8	8	1	4	4	
Permitted Phases			2			6			8			
Actuated Green, G (s)		14.0	14.0	23.1	43.1			4.0	27.1			
Effective Green, g (s)		16.0	16.0	25.1	45.1			3.8	31.1			
Actuated g/C Ratio		0.28	0.28	0.44	0.79			0.07	0.54			
Clearance Time (s)		6.0	6.0	6.0	6.0			4.2	6.0			
Vehicle Extension (s)		3.0	3.0	3.0	3.0			3.0	3.0			
Lane Grp Cap (vph)		988	442	1503	1466			117	1707			
v/s Ratio Prot		c0.12		c0.26	0.04			0.03	c0.11			
v/s Ratio Perm			0.05						0.04			
v/c Ratio		0.43	0.19	0.60	0.05			0.51	0.26			
Uniform Delay, d1		16.9	15.7	12.2	1.4			25.9	7.0			
Progression Factor		1.00	1.00	1.00	1.00			1.00	1.00			
Incremental Delay, d2		0.3	0.2	0.6	0.0			3.8	0.1			
Delay (s)		17.2	15.9	12.9	1.4			29.6	7.0			
Level of Service		B	B	B	A			C	A			
Approach Delay (s)		16.7			12.0			8.6			0.0	
Approach LOS		B			B			A			A	

Intersection Summary

HCM 2000 Control Delay	12.2	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.59		
Actuated Cycle Length (s)	57.3	Sum of lost time (s)	16.4
Intersection Capacity Utilization	48.1%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
25: Airway Blvd & I-580 WB Ramps

BART to Livermore Extension Project
2025 BART + INP + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↙	↖	↗		↑↑	↗		↑↑↑	
Traffic Volume (vph)	0	0	0	73	28	151	0	698	401	0	586	640
Future Volume (vph)	0	0	0	73	28	151	0	698	401	0	586	640
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0	4.0	4.0		4.0	4.0		4.0	
Lane Util. Factor				0.95	0.95	0.88		0.95	1.00		0.91	
Frt				1.00	1.00	0.85		1.00	0.85		0.92	
Flt Protected				0.95	0.97	1.00		1.00	1.00		1.00	
Satd. Flow (prot)				1681	1722	2787		3539	1583		4687	
Flt Permitted				0.95	0.97	1.00		1.00	1.00		1.00	
Satd. Flow (perm)				1681	1722	2787		3539	1583		4687	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	79	30	164	0	759	436	0	637	696
RTOR Reduction (vph)	0	0	0	0	0	149	0	0	84	0	135	0
Lane Group Flow (vph)	0	0	0	42	67	15	0	759	352	0	1198	0
Turn Type				Split	NA	Perm		NA	Perm		NA	
Protected Phases				8	8			2			6	
Permitted Phases						8			2			
Actuated Green, G (s)				7.5	7.5	7.5		63.2	63.2		63.2	
Effective Green, g (s)				7.5	7.5	7.5		64.5	64.5		64.5	
Actuated g/C Ratio				0.09	0.09	0.09		0.81	0.81		0.81	
Clearance Time (s)				4.0	4.0	4.0		5.3	5.3		5.3	
Vehicle Extension (s)				2.0	2.0	2.0		4.0	4.0		4.0	
Lane Grp Cap (vph)				157	161	261		2853	1276		3778	
v/s Ratio Prot				0.02	c0.04			0.21			c0.26	
v/s Ratio Perm						0.01			0.22			
v/c Ratio				0.27	0.42	0.06		0.27	0.28		0.32	
Uniform Delay, d1				33.7	34.2	33.0		1.9	1.9		2.0	
Progression Factor				1.00	1.00	1.00		0.47	1.42		1.00	
Incremental Delay, d2				0.3	0.6	0.0		0.2	0.5		0.2	
Delay (s)				34.0	34.8	33.1		1.1	3.2		2.2	
Level of Service				C	C	C		A	A		A	
Approach Delay (s)		0.0			33.6			1.9			2.2	
Approach LOS		A			C			A			A	

Intersection Summary		
HCM 2000 Control Delay	5.1	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.33	A
Actuated Cycle Length (s)	80.0	Sum of lost time (s)
Intersection Capacity Utilization	35.7%	8.0
Analysis Period (min)	15	ICU Level of Service
		A

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
26: Airway Blvd & I-580 EB Ramps/Kitty Hawk Rd

BART to Livermore Extension Project
2025 BART + INP + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↑	↖	↖	↑	↖	↖	↕↔		↖	↕↔	
Traffic Volume (vph)	572	208	323	61	93	128	49	442	168	92	238	302
Future Volume (vph)	572	208	323	61	93	128	49	442	168	92	238	302
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.4	4.4	4.4	4.0	4.0		4.0	4.0	
Lane Util. Factor	0.97	1.00	1.00	1.00	1.00	1.00	1.00	0.95		1.00	0.95	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.96		1.00	0.92	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	3433	1863	1583	1770	1863	1583	1770	3393		1770	3243	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	3433	1863	1583	1770	1863	1583	1770	3393		1770	3243	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	622	226	351	66	101	139	53	480	183	100	259	328
RTOR Reduction (vph)	0	0	244	0	0	111	0	63	0	0	227	0
Lane Group Flow (vph)	622	226	107	66	101	28	53	600	0	100	360	0
Turn Type	Split	NA	Perm	Split	NA	pm+ov	Prot	NA		Prot	NA	
Protected Phases	7	7		8	8	1	5	2		1	6	
Permitted Phases			7			8						
Actuated Green, G (s)	24.5	24.5	24.5	11.2	11.2	16.7	4.2	21.5		5.5	23.3	
Effective Green, g (s)	24.5	24.5	24.5	10.8	10.8	15.9	3.7	22.8		5.5	24.6	
Actuated g/C Ratio	0.31	0.31	0.31	0.14	0.14	0.20	0.05	0.29		0.07	0.31	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	3.5	5.3		4.0	5.3	
Vehicle Extension (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	3.5		2.0	4.0	
Lane Grp Cap (vph)	1051	570	484	238	251	314	81	967		121	997	
v/s Ratio Prot	c0.18	0.12		0.04	c0.05	0.01	0.03	c0.18		c0.06	0.11	
v/s Ratio Perm			0.07			0.01						
v/c Ratio	0.59	0.40	0.22	0.28	0.40	0.09	0.65	0.62		0.83	0.36	
Uniform Delay, d1	23.5	21.9	20.7	31.1	31.6	26.1	37.5	24.8		36.8	21.6	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.03	0.80	
Incremental Delay, d2	0.6	0.2	0.1	0.2	0.4	0.0	13.5	3.0		32.6	1.0	
Delay (s)	24.1	22.1	20.7	31.3	32.0	26.2	51.1	27.8		70.5	18.1	
Level of Service	C	C	C	C	C	C	D	C		E	B	
Approach Delay (s)		22.7			29.2			29.6			25.8	
Approach LOS		C			C			C			C	

Intersection Summary

HCM 2000 Control Delay	25.8	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.59		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	16.8
Intersection Capacity Utilization	64.3%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 27: Collier Canyon Rd & N Canyons Pkwy/Portola Ave

BART to Livermore Extension Project
 2025 BART + INP + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↖↖	↖↗	↖↗	↖↖	↖↗	↖↗	↖↖		↖↗	↖↖	↖↗
Traffic Volume (vph)	396	618	32	19	249	34	30	6	178	127	3	100
Future Volume (vph)	396	618	32	19	249	34	30	6	178	127	3	100
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	5.2	5.2
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.86		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	1770	1593		1770	1863	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	1770	1593		1770	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	430	672	35	21	271	37	33	7	193	138	3	109
RTOR Reduction (vph)	0	0	22	0	0	26	0	136	0	0	0	74
Lane Group Flow (vph)	430	672	13	21	271	11	33	64	0	138	3	35
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA		Prot	NA	Perm
Protected Phases	1	6		5	2		3	8		7	NA	4
Permitted Phases			6			2						4
Actuated Green, G (s)	5.2	21.1	21.1	0.5	16.4	16.4	1.4	17.2		4.2	20.4	20.4
Effective Green, g (s)	5.2	22.4	22.4	0.5	17.7	17.7	1.4	18.2		4.2	19.8	19.8
Actuated g/C Ratio	0.08	0.37	0.37	0.01	0.29	0.29	0.02	0.30		0.07	0.32	0.32
Clearance Time (s)	4.0	5.3	5.3	4.0	5.3	5.3	4.0	5.0		4.0	4.6	4.6
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	291	1293	578	14	1021	457	40	472		121	601	511
v/s Ratio Prot	c0.13	c0.19		0.01	0.08		0.02	c0.04		c0.08	0.00	
v/s Ratio Perm			0.01			0.01						c0.02
v/c Ratio	1.48	0.52	0.02	1.50	0.27	0.02	0.82	0.14		1.14	0.00	0.07
Uniform Delay, d1	28.0	15.2	12.4	30.4	16.8	15.6	29.8	15.8		28.5	14.1	14.4
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	232.6	0.4	0.0	427.8	0.1	0.0	76.6	0.1		124.5	0.0	0.1
Delay (s)	260.7	15.6	12.5	458.2	16.9	15.6	106.4	15.9		153.1	14.1	14.4
Level of Service	F	B	B	F	B	B	F	B		F	B	B
Approach Delay (s)		108.2			45.0			28.7			91.0	
Approach LOS		F			D			C			F	

Intersection Summary

HCM 2000 Control Delay	85.8	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	0.54		
Actuated Cycle Length (s)	61.3	Sum of lost time (s)	17.2
Intersection Capacity Utilization	52.1%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
28: Isabel Ave/Campus Hill Dr & Portola Ave

BART to Livermore Extension Project
2025 BART + INP + Garage PM





















Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↘	↑↑	↗↗	↘↘↘	↑↑		↘↘	↑↑	↗	↘	↑↑	↗
Traffic Volume (vph)	5	501	440	279	176	164	179	423	72	145	340	2
Future Volume (vph)	5	501	440	279	176	164	179	423	72	145	340	2
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	5.8	5.8
Lane Util. Factor	1.00	0.95	0.88	0.94	0.95		0.97	0.95	1.00	1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	0.93		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3539	2787	4990	3283		3433	3539	1583	1770	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	3539	2787	4990	3283		3433	3539	1583	1770	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	5	545	478	303	191	178	195	460	78	158	370	2
RTOR Reduction (vph)	0	0	324	0	103	0	0	0	61	0	0	2
Lane Group Flow (vph)	5	545	154	303	266	0	195	460	17	158	370	0
Turn Type	Prot	NA	Perm	Prot	NA		Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4						2			6
Actuated Green, G (s)	1.4	24.7	24.7	9.3	32.6		9.3	16.3	16.3	11.9	19.3	19.3
Effective Green, g (s)	1.4	26.0	26.0	9.3	33.9		9.3	17.6	17.6	11.9	18.4	18.4
Actuated g/C Ratio	0.02	0.32	0.32	0.12	0.42		0.12	0.22	0.22	0.15	0.23	0.23
Clearance Time (s)	4.0	5.3	5.3	4.0	5.3		4.0	5.3	5.3	4.0	4.9	4.9
Vehicle Extension (s)	2.0	3.0	3.0	2.0	3.0		2.0	3.0	3.0	2.0	3.0	3.0
Lane Grp Cap (vph)	30	1138	896	574	1377		395	770	344	260	805	360
v/s Ratio Prot	0.00	c0.15		c0.06	0.08		0.06	c0.13		c0.09	c0.10	
v/s Ratio Perm			0.06						0.01			0.00
v/c Ratio	0.17	0.48	0.17	0.53	0.19		0.49	0.60	0.05	0.61	0.46	0.00
Uniform Delay, d1	39.1	22.0	19.7	33.7	14.8		33.5	28.4	25.0	32.3	26.9	24.1
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.0	0.3	0.1	0.4	0.1		0.4	1.3	0.1	2.7	0.4	0.0
Delay (s)	40.1	22.3	19.8	34.1	14.9		33.9	29.7	25.0	35.0	27.3	24.1
Level of Service	D	C	B	C	B		C	C	C	D	C	C
Approach Delay (s)		21.2			23.5			30.3			29.6	
Approach LOS		C			C			C			C	

Intersection Summary		
HCM 2000 Control Delay	25.5	HCM 2000 Level of Service C
HCM 2000 Volume to Capacity ratio	0.55	
Actuated Cycle Length (s)	80.8	Sum of lost time (s) 17.8
Intersection Capacity Utilization	54.4%	ICU Level of Service A
Analysis Period (min)	15	

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 29: Isabel Ave & I-580 WB Ramps

BART to Livermore Extension Project
 2025 BART + INP + Garage PM

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations													
Traffic Volume (vph)	0	0	0	688	0	251	0	364	0	0	580	443	
Future Volume (vph)	0	0	0	688	0	251	0	364	0	0	580	443	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)				4.0		4.0		5.6			5.6	5.6	
Lane Util. Factor				0.97		1.00		0.95			0.95	1.00	
Frt				1.00		0.85		1.00			1.00	0.85	
Flt Protected				0.95		1.00		1.00			1.00	1.00	
Satd. Flow (prot)				3433		1583		3539			3539	1583	
Flt Permitted				0.95		1.00		1.00			1.00	1.00	
Satd. Flow (perm)				3433		1583		3539			3539	1583	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	
Adj. Flow (vph)	0	0	0	748	0	273	0	396	0	0	630	482	
RTOR Reduction (vph)	0	0	0	0	0	195	0	0	0	0	0	254	
Lane Group Flow (vph)	0	0	0	748	0	78	0	396	0	0	630	228	
Turn Type				Prot		Prot		NA	Free		NA	Prot	
Protected Phases				8		8		2			6	6	
Permitted Phases									Free				
Actuated Green, G (s)				11.5		11.5		19.7			19.7	19.7	
Effective Green, g (s)				11.5		11.5		18.9			18.9	18.9	
Actuated g/C Ratio				0.29		0.29		0.47			0.47	0.47	
Clearance Time (s)				4.0		4.0		4.8			4.8	4.8	
Vehicle Extension (s)				2.0		2.0		4.0			4.0	4.0	
Lane Grp Cap (vph)				986		455		1672			1672	747	
v/s Ratio Prot				c0.22		0.05		0.11			c0.18	0.14	
v/s Ratio Perm													
v/c Ratio				0.76		0.17		0.24			0.38	0.30	
Uniform Delay, d1				13.0		10.7		6.3			6.8	6.5	
Progression Factor				1.00		1.00		0.86			1.00	1.00	
Incremental Delay, d2				3.0		0.1		0.3			0.2	0.3	
Delay (s)				16.0		10.7		5.7			7.0	6.8	
Level of Service				B		B		A			A	A	
Approach Delay (s)		0.0			14.6			5.7			6.9		
Approach LOS		A			B			A			A		
Intersection Summary													
HCM 2000 Control Delay			9.8		HCM 2000 Level of Service						A		
HCM 2000 Volume to Capacity ratio			0.52										
Actuated Cycle Length (s)			40.0		Sum of lost time (s)						9.6		
Intersection Capacity Utilization			43.7%		ICU Level of Service						A		
Analysis Period (min)			15										
c Critical Lane Group													

HCM Signalized Intersection Capacity Analysis
30: Isabel Ave & I-580 EB Ramps

BART to Livermore Extension Project
2025 BART + INP + Garage PM



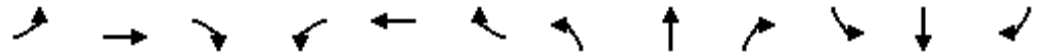
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	227	0	300	0	0	0	0	652	1258	0	47	602
Future Volume (vph)	227	0	300	0	0	0	0	652	1258	0	47	602
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0					4.0	4.0		4.0	4.0
Lane Util. Factor	0.97		0.88					0.95	1.00		0.95	1.00
Frt	1.00		0.85					1.00	0.85		1.00	0.85
Flt Protected	0.95		1.00					1.00	1.00		1.00	1.00
Satd. Flow (prot)	3433		2787					3539	1583		3539	1583
Flt Permitted	0.95		1.00					1.00	1.00		1.00	1.00
Satd. Flow (perm)	3433		2787					3539	1583		3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	247	0	326	0	0	0	0	709	1367	0	51	654
RTOR Reduction (vph)	0	0	284	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	247	0	42	0	0	0	0	709	1367	0	51	654
Turn Type	Prot		Perm					NA	Free		NA	Free
Protected Phases	4							2			6	
Permitted Phases			4						Free			Free
Actuated Green, G (s)	10.2		10.2					60.8	80.0		60.8	80.0
Effective Green, g (s)	10.2		10.2					61.8	80.0		61.8	80.0
Actuated g/C Ratio	0.13		0.13					0.77	1.00		0.77	1.00
Clearance Time (s)	4.0		4.0					5.0			5.0	
Vehicle Extension (s)	2.0		2.0					4.0			4.0	
Lane Grp Cap (vph)	437		355					2733	1583		2733	1583
v/s Ratio Prot	0.07							0.20			0.01	
v/s Ratio Perm			0.01						c0.86			0.41
v/c Ratio	0.57		0.12					0.26	0.86		0.02	0.41
Uniform Delay, d1	32.8		30.9					2.6	0.0		2.1	0.0
Progression Factor	1.00		1.00					1.00	1.00		1.03	1.00
Incremental Delay, d2	1.0		0.1					0.1	6.5		0.0	0.7
Delay (s)	33.8		31.0					2.7	6.5		2.2	0.7
Level of Service	C		C					A	A		A	A
Approach Delay (s)		32.2			0.0			5.2			0.8	
Approach LOS		C			A			A			A	

Intersection Summary			
HCM 2000 Control Delay	8.9	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.96		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	31.2%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
31: Isabel Ave & Airway Blvd

BART to Livermore Extension Project
2025 BART + INP + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	8	110	543	203	141	818	395	1152	148	387	1352	15
Future Volume (vph)	8	110	543	203	141	818	395	1152	148	387	1352	15
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.2	5.2	5.6	5.2	5.2	5.6	4.0	4.0	4.0	4.0	4.0	5.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.91	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	1863	1583	1770	1863	1583	1770	5085	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	1863	1583	1770	1863	1583	1770	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	9	120	590	221	153	889	429	1252	161	421	1470	16
RTOR Reduction (vph)	0	0	67	0	0	49	0	0	105	0	0	11
Lane Group Flow (vph)	9	120	523	221	153	840	429	1252	56	421	1470	5
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4	5	3	8	1	5	2		1	NA	6
Permitted Phases			4			8			2			6
Actuated Green, G (s)	0.8	14.8	32.8	10.4	24.4	41.4	18.0	31.4	31.4	17.0	30.4	30.4
Effective Green, g (s)	0.2	14.2	31.6	9.8	23.8	40.2	19.0	32.4	32.4	18.0	31.4	30.4
Actuated g/C Ratio	0.00	0.15	0.34	0.11	0.26	0.43	0.20	0.35	0.35	0.19	0.34	0.33
Clearance Time (s)	4.6	4.6	5.0	4.6	4.6	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	5.0	5.0	3.0	5.0	5.0
Lane Grp Cap (vph)	3	285	539	186	477	685	362	1775	552	665	1720	518
v/s Ratio Prot	0.01	0.06	0.18	c0.12	0.08	c0.22	c0.24	0.25		0.12	c0.29	
v/s Ratio Perm			0.15			0.31			0.04			0.00
v/c Ratio	3.00	0.42	0.97	1.19	0.32	1.23	1.19	0.71	0.10	0.63	0.85	0.01
Uniform Delay, d1	46.3	35.6	30.1	41.5	28.0	26.3	36.9	26.1	20.4	34.4	28.6	21.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1456.2	1.0	30.8	125.8	0.4	114.6	107.9	1.6	0.2	2.0	4.8	0.0
Delay (s)	1502.5	36.6	60.9	167.3	28.3	140.9	144.8	27.7	20.6	36.3	33.4	21.1
Level of Service	F	D	E	F	C	F	F	C	C	D	C	C
Approach Delay (s)		74.9			131.9			54.3			33.9	
Approach LOS		E			F			D			C	

Intersection Summary		
HCM 2000 Control Delay	67.2	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	1.13	E
Actuated Cycle Length (s)	92.8	Sum of lost time (s)
Intersection Capacity Utilization	88.6%	20.0
Analysis Period (min)	15	ICU Level of Service
		E

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
32: Isabel Ave & Jack London Blvd

BART to Livermore Extension Project
2025 BART + INP + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↕	↖	↗	↕	↖	↖↗	↕	↖	↖↗	↕	↖
Traffic Volume (vph)	121	704	235	199	148	301	88	1085	354	526	1286	65
Future Volume (vph)	121	704	235	199	148	301	88	1085	354	526	1286	65
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.97	0.91	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	3433	5085	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	3433	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	132	765	255	216	161	327	96	1179	385	572	1398	71
RTOR Reduction (vph)	0	0	133	0	0	43	0	0	146	0	0	43
Lane Group Flow (vph)	132	765	122	216	161	284	96	1179	239	572	1398	28
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8	1	5	2		1	NA	6
Permitted Phases			4			8			2			6
Actuated Green, G (s)	8.2	27.8	27.8	10.7	30.3	45.0	4.0	31.0	31.0	14.7	41.7	41.7
Effective Green, g (s)	8.2	27.8	27.8	10.7	30.3	45.0	4.0	31.0	31.0	14.7	41.7	41.7
Actuated g/C Ratio	0.08	0.26	0.26	0.10	0.29	0.43	0.04	0.29	0.29	0.14	0.40	0.40
Clearance Time (s)	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	267	933	417	179	1017	755	130	1495	465	478	2011	626
v/s Ratio Prot	0.04	c0.22		c0.12	0.05	0.05	0.03	c0.23		c0.17	0.27	
v/s Ratio Perm			0.08			0.13			0.15			0.02
v/c Ratio	0.49	0.82	0.29	1.21	0.16	0.38	0.74	0.79	0.51	1.20	0.70	0.04
Uniform Delay, d1	46.6	36.4	31.0	47.4	28.0	20.6	50.2	34.2	30.9	45.4	26.6	19.6
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.4	5.7	0.4	133.8	0.1	0.3	19.5	2.8	1.0	107.4	1.1	0.0
Delay (s)	48.1	42.2	31.4	181.2	28.1	20.9	69.7	37.0	31.9	152.7	27.6	19.6
Level of Service	D	D	C	F	C	C	E	D	C	F	C	B
Approach Delay (s)		40.4			71.7			37.7			62.4	
Approach LOS		D			E			D			E	

Intersection Summary			
HCM 2000 Control Delay	51.7	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.92		
Actuated Cycle Length (s)	105.4	Sum of lost time (s)	21.2
Intersection Capacity Utilization	84.1%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 33: Isabel Ave Connector & Stanley Blvd



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑	↑	↑↓	↑↑	↑↓	↑↓
Traffic Volume (vph)	1682	450	230	553	155	380
Future Volume (vph)	1682	450	230	553	155	380
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	3.8	4.0	4.0	4.0	2.5
Lane Util. Factor	0.95	1.00	0.97	0.95	0.97	0.88
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	3539	1583	3433	3539	3433	2787
Flt Permitted	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (perm)	3539	1583	3433	3539	3433	2787
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	1828	489	250	601	168	413
RTOR Reduction (vph)	0	1	0	0	0	8
Lane Group Flow (vph)	1828	488	250	601	168	405
Turn Type	NA	pm+ov	Prot	NA	Prot	pm+ov
Protected Phases	2	8	1	6	8	1
Permitted Phases		2				8
Actuated Green, G (s)	43.8	52.4	6.0	53.8	8.6	14.6
Effective Green, g (s)	45.5	55.8	6.0	55.5	10.1	17.6
Actuated g/C Ratio	0.62	0.76	0.08	0.75	0.14	0.24
Clearance Time (s)	5.7	5.5	4.0	5.7	5.5	4.0
Vehicle Extension (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Grp Cap (vph)	2187	1200	279	2668	471	666
v/s Ratio Prot	c0.52	0.06	c0.07	0.17	0.05	c0.06
v/s Ratio Perm		0.25				0.08
v/c Ratio	0.84	0.41	0.90	0.23	0.36	0.61
Uniform Delay, d1	11.1	3.1	33.5	2.7	28.8	24.9
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	2.8	0.1	27.9	0.0	0.2	1.1
Delay (s)	13.9	3.2	61.4	2.7	29.0	26.0
Level of Service	B	A	E	A	C	C
Approach Delay (s)	11.6			19.9	26.9	
Approach LOS	B			B	C	

Intersection Summary

HCM 2000 Control Delay	15.9	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.80		
Actuated Cycle Length (s)	73.6	Sum of lost time (s)	12.0
Intersection Capacity Utilization	69.7%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 34: Murrieta Blvd/Driveway & Portola Ave

BART to Livermore Extension Project
 2025 BART + INP + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗		↖	↗		↖	↗	↗		↗	
Traffic Volume (vph)	0	1622	143	209	827	1	135	5	335	5	6	0
Future Volume (vph)	0	1622	143	209	827	1	135	5	335	5	6	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.8		4.0	5.8		5.2	5.2	5.2		4.0	
Lane Util. Factor		0.95		1.00	0.95		0.95	0.95	1.00		1.00	
Frt		0.99		1.00	1.00		1.00	1.00	0.85		1.00	
Flt Protected		1.00		0.95	1.00		0.95	0.96	1.00		0.98	
Satd. Flow (prot)		3496		1770	3539		1681	1691	1583		1825	
Flt Permitted		1.00		0.95	1.00		0.95	0.96	1.00		0.98	
Satd. Flow (perm)		3496		1770	3539		1681	1691	1583		1825	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	1763	155	227	899	1	147	5	364	5	7	0
RTOR Reduction (vph)	0	5	0	0	0	0	0	0	160	0	0	0
Lane Group Flow (vph)	0	1913	0	227	900	0	76	76	204	0	12	0
Turn Type	Prot	NA		Prot	NA		Split	NA	Perm		Split	NA
Protected Phases	5	2		1	6		8	8			4	4
Permitted Phases									8			
Actuated Green, G (s)		61.1		13.1	78.2		17.3	17.3	17.3		1.4	
Effective Green, g (s)		60.2		13.1	77.3		16.7	16.7	16.7		1.4	
Actuated g/C Ratio		0.55		0.12	0.70		0.15	0.15	0.15		0.01	
Clearance Time (s)		4.9		4.0	4.9		4.6	4.6	4.6		4.0	
Vehicle Extension (s)		2.0		2.0	2.0		2.0	2.0	2.0		2.0	
Lane Grp Cap (vph)		1906		210	2477		254	255	239		23	
v/s Ratio Prot		c0.55		c0.13	0.25		0.05	0.04			c0.01	
v/s Ratio Perm									c0.13			
v/c Ratio		1.00		1.08	0.36		0.30	0.30	0.85		0.52	
Uniform Delay, d1		25.1		48.7	6.7		41.6	41.6	45.6		54.2	
Progression Factor		1.00		1.00	1.00		1.00	1.00	1.00		1.00	
Incremental Delay, d2		21.5		85.3	0.0		0.2	0.2	23.4		9.5	
Delay (s)		46.6		134.0	6.7		41.9	41.9	69.0		63.7	
Level of Service		D		F	A		D	D	E		E	
Approach Delay (s)		46.6			32.3			61.0			63.7	
Approach LOS		D			C			E			E	

Intersection Summary

HCM 2000 Control Delay	44.2	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.98		
Actuated Cycle Length (s)	110.4	Sum of lost time (s)	19.0
Intersection Capacity Utilization	86.0%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
35: Murrieta Blvd & Jack London Blvd

BART to Livermore Extension Project
2025 BART + INP + Garage PM



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	275	861	448	241	280	127
Future Volume (vph)	275	861	448	241	280	127
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00	1.00	0.95	0.91	
Frt	1.00	0.85	1.00	1.00	0.95	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1770	1583	1770	3539	4847	
Flt Permitted	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	1770	1583	1770	3539	4847	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	299	936	487	262	304	138
RTOR Reduction (vph)	0	478	0	0	95	0
Lane Group Flow (vph)	299	458	487	262	347	0
Turn Type	Prot	Perm	Prot	NA	NA	
Protected Phases	4		5	2	6	
Permitted Phases		4				
Actuated Green, G (s)	25.1	25.1	24.4	39.9	11.5	
Effective Green, g (s)	25.1	25.1	24.4	39.9	11.5	
Actuated g/C Ratio	0.34	0.34	0.33	0.55	0.16	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	608	544	591	1934	763	
v/s Ratio Prot	0.17		c0.28	0.07	c0.07	
v/s Ratio Perm		c0.29				
v/c Ratio	0.49	0.84	0.82	0.14	0.45	
Uniform Delay, d1	18.9	22.1	22.3	8.1	27.9	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.6	11.3	9.1	0.0	0.4	
Delay (s)	19.5	33.5	31.4	8.1	28.3	
Level of Service	B	C	C	A	C	
Approach Delay (s)	30.1			23.3	28.3	
Approach LOS	C			C	C	

Intersection Summary

HCM 2000 Control Delay	27.7	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.76		
Actuated Cycle Length (s)	73.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	68.2%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
36: Murrieta Blvd & Stanley Blvd

BART to Livermore Extension Project
2025 BART + INP + Garage PM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	276	1070	528	44	546	158	230	374	18	245	345	182
Future Volume (vph)	276	1070	528	44	546	158	230	374	18	245	345	182
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.9	4.9	4.0	4.9	4.9	4.9	4.9		4.9	4.9	4.0
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.97	0.95		1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	3433	3514		1770	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	3433	3514		1770	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	300	1163	574	48	593	172	250	407	20	266	375	198
RTOR Reduction (vph)	0	0	304	0	0	70	0	4	0	0	0	151
Lane Group Flow (vph)	300	1163	270	48	593	102	250	423	0	266	375	47
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Prot	NA		Prot	NA	Perm
Protected Phases	7	4		3	8	1	5	2		1	6	
Permitted Phases			4			8						6
Actuated Green, G (s)	10.8	29.2	29.2	2.2	20.6	34.4	9.9	14.0		13.8	17.9	17.9
Effective Green, g (s)	10.8	28.3	28.3	2.2	19.7	32.6	9.0	13.1		12.9	17.0	17.9
Actuated g/C Ratio	0.14	0.38	0.38	0.03	0.26	0.43	0.12	0.17		0.17	0.23	0.24
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	493	1331	595	51	927	789	410	612		303	800	376
v/s Ratio Prot	c0.09	c0.33		0.03	0.17	0.02	0.07	c0.12		c0.15	c0.11	
v/s Ratio Perm			0.17			0.04						0.03
v/c Ratio	0.61	0.87	0.45	0.94	0.64	0.13	0.61	0.69		0.88	0.47	0.13
Uniform Delay, d1	30.2	21.8	17.6	36.4	24.6	12.8	31.4	29.1		30.4	25.2	22.5
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	2.1	6.6	0.6	103.8	1.5	0.1	2.6	3.4		23.6	0.4	0.2
Delay (s)	32.3	28.4	18.2	140.2	26.1	12.9	34.0	32.5		54.0	25.6	22.7
Level of Service	C	C	B	F	C	B	C	C		D	C	C
Approach Delay (s)		26.1			30.0			33.1			33.9	
Approach LOS		C			C			C			C	
Intersection Summary												
HCM 2000 Control Delay			29.4	HCM 2000 Level of Service						C		
HCM 2000 Volume to Capacity ratio			0.83									
Actuated Cycle Length (s)			75.2	Sum of lost time (s)						18.7		
Intersection Capacity Utilization			73.0%	ICU Level of Service						C		
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis
 37: Livermore Ave & I-580 WB Ramps

BART to Livermore Extension Project
 2025 BART + INP + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↖	↔		↗	↑			↕	
Traffic Volume (vph)	0	0	0	379	18	22	704	465	0	0	112	0
Future Volume (vph)	0	0	0	379	18	22	704	465	0	0	112	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)					4.0		4.0	4.0			4.0	
Lane Util. Factor					0.95		0.97	1.00			0.95	
Frt					0.99		1.00	1.00			1.00	
Flt Protected					0.96		0.95	1.00			1.00	
Satd. Flow (prot)					1680		3433	1863			3539	
Flt Permitted					0.96		0.95	1.00			1.00	
Satd. Flow (perm)					1680		3433	1863			3539	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	412	20	24	765	505	0	0	122	0
RTOR Reduction (vph)	0	0	0	0	4	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	0	452	0	765	505	0	0	122	0
Turn Type				Split	NA		Prot	NA			NA	
Protected Phases				8	8		5	2			6	
Permitted Phases												
Actuated Green, G (s)					20.0		14.4	30.3			12.4	
Effective Green, g (s)					20.0		13.9	32.0			14.1	
Actuated g/C Ratio					0.33		0.23	0.53			0.23	
Clearance Time (s)					4.0		3.5	5.7			5.7	
Vehicle Extension (s)					2.0		2.0	2.5			2.5	
Lane Grp Cap (vph)					560		795	993			831	
v/s Ratio Prot					c0.27		c0.22	c0.27			0.03	
v/s Ratio Perm												
v/c Ratio					0.81		0.96	0.51			0.15	
Uniform Delay, d1					18.2		22.8	9.0			18.2	
Progression Factor					1.00		1.00	1.00			1.00	
Incremental Delay, d2					7.9		22.8	1.9			0.4	
Delay (s)					26.1		45.6	10.8			18.6	
Level of Service					C		D	B			B	
Approach Delay (s)		0.0			26.1			31.8			18.6	
Approach LOS		A			C			C			B	

Intersection Summary			
HCM 2000 Control Delay	29.5	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.78		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	98.4%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 38: Livermore Ave & I-580 EB Ramps































Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕	↗					↕		↘	↕	
Traffic Volume (vph)	219	18	1321	0	0	0	0	992	470	104	385	0
Future Volume (vph)	219	18	1321	0	0	0	0	992	470	104	385	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0					4.0		4.0	4.0	
Lane Util. Factor		0.95	0.95					0.95		1.00	0.95	
Frt		0.89	0.85					0.95		1.00	1.00	
Flt Protected		0.99	1.00					1.00		0.95	1.00	
Satd. Flow (prot)		1556	1504					3368		1770	3539	
Flt Permitted		0.99	1.00					1.00		0.95	1.00	
Satd. Flow (perm)		1556	1504					3368		1770	3539	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	238	20	1436	0	0	0	0	1078	511	113	418	0
RTOR Reduction (vph)	0	109	286	0	0	0	0	63	0	0	0	0
Lane Group Flow (vph)	0	853	446	0	0	0	0	1526	0	113	418	0
Turn Type	Prot	NA	Perm					NA		Prot	NA	
Protected Phases	7	4						2		1	6	
Permitted Phases			4									
Actuated Green, G (s)		30.0	30.0					41.0		7.0	51.0	
Effective Green, g (s)		30.0	30.0					42.0		6.0	52.0	
Actuated g/C Ratio		0.33	0.33					0.47		0.07	0.58	
Clearance Time (s)		4.0	4.0					5.0		3.0	5.0	
Vehicle Extension (s)		2.0	2.0					2.5		2.0	2.5	
Lane Grp Cap (vph)		518	501					1571		118	2044	
v/s Ratio Prot								c0.45		c0.06	0.12	
v/s Ratio Perm		0.55	0.30									
v/c Ratio		1.65	0.89					0.97		0.96	0.20	
Uniform Delay, d1		30.0	28.4					23.4		41.9	9.1	
Progression Factor		1.00	1.00					1.00		1.00	1.00	
Incremental Delay, d2		299.3	17.3					16.9		68.4	0.2	
Delay (s)		329.3	45.7					40.3		110.3	9.3	
Level of Service		F	D					D		F	A	
Approach Delay (s)		206.8			0.0			40.3			30.8	
Approach LOS		F			A			D			C	

Intersection Summary		
HCM 2000 Control Delay	112.9	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	1.23	F
Actuated Cycle Length (s)	90.0	Sum of lost time (s)
Intersection Capacity Utilization	98.4%	12.0
Analysis Period (min)	15	ICU Level of Service
		F

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 39: Livermore Ave & Portola Ave

BART to Livermore Extension Project
 2025 BART + INP + Garage PM

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations	 	 			 			 			 		
Traffic Volume (vph)	881	711	183	15	359	68	199	582	76	230	873	543	
Future Volume (vph)	881	711	183	15	359	68	199	582	76	230	873	543	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)	4.0	4.0	5.3	4.0	4.0	5.3	4.0	5.8		4.0	5.8	4.9	
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	1.00	0.95		1.00	0.95	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.98		1.00	1.00	0.85	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	1770	3478		1770	3539	1583	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	1770	3478		1770	3539	1583	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	
Adj. Flow (vph)	958	773	199	16	390	74	216	633	83	250	949	590	
RTOR Reduction (vph)	0	0	112	0	0	63	0	7	0	0	0	53	
Lane Group Flow (vph)	958	773	87	16	390	11	216	709	0	250	949	537	
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA		Prot	NA	pm+ov	
Protected Phases	3	8		7	4		1	6		5	2	3	
Permitted Phases			8			4						2	
Actuated Green, G (s)	38.5	56.1	56.1	1.9	19.5	19.5	16.0	32.8		19.0	35.8	74.3	
Effective Green, g (s)	38.5	57.4	56.1	1.9	20.8	19.5	16.0	31.9		19.0	34.9	72.5	
Actuated g/C Ratio	0.30	0.45	0.44	0.01	0.16	0.15	0.12	0.25		0.15	0.27	0.57	
Clearance Time (s)	4.0	5.3	5.3	4.0	5.3	5.3	4.0	4.9		4.0	4.9	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	
Lane Grp Cap (vph)	1032	1587	693	26	575	241	221	866		262	964	896	
v/s Ratio Prot	c0.28	0.22		0.01	c0.11		0.12	0.20		c0.14	c0.27	0.18	
v/s Ratio Perm			0.06			0.01						0.16	
v/c Ratio	0.93	0.49	0.13	0.62	0.68	0.05	0.98	0.82		0.95	0.98	0.60	
Uniform Delay, d1	43.4	24.9	21.4	62.7	50.5	46.3	55.8	45.3		54.1	46.3	18.2	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	
Incremental Delay, d2	13.8	0.2	0.1	36.3	3.2	0.1	53.5	6.1		42.8	25.0	1.1	
Delay (s)	57.2	25.1	21.5	99.0	53.6	46.4	109.3	51.4		96.9	71.3	19.3	
Level of Service	E	C	C	F	D	D	F	D		F	E	B	
Approach Delay (s)		40.7			54.0			64.8			57.7		
Approach LOS		D			D			E			E		
Intersection Summary													
HCM 2000 Control Delay			52.3									HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio			0.92										
Actuated Cycle Length (s)			128.0									Sum of lost time (s)	18.7
Intersection Capacity Utilization			85.0%									ICU Level of Service	E
Analysis Period (min)			15										
c Critical Lane Group													

HCM Signalized Intersection Capacity Analysis
40: First St/Springtown Blvd & I-580 WB Ramps

BART to Livermore Extension Project
2025 BART + INP + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations			↗↗			↗	↗↗	↑			↖↖	↗
Traffic Volume (vph)	0	0	261	0	0	0	387	1515	0	0	422	201
Future Volume (vph)	0	0	261	0	0	0	387	1515	0	0	422	201
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)			4.0				4.0	4.0			5.0	5.0
Lane Util. Factor			0.88				0.97	1.00			0.95	1.00
Frt			0.85				1.00	1.00			1.00	0.85
Flt Protected			1.00				0.95	1.00			1.00	1.00
Satd. Flow (prot)			2787				3433	1863			3539	1583
Flt Permitted			1.00				0.95	1.00			1.00	1.00
Satd. Flow (perm)			2787				3433	1863			3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	284	0	0	0	421	1647	0	0	459	218
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	36
Lane Group Flow (vph)	0	0	284	0	0	0	421	1647	0	0	459	182
Turn Type			Over			Free	Prot	NA			NA	Perm
Protected Phases			5				5	2			6	
Permitted Phases						Free						6
Actuated Green, G (s)			36.7				36.7	80.0			35.3	35.3
Effective Green, g (s)			36.2				36.2	80.0			34.8	34.8
Actuated g/C Ratio			0.45				0.45	1.00			0.43	0.43
Clearance Time (s)			3.5				3.5	4.0			4.5	4.5
Vehicle Extension (s)			2.0				2.0	0.2			4.0	4.0
Lane Grp Cap (vph)			1261				1553	1863			1539	688
v/s Ratio Prot			0.10				0.12	c0.88			0.13	
v/s Ratio Perm												0.12
v/c Ratio			0.23				0.27	0.88			0.30	0.27
Uniform Delay, d1			13.4				13.7	0.0			14.7	14.4
Progression Factor			1.00				0.97	1.00			1.00	1.00
Incremental Delay, d2			0.0				0.0	2.0			0.1	0.3
Delay (s)			13.4				13.3	2.0			14.8	14.7
Level of Service			B				B	A			B	B
Approach Delay (s)		13.4			0.0			4.3			14.8	
Approach LOS		B			A			A			B	

Intersection Summary

HCM 2000 Control Delay	7.5	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	1.00		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	83.1%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

41: First St & I-580 EB Ramps

BART to Livermore Extension Project
2025 BART + INP + Garage PM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations		↔	↔↔					↕↕	↔	↔	↕↕		
Traffic Volume (vph)	554	4	783	0	0	0	0	1404	461	81	880	0	
Future Volume (vph)	554	4	783	0	0	0	0	1404	461	81	880	0	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)		4.0	4.0					5.0	5.0	4.0	5.0		
Lane Util. Factor		1.00	0.88					0.95	1.00	1.00	0.95		
Frt		1.00	0.85					1.00	0.85	1.00	1.00		
Flt Protected		0.95	1.00					1.00	1.00	0.95	1.00		
Satd. Flow (prot)		1775	2787					3539	1583	1770	3539		
Flt Permitted		0.95	1.00					1.00	1.00	0.95	1.00		
Satd. Flow (perm)		1775	2787					3539	1583	1770	3539		
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	
Adj. Flow (vph)	602	4	851	0	0	0	0	1526	501	88	957	0	
RTOR Reduction (vph)	0	0	127	0	0	0	0	0	276	0	0	0	
Lane Group Flow (vph)	0	606	724	0	0	0	0	1526	225	88	957	0	
Turn Type	Perm	NA	Perm					NA	Perm	Prot	NA		
Protected Phases		4						2		1	6		
Permitted Phases	4		4						2				
Actuated Green, G (s)		27.5	27.5					36.5	36.5	5.0	44.5		
Effective Green, g (s)		27.0	27.0					36.0	36.0	4.0	44.0		
Actuated g/C Ratio		0.34	0.34					0.45	0.45	0.05	0.55		
Clearance Time (s)		3.5	3.5					4.5	4.5	3.0	4.5		
Vehicle Extension (s)		2.5	2.5					4.0	4.0	2.0	4.0		
Lane Grp Cap (vph)		599	940					1592	712	88	1946		
v/s Ratio Prot								c0.43		c0.05	0.27		
v/s Ratio Perm		0.34	0.26						0.14				
v/c Ratio		1.01	0.77					0.96	0.32	1.00	0.49		
Uniform Delay, d1		26.5	23.7					21.3	14.1	38.0	11.1		
Progression Factor		1.00	1.00					1.00	1.00	0.89	0.62		
Incremental Delay, d2		39.7	3.7					14.6	1.2	95.7	0.9		
Delay (s)		66.2	27.4					35.9	15.3	129.5	7.7		
Level of Service		E	C					D	B	F	A		
Approach Delay (s)		43.5			0.0			30.8			18.0		
Approach LOS		D			A			C			B		
Intersection Summary													
HCM 2000 Control Delay			32.0									HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio			0.98										
Actuated Cycle Length (s)			80.0									Sum of lost time (s)	13.0
Intersection Capacity Utilization			85.0%									ICU Level of Service	E
Analysis Period (min)			15										

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
42: 1st St & Mines Rd

BART to Livermore Extension Project
2025 BART + INP + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↘	↑	↗	↘↗	↑	↗	↘	↑↑↑	↗	↘↗	↑↑↑	↗
Traffic Volume (vph)	67	240	59	440	275	387	69	1470	910	390	936	48
Future Volume (vph)	67	240	59	440	275	387	69	1470	910	390	936	48
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	0.97	1.00	1.00	1.00	0.91	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	1863	1583	3433	1863	1583	1770	5085	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	1863	1583	3433	1863	1583	1770	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	73	261	64	478	299	421	75	1598	989	424	1017	52
RTOR Reduction (vph)	0	0	54	0	0	33	0	0	166	0	0	25
Lane Group Flow (vph)	73	261	10	478	299	388	75	1598	823	424	1017	27
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8	1	5	2		1	NA	6
Permitted Phases			4			8			2			6
Actuated Green, G (s)	5.6	16.8	16.8	14.0	25.2	38.2	7.7	51.8	51.8	13.0	57.1	57.1
Effective Green, g (s)	5.6	16.8	16.8	14.0	25.2	38.2	7.7	51.8	51.8	13.0	57.1	57.1
Actuated g/C Ratio	0.05	0.15	0.15	0.13	0.23	0.34	0.07	0.46	0.46	0.12	0.51	0.51
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	88	280	238	430	420	598	122	2360	734	399	2601	809
v/s Ratio Prot	0.04	c0.14		c0.14	0.16	0.08	0.04	0.31		c0.12	0.20	
v/s Ratio Perm			0.01			0.17			c0.52			0.02
v/c Ratio	0.83	0.93	0.04	1.11	0.71	0.65	0.61	0.68	1.12	1.06	0.39	0.03
Uniform Delay, d1	52.5	46.8	40.5	48.8	39.9	31.0	50.5	23.4	29.9	49.3	16.6	13.5
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	44.8	36.0	0.1	77.3	5.6	2.4	8.9	0.8	72.0	62.6	0.1	0.0
Delay (s)	97.3	82.8	40.6	126.1	45.5	33.5	59.4	24.1	101.9	111.9	16.7	13.6
Level of Service	F	F	D	F	D	C	E	C	F	F	B	B
Approach Delay (s)		78.7			73.4			54.0			43.7	
Approach LOS		E			E			D			D	



















Intersection Summary

HCM 2000 Control Delay	57.1	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.08		
Actuated Cycle Length (s)	111.6	Sum of lost time (s)	16.0
Intersection Capacity Utilization	90.1%	ICU Level of Service	E
Analysis Period (min)	15		



















c Critical Lane Group

HCM Unsignalized Intersection Capacity Analysis
43: Vasco Rd & I-580 WB Ramps

BART to Livermore Extension Project
2025 BART + INP + Garage PM


























												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	0	0	88	0	1848	0	0	437	0
Future Volume (Veh/h)	0	0	0	0	0	88	0	1848	0	0	437	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	0	0	0	96	0	2009	0	0	475	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage (veh)												
Upstream signal (ft)											487	
pX, platoon unblocked												
vC, conflicting volume	1576	2484	475	2484	2484	1004	475			2009		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1576	2484	475	2484	2484	1004	475			2009		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	100	100	60	100			100		
cM capacity (veh/h)	44	29	536	15	29	240	1083			281		
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	SB 1	SB 2					
Volume Total	0	96	1004	1004	0	475	0					
Volume Left	0	0	0	0	0	0	0					
Volume Right	0	96	0	0	0	0	0					
cSH	1700	240	1700	1700	1700	1700	1700					
Volume to Capacity	0.00	0.40	0.59	0.59	0.00	0.28	0.00					
Queue Length 95th (ft)	0	45	0	0	0	0	0					
Control Delay (s)	0.0	29.7	0.0	0.0	0.0	0.0	0.0					
Lane LOS	A	D										
Approach Delay (s)	0.0	29.7	0.0			0.0						
Approach LOS	A	D										
Intersection Summary												
Average Delay			1.1									
Intersection Capacity Utilization			63.2%	ICU Level of Service	B							
Analysis Period (min)			15									

HCM Unsignalized Intersection Capacity Analysis
44: Vasco Rd & I-580 EB Ramps

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	0	0	0	0	2096	0	64	568	0
Future Volume (Veh/h)	0	0	0	0	0	0	0	2096	0	64	568	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	0	0	0	0	0	2278	0	70	617	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1896	3035	617	3035	3035	1139	617			2278		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1896	3035	617	3035	3035	1139	617			2278		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	100	100	100	100			68		
cM capacity (veh/h)	32	9	433	4	9	195	959			220		
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2						
Volume Total	0	0	1519	759	70	617						
Volume Left	0	0	0	0	70	0						
Volume Right	0	0	0	0	0	0						
cSH	1700	1700	1700	1700	220	1700						
Volume to Capacity	0.00	0.00	0.89	0.45	0.32	0.36						
Queue Length 95th (ft)	0	0	0	0	33	0						
Control Delay (s)	0.0	0.0	0.0	0.0	28.8	0.0						
Lane LOS	A	A			D							
Approach Delay (s)	0.0	0.0	0.0		2.9							
Approach LOS	A	A										
Intersection Summary												
Average Delay			0.7									
Intersection Capacity Utilization			61.3%	ICU Level of Service	B							
Analysis Period (min)			15									

HCM Signalized Intersection Capacity Analysis
45: Vasco Rd & East Ave

BART to Livermore Extension Project
2025 BART + INP + Garage PM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		 			 			 		 		
Traffic Volume (vph)	479	27	96	139	359	236	102	343	12	12	347	362
Future Volume (vph)	479	27	96	139	359	236	102	343	12	12	347	362
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	0.95		0.97	1.00	1.00
Frt	1.00	0.88		1.00	0.94		1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	3124		1770	3328		1770	3521		3433	1863	1583
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1770	3124		1770	3328		1770	3521		3433	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	521	29	104	151	390	257	111	373	13	13	377	393
RTOR Reduction (vph)	0	66	0	0	139	0	0	3	0	0	0	294
Lane Group Flow (vph)	521	67	0	151	508	0	111	383	0	13	377	99
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												6
Actuated Green, G (s)	24.0	30.5		9.5	16.0		6.0	26.0		0.8	20.8	20.8
Effective Green, g (s)	24.0	30.5		9.5	16.0		6.0	26.0		0.8	20.8	20.8
Actuated g/C Ratio	0.29	0.37		0.11	0.19		0.07	0.31		0.01	0.25	0.25
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	513	1150		203	643		128	1105		33	468	397
v/s Ratio Prot	c0.29	0.02		0.09	c0.15		c0.06	0.11		0.00	c0.20	
v/s Ratio Perm												0.06
v/c Ratio	1.02	0.06		0.74	0.79		0.87	0.35		0.39	0.81	0.25
Uniform Delay, d1	29.4	16.9		35.5	31.8		38.0	21.9		40.8	29.1	24.8
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	43.7	0.0		13.7	6.6		41.9	0.2		7.6	9.7	0.3
Delay (s)	73.1	16.9		49.2	38.4		79.9	22.1		48.3	38.9	25.1
Level of Service	E	B		D	D		E	C		D	D	C
Approach Delay (s)		61.7			40.4			35.0			32.1	
Approach LOS		E			D			C			C	

Intersection Summary

HCM 2000 Control Delay	42.1	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.88		
Actuated Cycle Length (s)	82.8	Sum of lost time (s)	16.0
Intersection Capacity Utilization	81.3%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Unsignalized Intersection Capacity Analysis
 46: I-580 WB Ramps & Northfront Rd/Northfront Road



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↻			↻	↻	↻
Traffic Volume (veh/h)	630	35	199	208	5	130
Future Volume (Veh/h)	630	35	199	208	5	130
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	685	38	216	226	5	141
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage (veh)						
Upstream signal (ft)	1007					
pX, platoon unblocked						
vC, conflicting volume			685	1362		704
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			685	1362		704
tC, single (s)			4.1	6.4		6.2
tC, 2 stage (s)						
tF (s)			2.2	3.5		3.3
p0 queue free %			76	96		68
cM capacity (veh/h)			908	124		437

Direction, Lane #	EB 1	WB 1	NB 1	NB 2
Volume Total	723	442	5	141
Volume Left	0	216	5	0
Volume Right	38	0	0	141
cSH	1700	908	124	437
Volume to Capacity	0.43	0.24	0.04	0.32
Queue Length 95th (ft)	0	23	3	34
Control Delay (s)	0.0	6.4	35.2	17.1
Lane LOS		A	E	C
Approach Delay (s)	0.0	6.4	17.7	
Approach LOS			C	

Intersection Summary			
Average Delay	4.1		
Intersection Capacity Utilization	70.6%	ICU Level of Service	C
Analysis Period (min)	15		

Intersection	
Intersection Delay, s/veh	13.7
Intersection LOS	B

Movement	EBU	EBL	EBT	WBU	WBT	WBR	SBU	SBL	SBR
Lane Configurations		↘	↕↕		↕	↘		↘↘	↘
Traffic Vol, veh/h	0	292	257	0	84	267	0	190	7
Future Vol, veh/h	0	292	257	0	84	267	0	190	7
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	317	279	0	91	290	0	207	8
Number of Lanes	0	1	2	0	1	1	0	2	1

Approach	EB	WB	SB
Opposing Approach	WB	EB	
Opposing Lanes	2	3	0
Conflicting Approach Left	SB		WB
Conflicting Lanes Left	3	0	2
Conflicting Approach Right		SB	EB
Conflicting Lanes Right	0	3	3
HCM Control Delay	14.7	13.3	11.9
HCM LOS	B	B	B

Lane	EBLn1	EBLn2	EBLn3	WBLn1	WBLn2	SBLn1	SBLn2	SBLn3
Vol Left, %	100%	0%	0%	0%	0%	100%	100%	0%
Vol Thru, %	0%	100%	100%	100%	0%	0%	0%	0%
Vol Right, %	0%	0%	0%	0%	100%	0%	0%	100%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	292	129	129	84	267	95	95	7
LT Vol	292	0	0	0	0	95	95	0
Through Vol	0	129	129	84	0	0	0	0
RT Vol	0	0	0	0	267	0	0	7
Lane Flow Rate	317	140	140	91	290	103	103	8
Geometry Grp	8	8	8	8	8	7	7	7
Degree of Util (X)	0.597	0.243	0.175	0.169	0.48	0.212	0.212	0.009
Departure Headway (Hd)	6.776	6.271	4.518	6.661	5.953	7.382	7.382	4.417
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cap	533	571	789	537	604	485	485	805
Service Time	4.531	4.025	2.272	4.421	3.713	5.14	5.14	2.172
HCM Lane V/C Ratio	0.595	0.245	0.177	0.169	0.48	0.212	0.212	0.01
HCM Control Delay	19.1	11	8.2	10.8	14.1	12.1	12.1	7.2
HCM Lane LOS	C	B	A	B	B	B	B	A
HCM 95th-tile Q	3.9	0.9	0.6	0.6	2.6	0.8	0.8	0

HCM Signalized Intersection Capacity Analysis
48: Greenville Rd & Northfront Road/Altamont Pass Road



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↗	↖	↑	↘	↗
Traffic Volume (vph)	609	146	1	51	362	1038
Future Volume (vph)	609	146	1	51	362	1038
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	1863	1583	1770	1863	1770	1583
Flt Permitted	1.00	1.00	0.10	1.00	0.95	1.00
Satd. Flow (perm)	1863	1583	191	1863	1770	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	662	159	1	55	393	1128
RTOR Reduction (vph)	0	65	0	0	0	28
Lane Group Flow (vph)	662	94	1	55	393	1100
Turn Type	NA	Perm	Perm	NA	Prot	Perm
Protected Phases	4			8	2	
Permitted Phases		4	8			2
Actuated Green, G (s)	39.0	39.0	39.0	39.0	73.0	73.0
Effective Green, g (s)	39.0	39.0	39.0	39.0	73.0	73.0
Actuated g/C Ratio	0.32	0.32	0.32	0.32	0.61	0.61
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	605	514	62	605	1076	962
v/s Ratio Prot	c0.36			0.03	0.22	
v/s Ratio Perm		0.06	0.01			c0.69
v/c Ratio	1.09	0.18	0.02	0.09	0.37	1.14
Uniform Delay, d1	40.5	29.1	27.5	28.2	11.8	23.5
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	65.0	0.2	0.1	0.1	0.2	77.0
Delay (s)	105.5	29.2	27.6	28.2	12.0	100.5
Level of Service	F	C	C	C	B	F
Approach Delay (s)	90.7			28.2	77.6	
Approach LOS	F			C	E	

Intersection Summary

HCM 2000 Control Delay	80.9	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.13		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	103.0%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
49: Greenville Rd & Southfront Rd



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	417	113	243	1017	67	80
Future Volume (vph)	417	113	243	1017	67	80
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.2	5.2	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.88	0.97	0.95	0.95	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	3433	2787	3433	3539	3539	1583
Flt Permitted	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (perm)	3433	2787	3433	3539	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	453	123	264	1105	73	87
RTOR Reduction (vph)	0	103	0	0	0	54
Lane Group Flow (vph)	453	21	264	1105	73	33
Turn Type	Prot	Perm	Prot	NA	NA	Perm
Protected Phases	8		1	6	2	
Permitted Phases		8				2
Actuated Green, G (s)	6.5	6.5	3.0	18.6	11.6	11.6
Effective Green, g (s)	5.9	5.9	3.0	20.3	13.3	13.3
Actuated g/C Ratio	0.17	0.17	0.08	0.57	0.38	0.38
Clearance Time (s)	4.6	4.6	4.0	5.7	5.7	5.7
Vehicle Extension (s)	5.0	5.0	6.0	2.5	2.5	2.5
Lane Grp Cap (vph)	572	464	290	2029	1329	594
v/s Ratio Prot	c0.13		c0.08	c0.31	0.02	
v/s Ratio Perm		0.01				0.02
v/c Ratio	0.79	0.04	0.91	0.54	0.05	0.06
Uniform Delay, d1	14.2	12.4	16.1	4.7	7.0	7.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	8.5	0.1	32.9	0.2	0.0	0.0
Delay (s)	22.6	12.5	48.9	4.9	7.1	7.1
Level of Service	C	B	D	A	A	A
Approach Delay (s)	20.5			13.4	7.1	
Approach LOS	C			B	A	

Intersection Summary

HCM 2000 Control Delay	14.9	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.72		
Actuated Cycle Length (s)	35.4	Sum of lost time (s)	13.2
Intersection Capacity Utilization	47.7%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
50: Greenville Rd & Patterson Pass Rd

BART to Livermore Extension Project
2025 BART + INP + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	44	537	60	4	13	8	65	396	259	423	204	51
Future Volume (vph)	44	537	60	4	13	8	65	396	259	423	204	51
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.98		1.00	0.94		1.00	0.94		1.00	0.97	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1835		1770	1753		1770	1752		1770	1807	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	1835		1770	1753		1770	1752		1770	1807	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	48	584	65	4	14	9	71	430	282	460	222	55
RTOR Reduction (vph)	0	4	0	0	7	0	0	19	0	0	7	0
Lane Group Flow (vph)	48	645	0	4	16	0	71	693	0	460	270	0
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												
Actuated Green, G (s)	4.7	34.0		0.8	30.1		7.6	41.9		25.0	59.3	
Effective Green, g (s)	4.7	34.0		0.8	30.1		7.6	41.9		25.0	59.3	
Actuated g/C Ratio	0.04	0.29		0.01	0.26		0.06	0.36		0.21	0.50	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	70	530		12	448		114	623		375	910	
v/s Ratio Prot	c0.03	c0.35		0.00	0.01		0.04	c0.40		c0.26	0.15	
v/s Ratio Perm												
v/c Ratio	0.69	1.22		0.33	0.04		0.62	1.11		1.23	0.30	
Uniform Delay, d1	55.8	41.9		58.2	32.9		53.7	37.9		46.4	17.0	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	24.3	114.3		15.7	0.0		10.1	70.8		123.5	0.8	
Delay (s)	80.1	156.2		73.9	32.9		63.8	108.7		169.8	17.9	
Level of Service	F	F		E	C		E	F		F	B	
Approach Delay (s)		150.9			39.0			104.6			112.7	
Approach LOS		F			D			F			F	

Intersection Summary

HCM 2000 Control Delay	120.9	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.18		
Actuated Cycle Length (s)	117.7	Sum of lost time (s)	16.0
Intersection Capacity Utilization	102.0%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
1: Dougherty Rd & Amador Valley Rd

BART to Livermore Extension Project
2025 DMU + INP + Garage AM



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	88	547	392	712	1793	135
Future Volume (vph)	88	547	392	712	1793	135
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5	5.7	5.7	
Lane Util. Factor	1.00	1.00	0.97	0.91	0.91	
Frt	1.00	0.85	1.00	1.00	0.99	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1770	1583	3433	5085	5032	
Flt Permitted	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	1770	1583	3433	5085	5032	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	96	595	426	774	1949	147
RTOR Reduction (vph)	0	190	0	0	9	0
Lane Group Flow (vph)	96	405	426	774	2087	0
Turn Type	Perm	Perm	Prot	NA	NA	
Protected Phases			5	2	6	
Permitted Phases	4	4				
Actuated Green, G (s)	25.2	25.2	12.3	56.0	39.2	
Effective Green, g (s)	25.2	25.2	12.3	56.0	39.2	
Actuated g/C Ratio	0.28	0.28	0.13	0.61	0.43	
Clearance Time (s)	4.5	4.5	4.5	5.7	5.7	
Vehicle Extension (s)	1.8	1.8	2.0	4.0	4.0	
Lane Grp Cap (vph)	488	436	461	3115	2158	
v/s Ratio Prot			c0.12	0.15	c0.41	
v/s Ratio Perm	0.05	c0.26				
v/c Ratio	0.20	0.93	0.92	0.25	0.97	
Uniform Delay, d1	25.3	32.2	39.1	8.1	25.5	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.1	25.5	23.9	0.1	12.6	
Delay (s)	25.4	57.7	63.0	8.1	38.0	
Level of Service	C	E	E	A	D	
Approach Delay (s)	53.2			27.6	38.0	
Approach LOS	D			C	D	

Intersection Summary

HCM 2000 Control Delay	37.5	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.95		
Actuated Cycle Length (s)	91.4	Sum of lost time (s)	14.7
Intersection Capacity Utilization	80.0%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

2: Dougherty Rd & Dublin Blvd

BART to Livermore Extension Project
2025 DMU + INP + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	39	364	414	268	620	349	674	1020	127	700	1776	78
Future Volume (vph)	39	364	414	268	620	349	674	1020	127	700	1776	78
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	6.0	5.0	5.0	5.5	5.0	5.0	5.5	5.0	5.0	5.5	
Lane Util. Factor	0.97	0.91	0.88	0.94	0.91	1.00	0.94	0.91	0.88	0.97	0.86	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	3433	5085	2787	4990	5085	1583	4990	5085	2787	3433	6367	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	3433	5085	2787	4990	5085	1583	4990	5085	2787	3433	6367	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	42	396	450	291	674	379	733	1109	138	761	1930	85
RTOR Reduction (vph)	0	0	41	0	0	98	0	0	81	0	4	0
Lane Group Flow (vph)	42	396	409	291	674	281	733	1109	57	761	2011	0
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	
Protected Phases	5	2	3	1	6	7	3	8	1	7	4	
Permitted Phases			2			6			8			
Actuated Green, G (s)	8.7	22.4	38.4	15.0	29.2	54.7	16.0	33.6	48.6	25.5	43.1	
Effective Green, g (s)	8.7	22.4	38.4	15.0	29.2	54.7	16.0	33.6	48.6	25.5	43.1	
Actuated g/C Ratio	0.07	0.19	0.33	0.13	0.25	0.46	0.14	0.28	0.41	0.22	0.37	
Clearance Time (s)	5.0	6.0	5.0	5.0	5.5	5.0	5.0	5.5	5.0	5.0	5.5	
Vehicle Extension (s)	2.0	4.5	2.0	2.0	4.5	2.0	2.0	4.5	2.0	2.0	4.5	
Lane Grp Cap (vph)	253	965	906	634	1258	733	676	1447	1147	741	2325	
v/s Ratio Prot	0.01	0.08	0.06	c0.06	c0.13	0.08	0.15	0.22	0.01	c0.22	c0.32	
v/s Ratio Perm			0.09			0.09			0.01			
v/c Ratio	0.17	0.41	0.45	0.46	0.54	0.38	1.08	0.77	0.05	1.03	0.86	
Uniform Delay, d1	51.2	42.0	31.5	47.7	38.5	20.6	51.0	38.6	20.8	46.2	34.7	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.1	0.5	0.1	0.2	0.7	0.1	59.7	2.8	0.0	40.1	3.9	
Delay (s)	51.4	42.5	31.6	47.9	39.2	20.8	110.7	41.4	20.8	86.4	38.6	
Level of Service	D	D	C	D	D	C	F	D	C	F	D	
Approach Delay (s)		37.4			35.9			65.6			51.7	
Approach LOS		D			D			E			D	

Intersection Summary

HCM 2000 Control Delay	50.8	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.81		
Actuated Cycle Length (s)	118.0	Sum of lost time (s)	21.5
Intersection Capacity Utilization	82.3%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
3: Dougherty Rd & I-580 WB Ramps

BART to Livermore Extension Project
2025 DMU + INP + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↔		↔		↑↑↑			↑↑↑	↔
Traffic Volume (vph)	0	0	0	391	0	658	0	1286	0	0	1675	0
Future Volume (vph)	0	0	0	391	0	658	0	1286	0	0	1675	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0		4.0		4.0			4.0	
Lane Util. Factor				0.97		0.88		0.91			0.86	
Frt				1.00		0.85		1.00			1.00	
Flt Protected				0.95		1.00		1.00			1.00	
Satd. Flow (prot)				3433		2787		5085			4806	
Flt Permitted				0.95		1.00		1.00			1.00	
Satd. Flow (perm)				3433		2787		5085			4806	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	425	0	715	0	1398	0	0	1821	0
RTOR Reduction (vph)	0	0	0	0	0	36	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	425	0	679	0	1398	0	0	1821	0
Turn Type				Prot		Prot		NA			NA	Perm
Protected Phases				4		4		2			6	
Permitted Phases												6
Actuated Green, G (s)				14.1		14.1		25.1			25.1	
Effective Green, g (s)				15.5		15.5		26.5			26.5	
Actuated g/C Ratio				0.31		0.31		0.53			0.53	
Clearance Time (s)				5.4		5.4		5.4			5.4	
Vehicle Extension (s)				3.0		3.0		3.0			3.0	
Lane Grp Cap (vph)				1064		863		2695			2547	
v/s Ratio Prot				0.12		c0.24		0.27			c0.38	
v/s Ratio Perm												
v/c Ratio				0.40		0.79		0.52			0.71	
Uniform Delay, d1				13.6		15.7		7.6			8.9	
Progression Factor				1.00		1.00		0.74			1.00	
Incremental Delay, d2				0.2		4.8		0.6			1.7	
Delay (s)				13.8		20.5		6.3			10.6	
Level of Service				B		C		A			B	
Approach Delay (s)		0.0			18.0			6.3			10.6	
Approach LOS		A			B			A			B	

Intersection Summary		
HCM 2000 Control Delay	11.2	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.74	B
Actuated Cycle Length (s)	50.0	Sum of lost time (s)
Intersection Capacity Utilization	54.5%	8.0
Analysis Period (min)	15	ICU Level of Service
		A

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 4: Hopyard Rd/Dougherty Rd & I-580 EB Ramps

BART to Livermore Extension Project
 2025 DMU + INP + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔↔		↔↔					↑↑↑	↔		↑↑↑	↔
Traffic Volume (vph)	769	0	1449	0	0	0	0	754	0	0	1534	0
Future Volume (vph)	769	0	1449	0	0	0	0	754	0	0	1534	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0					4.0			4.0	
Lane Util. Factor	0.97		0.88					0.91			0.86	
Frt	1.00		0.85					1.00			1.00	
Flt Protected	0.95		1.00					1.00			1.00	
Satd. Flow (prot)	3433		2787					5085			4806	
Flt Permitted	0.95		1.00					1.00			1.00	
Satd. Flow (perm)	3433		2787					5085			4806	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	836	0	1575	0	0	0	0	820	0	0	1667	0
RTOR Reduction (vph)	0	0	27	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	836	0	1548	0	0	0	0	820	0	0	1667	0
Turn Type	Prot		Prot					NA	Free		NA	Perm
Protected Phases	4		4					2			6	
Permitted Phases									Free			6
Actuated Green, G (s)	22.6		22.6					16.6			16.6	
Effective Green, g (s)	24.0		24.0					18.0			18.0	
Actuated g/C Ratio	0.48		0.48					0.36			0.36	
Clearance Time (s)	5.4		5.4					5.4			5.4	
Vehicle Extension (s)	3.0		3.0					3.0			3.0	
Lane Grp Cap (vph)	1647		1337					1830			1730	
v/s Ratio Prot	0.24		c0.56					0.16			c0.35	
v/s Ratio Perm												
v/c Ratio	0.51		1.16					0.45			0.96	
Uniform Delay, d1	8.9		13.0					12.2			15.7	
Progression Factor	1.00		1.00					1.00			0.69	
Incremental Delay, d2	0.2		79.8					0.8			12.0	
Delay (s)	9.2		92.8					13.0			22.8	
Level of Service	A		F					B			C	
Approach Delay (s)		63.8			0.0			13.0			22.8	
Approach LOS		E			A			B			C	

Intersection Summary

HCM 2000 Control Delay	41.3	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	1.07		
Actuated Cycle Length (s)	50.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	87.0%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
5: Hopyard Rd & Owens Rd

BART to Livermore Extension Project
2025 DMU + INP + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	192	104	53	121	135	194	145	679	160	881	1609	543
Future Volume (vph)	192	104	53	121	135	194	145	679	160	881	1609	543
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	2.7	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	0.91	0.91		1.00	0.95	0.95	1.00	0.91	1.00	0.97	0.91	
Frt	1.00	0.97		1.00	0.95	0.85	1.00	1.00	0.85	1.00	0.96	
Flt Protected	0.95	0.98		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1610	3222		1770	1688	1504	1770	5085	1583	3433	4893	
Flt Permitted	0.95	0.98		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1610	3222		1770	1688	1504	1770	5085	1583	3433	4893	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	209	113	58	132	147	211	158	738	174	958	1749	590
RTOR Reduction (vph)	0	26	0	0	18	49	0	0	129	0	68	0
Lane Group Flow (vph)	115	239	0	132	194	97	158	738	45	958	2271	0
Turn Type	Split	NA		Split	NA	pm+ov	Prot	NA	Perm	Prot	NA	
Protected Phases	8	8		4	4	1	5	2		1	6	
Permitted Phases						4			2			
Actuated Green, G (s)	6.5	6.5		9.8	9.8	41.7	9.0	21.5	21.5	31.9	44.4	
Effective Green, g (s)	7.8	7.8		11.1	11.1	44.3	9.0	23.2	23.2	31.9	46.1	
Actuated g/C Ratio	0.09	0.09		0.12	0.12	0.49	0.10	0.26	0.26	0.35	0.51	
Clearance Time (s)	5.3	5.3		5.3	5.3	4.0	4.0	5.7	5.7	4.0	5.7	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	139	279		218	208	785	177	1310	408	1216	2506	
v/s Ratio Prot	0.07	c0.07		0.07	c0.12	0.05	0.09	0.15		c0.28	c0.46	
v/s Ratio Perm						0.02			0.03			
v/c Ratio	0.83	0.85		0.61	0.93	0.12	0.89	0.56	0.11	0.79	0.91	
Uniform Delay, d1	40.4	40.5		37.4	39.1	12.4	40.0	29.0	25.5	26.0	20.0	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	31.4	21.7		4.7	44.1	0.1	38.7	0.6	0.1	3.5	5.2	
Delay (s)	71.9	62.2		42.1	83.2	12.4	78.7	29.6	25.6	29.5	25.2	
Level of Service	E	E		D	F	B	E	C	C	C	C	
Approach Delay (s)		65.2			51.0			36.2			26.4	
Approach LOS		E			D			D			C	

Intersection Summary

HCM 2000 Control Delay	33.5	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.92		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	82.4%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
6: Hopyard Rd & Stoneridge Dr

BART to Livermore Extension Project
2025 DMU + INP + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	156	737	443	81	994	119	642	743	84	276	966	236
Future Volume (vph)	156	737	443	81	994	119	642	743	84	276	966	236
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.91	1.00	0.97	0.91	1.00	0.94	0.95	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5085	1583	3433	5085	1583	4990	3539	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5085	1583	3433	5085	1583	4990	3539	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	170	801	482	88	1080	129	698	808	91	300	1050	257
RTOR Reduction (vph)	0	0	223	0	0	94	0	0	66	0	0	121
Lane Group Flow (vph)	170	801	259	88	1080	35	698	808	25	300	1050	136
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8			2			6
Actuated Green, G (s)	4.0	17.5	17.5	3.2	16.7	16.7	8.0	17.0	17.0	7.0	16.0	16.0
Effective Green, g (s)	4.0	17.5	17.5	3.2	16.7	16.7	8.0	17.0	17.0	7.0	16.0	16.0
Actuated g/C Ratio	0.07	0.29	0.29	0.05	0.28	0.28	0.13	0.28	0.28	0.12	0.26	0.26
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	226	1466	456	180	1399	435	657	991	443	395	1340	417
v/s Ratio Prot	c0.05	0.16		0.03	c0.21		c0.14	c0.23		0.09	0.21	
v/s Ratio Perm			0.16			0.02			0.02			0.09
v/c Ratio	0.75	0.55	0.57	0.49	0.77	0.08	1.06	0.82	0.06	0.76	0.78	0.33
Uniform Delay, d1	27.9	18.2	18.4	28.0	20.2	16.3	26.4	20.4	16.0	26.0	20.7	18.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	13.2	0.4	1.6	2.1	2.7	0.1	52.9	5.3	0.1	8.2	3.1	0.5
Delay (s)	41.1	18.7	20.0	30.0	23.0	16.4	79.2	25.6	16.0	34.2	23.8	18.5
Level of Service	D	B	B	C	C	B	E	C	B	C	C	B
Approach Delay (s)		21.7			22.8			48.5			24.9	
Approach LOS		C			C			D			C	

Intersection Summary

HCM 2000 Control Delay	30.0	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.86		
Actuated Cycle Length (s)	60.7	Sum of lost time (s)	16.0
Intersection Capacity Utilization	67.9%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

7: Hopyard Rd & Las Positas Blvd

BART to Livermore Extension Project
2025 DMU + INP + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↕	↖	↖↗	↕	↖	↖↗	↕↕↕	↖	↖↗	↕↕↕	↖
Traffic Volume (vph)	151	461	371	350	447	57	412	1153	366	110	1002	89
Future Volume (vph)	151	461	371	350	447	57	412	1153	366	110	1002	89
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.95	1.00	0.97	0.95	1.00	0.97	0.91	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	3433	3539	1583	3433	5085	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	3433	3539	1583	3433	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	164	501	403	380	486	62	448	1253	398	120	1089	97
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	72
Lane Group Flow (vph)	164	501	403	380	486	62	448	1253	398	120	1089	25
Turn Type	Prot	NA	Free	Prot	NA	Free	Prot	NA	Free	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			Free			Free			Free			6
Actuated Green, G (s)	5.5	14.6	64.5	8.0	17.1	64.5	9.0	22.7	64.5	3.2	16.9	16.9
Effective Green, g (s)	5.5	14.6	64.5	8.0	17.1	64.5	9.0	22.7	64.5	3.2	16.9	16.9
Actuated g/C Ratio	0.09	0.23	1.00	0.12	0.27	1.00	0.14	0.35	1.00	0.05	0.26	0.26
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	292	801	1583	425	938	1583	479	1789	1583	170	1332	414
v/s Ratio Prot	0.05	c0.14		c0.11	0.14		c0.13	0.25		0.03	c0.21	
v/s Ratio Perm			c0.25			0.04			0.25			0.02
v/c Ratio	0.56	0.63	0.25	0.89	0.52	0.04	0.94	0.70	0.25	0.71	0.82	0.06
Uniform Delay, d1	28.3	22.5	0.0	27.8	20.2	0.0	27.5	18.0	0.0	30.2	22.4	17.9
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	2.5	1.5	0.4	20.6	0.5	0.0	25.6	1.3	0.4	12.5	4.0	0.1
Delay (s)	30.8	24.0	0.4	48.4	20.7	0.0	53.1	19.2	0.4	42.7	26.4	17.9
Level of Service	C	C	A	D	C	A	D	B	A	D	C	B
Approach Delay (s)		16.1			30.7			22.9			27.2	
Approach LOS		B			C			C			C	

Intersection Summary

HCM 2000 Control Delay	23.9	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.79		
Actuated Cycle Length (s)	64.5	Sum of lost time (s)	16.0
Intersection Capacity Utilization	67.2%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
8: Willow Rd & Owens Rd

BART to Livermore Extension Project
2025 DMU + INP + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	181	359	230	95	330	106	87	100	0	90	87	98
Future Volume (vph)	181	359	230	95	330	106	87	100	0	90	87	98
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	5.3	4.0		5.3	4.0	4.0
Lane Util. Factor	0.97	0.91		0.97	0.91	1.00	1.00	0.95		1.00	1.00	1.00
Frt	1.00	0.94		1.00	1.00	0.85	1.00	1.00		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	4787		3433	5085	1583	1770	3539		1770	1863	1583
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.70	1.00		0.68	1.00	1.00
Satd. Flow (perm)	3433	4787		3433	5085	1583	1295	3539		1273	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	197	390	250	103	359	115	95	109	0	98	95	107
RTOR Reduction (vph)	0	138	0	0	0	72	0	0	0	0	0	86
Lane Group Flow (vph)	197	502	0	103	359	43	95	109	0	98	95	21
Turn Type	Prot	NA		Prot	NA	Perm	Perm	NA	Perm	Perm	NA	Perm
Protected Phases	1	6		5	2			4			8	
Permitted Phases						2	4		4	8		8
Actuated Green, G (s)	5.7	16.9		2.7	13.9	13.9	7.0	7.0		7.0	7.0	7.0
Effective Green, g (s)	5.7	18.6		2.7	15.6	15.6	7.0	8.3		7.0	8.3	8.3
Actuated g/C Ratio	0.14	0.45		0.06	0.37	0.37	0.17	0.20		0.17	0.20	0.20
Clearance Time (s)	4.0	5.7		4.0	5.7	5.7	5.3	5.3		5.3	5.3	5.3
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	470	2140		222	1906	593	217	706		214	371	315
v/s Ratio Prot	c0.06	c0.10		0.03	0.07			0.03			0.05	
v/s Ratio Perm						0.03	0.07			c0.08		0.01
v/c Ratio	0.42	0.23		0.46	0.19	0.07	0.44	0.15		0.46	0.26	0.07
Uniform Delay, d1	16.4	7.1		18.8	8.7	8.4	15.5	13.8		15.6	14.0	13.5
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	0.6	0.1		1.5	0.0	0.1	1.4	0.1		1.6	0.4	0.1
Delay (s)	17.0	7.2		20.3	8.8	8.4	16.9	13.9		17.1	14.4	13.6
Level of Service	B	A		C	A	A	B	B		B	B	B
Approach Delay (s)		9.5			10.8			15.3			15.0	
Approach LOS		A			B			B			B	

Intersection Summary

HCM 2000 Control Delay	11.4	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.31		
Actuated Cycle Length (s)	41.6	Sum of lost time (s)	12.0
Intersection Capacity Utilization	37.1%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
9: Hacienda Dr & Dublin Blvd

BART to Livermore Extension Project
2025 DMU + INP + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↖↖↖	↗↗	↖↗	↖↖↖		↖↗↗	↖↖	↗↗	↖↗	↖↖↖	↗
Traffic Volume (vph)	73	337	94	271	745	80	157	631	115	12	390	132
Future Volume (vph)	73	337	94	271	745	80	157	631	115	12	390	132
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	6.0	5.0	4.5	6.0		5.0	6.0	6.0	4.5	5.5	5.5
Lane Util. Factor	0.97	0.91	0.88	0.97	0.91		0.94	0.95	0.88	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5085	2787	3433	5011		4990	3539	2787	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5085	2787	3433	5011		4990	3539	2787	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	79	366	102	295	810	87	171	686	125	13	424	143
RTOR Reduction (vph)	0	0	72	0	12	0	0	0	86	0	0	116
Lane Group Flow (vph)	79	366	30	295	885	0	171	686	39	13	424	27
Turn Type	Prot	NA	pm+ov	Prot	NA		Prot	NA	Perm	Prot	NA	Perm
Protected Phases	5	2	3	1	6		3	8		7	NA	4
Permitted Phases			2						8			4
Actuated Green, G (s)	4.9	12.1	22.2	17.4	24.6		10.1	23.3	23.3	0.6	13.8	13.8
Effective Green, g (s)	4.9	12.1	22.2	17.4	24.6		10.1	23.3	23.3	0.6	13.8	13.8
Actuated g/C Ratio	0.07	0.16	0.30	0.23	0.33		0.14	0.31	0.31	0.01	0.19	0.19
Clearance Time (s)	4.5	6.0	5.0	4.5	6.0		5.0	6.0	6.0	4.5	5.5	5.5
Vehicle Extension (s)	2.0	3.5	2.0	2.0	3.5		2.0	3.5	3.5	2.0	3.5	3.5
Lane Grp Cap (vph)	226	826	1018	802	1656		677	1108	872	27	943	293
v/s Ratio Prot	0.02	c0.07	0.00	0.09	c0.18		0.03	c0.19		0.00	c0.08	
v/s Ratio Perm			0.01						0.01			0.02
v/c Ratio	0.35	0.44	0.03	0.37	0.53		0.25	0.62	0.04	0.48	0.45	0.09
Uniform Delay, d1	33.2	28.1	18.5	23.9	20.2		28.8	21.8	17.8	36.7	26.9	25.1
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.3	0.4	0.0	0.1	0.4		0.1	1.1	0.0	4.9	0.4	0.2
Delay (s)	33.6	28.6	18.5	24.0	20.6		28.8	22.9	17.8	41.6	27.3	25.3
Level of Service	C	C	B	C	C		C	C	B	D	C	C
Approach Delay (s)		27.4			21.5			23.3			27.1	
Approach LOS		C			C			C			C	

Intersection Summary

HCM 2000 Control Delay	24.0	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.60		
Actuated Cycle Length (s)	74.4	Sum of lost time (s)	21.0
Intersection Capacity Utilization	57.8%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 10: Hacienda Dr & Martinelli Blvd/Hacienda Crossings



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗	↖↗	↖↗	↗		↖↗↘	↖↗↘	↖	↖↗	↖↗↘	
Traffic Volume (vph)	11	8	175	110	12	8	244	866	112	17	727	49
Future Volume (vph)	11	8	175	110	12	8	244	866	112	17	727	49
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	3.0	3.0	5.5	3.0		3.5	3.0	3.0	5.0	3.5	
Lane Util. Factor	1.00	0.91	0.91	0.97	1.00		0.94	0.91	1.00	0.97	0.86	
Frt	1.00	0.90	0.85	1.00	0.94		1.00	1.00	0.85	1.00	0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1770	1523	2882	3433	1748		4990	5085	1583	3433	6347	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1770	1523	2882	3433	1748		4990	5085	1583	3433	6347	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	12	9	190	120	13	9	265	941	122	18	790	53
RTOR Reduction (vph)	0	14	129	0	6	0	0	0	54	0	8	0
Lane Group Flow (vph)	12	14	42	120	16	0	265	941	68	18	835	0
Turn Type	Prot	NA	Perm	Prot	NA		Prot	NA	pm+ov	Prot	NA	
Protected Phases	5	2		1	6		3	8	1	7	4	
Permitted Phases			2						8			
Actuated Green, G (s)	1.7	15.8	15.8	6.9	21.5		8.2	29.7	36.6	1.1	22.6	
Effective Green, g (s)	1.2	17.8	17.8	6.4	23.5		9.2	31.7	40.6	0.6	24.1	
Actuated g/C Ratio	0.02	0.24	0.24	0.09	0.32		0.13	0.43	0.56	0.01	0.33	
Clearance Time (s)	4.5	5.0	5.0	5.0	5.0		4.5	5.0	5.0	4.5	5.0	
Vehicle Extension (s)	3.0	4.0	4.0	2.0	4.0		3.0	4.0	2.0	3.0	4.0	
Lane Grp Cap (vph)	29	371	702	300	562		628	2208	945	28	2095	
v/s Ratio Prot	c0.01	0.01		c0.03	0.01		c0.05	c0.19	0.01	0.01	0.13	
v/s Ratio Perm			c0.01						0.03			
v/c Ratio	0.41	0.04	0.06	0.40	0.03		0.42	0.43	0.07	0.64	0.40	
Uniform Delay, d1	35.6	21.1	21.2	31.5	16.9		29.4	14.3	7.5	36.1	18.9	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	9.3	0.1	0.0	0.3	0.0		0.5	0.2	0.0	40.9	0.2	
Delay (s)	44.9	21.1	21.2	31.8	17.0		29.9	14.5	7.5	77.0	19.0	
Level of Service	D	C	C	C	B		C	B	A	E	B	
Approach Delay (s)		22.6			29.5			16.9			20.2	
Approach LOS		C			C			B			C	

Intersection Summary		
HCM 2000 Control Delay	19.2	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.34	B
Actuated Cycle Length (s)	73.0	Sum of lost time (s)
Intersection Capacity Utilization	42.6%	16.5
Analysis Period (min)	15	ICU Level of Service
		A

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 11: Hacienda Dr & I-580 WB Ramps

BART to Livermore Extension Project
 2025 DMU + INP + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↔↔		↔↔		↑↑↑			↑↑↑	↔
Traffic Volume (vph)	0	0	0	281	0	452	0	1066	183	0	615	416
Future Volume (vph)	0	0	0	281	0	452	0	1066	183	0	615	416
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0		4.0		4.0			4.0	4.0
Lane Util. Factor				0.97		0.88		0.91			0.86	0.86
Frt				1.00		0.85		0.98			0.96	0.85
Flt Protected				0.95		1.00		1.00			1.00	1.00
Satd. Flow (prot)				3433		2787		4974			4624	1362
Flt Permitted				0.95		1.00		1.00			1.00	1.00
Satd. Flow (perm)				3433		2787		4974			4624	1362
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	305	0	491	0	1159	199	0	668	452
RTOR Reduction (vph)	0	0	0	0	0	97	0	45	0	0	92	92
Lane Group Flow (vph)	0	0	0	305	0	394	0	1313	0	0	802	134
Turn Type				Prot		Prot		NA			NA	Perm
Protected Phases				4		4		2			6	
Permitted Phases												6
Actuated Green, G (s)				10.9		10.9		27.8			27.8	27.8
Effective Green, g (s)				12.3		12.3		29.7			29.7	29.7
Actuated g/C Ratio				0.25		0.25		0.59			0.59	0.59
Clearance Time (s)				5.4		5.4		5.9			5.9	5.9
Vehicle Extension (s)				3.0		3.0		3.0			3.0	3.0
Lane Grp Cap (vph)				844		685		2954			2746	809
v/s Ratio Prot				0.09		c0.14		c0.26			0.17	
v/s Ratio Perm												0.10
v/c Ratio				0.36		0.57		0.44			0.29	0.17
Uniform Delay, d1				15.6		16.6		5.6			5.0	4.6
Progression Factor				1.00		1.00		0.55			1.00	1.00
Incremental Delay, d2				0.3		1.2		0.4			0.3	0.4
Delay (s)				15.9		17.7		3.5			5.3	5.0
Level of Service				B		B		A			A	A
Approach Delay (s)		0.0			17.0			3.5			5.2	
Approach LOS		A			B			A			A	

Intersection Summary			
HCM 2000 Control Delay	7.4	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.48		
Actuated Cycle Length (s)	50.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	47.2%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 12: Hacienda Dr & I-580 EB Ramps

BART to Livermore Extension Project
 2025 DMU + INP + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗		↖↗					↖↗↘	↖		↖↗↘	
Traffic Volume (vph)	751	0	1081	0	0	0	0	458	166	0	1002	149
Future Volume (vph)	751	0	1081	0	0	0	0	458	166	0	1002	149
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0					4.0	4.0		4.0	
Lane Util. Factor	0.97		0.88					0.86	0.86		0.91	
Frt	1.00		0.85					0.98	0.85		0.98	
Flt Protected	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (prot)	3433		2787					4733	1362		4987	
Flt Permitted	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (perm)	3433		2787					4733	1362		4987	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	816	0	1175	0	0	0	0	498	180	0	1089	162
RTOR Reduction (vph)	0	0	86	0	0	0	0	32	70	0	51	0
Lane Group Flow (vph)	816	0	1089	0	0	0	0	522	54	0	1200	0
Turn Type	Prot		Prot					NA	Perm		NA	
Protected Phases	4		4					2			6	
Permitted Phases									2			
Actuated Green, G (s)	18.9		18.9					19.8	19.8		19.8	
Effective Green, g (s)	20.3		20.3					21.7	21.7		21.7	
Actuated g/C Ratio	0.41		0.41					0.43	0.43		0.43	
Clearance Time (s)	5.4		5.4					5.9	5.9		5.9	
Vehicle Extension (s)	2.0		2.0					2.0	2.0		2.0	
Lane Grp Cap (vph)	1393		1131					2054	591		2164	
v/s Ratio Prot	0.24		c0.39					0.11			c0.24	
v/s Ratio Perm									0.04			
v/c Ratio	0.59		0.96					0.25	0.09		0.55	
Uniform Delay, d1	11.6		14.5					9.0	8.3		10.5	
Progression Factor	1.00		1.00					1.00	1.00		0.80	
Incremental Delay, d2	0.4		18.4					0.3	0.3		1.0	
Delay (s)	12.0		32.8					9.3	8.6		9.5	
Level of Service	B		C					A	A		A	
Approach Delay (s)		24.3			0.0			9.2			9.5	
Approach LOS		C			A			A			A	



































Intersection Summary

HCM 2000 Control Delay	17.0	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.75		
Actuated Cycle Length (s)	50.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	67.2%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
13: Hacienda Dr & Owens Rd

BART to Livermore Extension Project
2025 DMU + INP + Garage AM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 	  		  	  		 	  		  		
Traffic Volume (vph)	100	193	23	121	343	250	31	253	127	529	944	582
Future Volume (vph)	100	193	23	121	343	250	31	253	127	529	944	582
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	2.3	4.0	4.0	2.3	4.0	4.0	2.7	4.0	4.0	2.7
Lane Util. Factor	0.97	0.91	1.00	0.97	0.91	1.00	0.97	0.91	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5085	1583	3433	5085	1583	3433	5085	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5085	1583	3433	5085	1583	3433	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	109	210	25	132	373	272	34	275	138	575	1026	633
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	109	210	25	132	373	272	34	275	138	575	1026	633
Turn Type	Prot	NA	Free	Prot	NA	Free	Prot	NA	Free	Prot	NA	Free
Protected Phases	1	6		5	2		7	4		3	8	
Permitted Phases			Free			Free			Free			Free
Actuated Green, G (s)	4.0	10.1	61.2	4.0	10.1	61.2	1.5	8.8	61.2	19.3	26.6	61.2
Effective Green, g (s)	4.0	11.8	61.2	4.0	11.8	61.2	1.5	10.1	61.2	19.3	27.9	61.2
Actuated g/C Ratio	0.07	0.19	1.00	0.07	0.19	1.00	0.02	0.17	1.00	0.32	0.46	1.00
Clearance Time (s)	4.0	5.7		4.0	5.7		4.0	5.3		4.0	5.3	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	224	980	1583	224	980	1583	84	839	1583	1082	2318	1583
v/s Ratio Prot	0.03	0.04		0.04	0.07		0.01	0.05		c0.17	0.20	
v/s Ratio Perm			0.02			0.17			0.09			c0.40
v/c Ratio	0.49	0.21	0.02	0.59	0.38	0.17	0.40	0.33	0.09	0.53	0.44	0.40
Uniform Delay, d1	27.6	20.8	0.0	27.8	21.5	0.0	29.4	22.6	0.0	17.2	11.3	0.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.7	0.1	0.0	3.9	0.2	0.2	3.2	0.2	0.1	0.5	0.1	0.8
Delay (s)	29.3	20.9	0.0	31.7	21.8	0.2	32.6	22.8	0.1	17.7	11.5	0.8
Level of Service	C	C	A	C	C	A	C	C	A	B	B	A
Approach Delay (s)		22.0			15.9			16.5			10.1	
Approach LOS		C			B			B			B	
Intersection Summary												
HCM 2000 Control Delay			13.1				HCM 2000 Level of Service			B		
HCM 2000 Volume to Capacity ratio			0.56									
Actuated Cycle Length (s)			61.2			Sum of lost time (s)			16.0			
Intersection Capacity Utilization			44.9%			ICU Level of Service			A			
Analysis Period (min)			15									

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 14: Tassajara Rd & Dublin Blvd

BART to Livermore Extension Project
 2025 DMU + INP + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↑↑	↖↗	↖↗↘	↑↓		↖↗↘	↑↑↑	↖	↖↗	↑↑↑	↖↗
Traffic Volume (vph)	91	149	162	508	607	41	220	512	148	25	1252	220
Future Volume (vph)	91	149	162	508	607	41	220	512	148	25	1252	220
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	6.0	6.0	5.0	6.0		5.0	6.0	6.0	5.0	6.0	6.0
Lane Util. Factor	0.97	0.95	0.88	0.94	0.95		0.94	0.91	1.00	0.97	0.86	0.88
Frt	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	2787	4990	3505		4990	5085	1583	3433	6408	2787
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	2787	4990	3505		4990	5085	1583	3433	6408	2787
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	99	162	176	552	660	45	239	557	161	27	1361	239
RTOR Reduction (vph)	0	0	136	0	4	0	0	0	97	0	0	159
Lane Group Flow (vph)	99	162	40	552	701	0	239	557	64	27	1361	80
Turn Type	Prot	NA	Perm	Prot	NA		Prot	NA	Perm	Prot	NA	Perm
Protected Phases	5	2		1	6		3	8		7	NA	4
Permitted Phases			2						8			4
Actuated Green, G (s)	16.1	29.8	29.8	19.0	32.7		16.1	51.6	51.6	8.4	43.9	43.9
Effective Green, g (s)	16.1	29.8	29.8	19.0	32.7		16.1	51.6	51.6	8.4	43.9	43.9
Actuated g/C Ratio	0.12	0.23	0.23	0.15	0.25		0.12	0.39	0.39	0.06	0.34	0.34
Clearance Time (s)	5.0	6.0	6.0	5.0	6.0		5.0	6.0	6.0	5.0	6.0	6.0
Vehicle Extension (s)	2.0	3.0	3.0	2.0	3.0		2.0	4.0	4.0	2.0	4.0	4.0
Lane Grp Cap (vph)	422	806	634	724	876		614	2006	624	220	2150	935
v/s Ratio Prot	0.03	0.05		c0.11	c0.20		c0.05	0.11		0.01	c0.21	
v/s Ratio Perm			0.01						0.04			0.03
v/c Ratio	0.23	0.20	0.06	0.76	0.80		0.39	0.28	0.10	0.12	0.63	0.09
Uniform Delay, d1	51.8	40.9	39.6	53.7	46.0		52.8	26.9	25.0	57.7	36.7	29.7
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.1	0.1	0.0	4.3	5.3		0.1	0.1	0.1	0.1	0.7	0.1
Delay (s)	51.9	41.0	39.6	58.0	51.3		53.0	27.0	25.1	57.8	37.3	29.8
Level of Service	D	D	D	E	D		D	C	C	E	D	C
Approach Delay (s)		42.9			54.2			33.2			36.6	
Approach LOS		D			D			C			D	

Intersection Summary		
HCM 2000 Control Delay	41.7	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.68	D
Actuated Cycle Length (s)	130.8	Sum of lost time (s)
Intersection Capacity Utilization	81.2%	22.0
Analysis Period (min)	15	ICU Level of Service
		D

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 15: Tassajara Rd & I-580 WB Ramps

BART to Livermore Extension Project
 2025 DMU + INP + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↔		↔		↑↑	↔		↑↑↑	↔
Traffic Volume (vph)	0	0	0	556	0	293	0	1036	468	0	945	935
Future Volume (vph)	0	0	0	556	0	293	0	1036	468	0	945	935
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0		4.0		4.0	4.0		4.0	4.0
Lane Util. Factor				0.97		0.88		0.95	1.00		0.86	0.86
Frt				1.00		0.85		1.00	0.85		0.95	0.85
Flt Protected				0.95		1.00		1.00	1.00		1.00	1.00
Satd. Flow (prot)				3433		2787		3539	1583		4567	1362
Flt Permitted				0.95		1.00		1.00	1.00		1.00	1.00
Satd. Flow (perm)				3433		2787		3539	1583		4567	1362
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	604	0	318	0	1126	509	0	1027	1016
RTOR Reduction (vph)	0	0	0	0	0	28	0	0	283	0	207	283
Lane Group Flow (vph)	0	0	0	604	0	290	0	1126	226	0	1328	225
Turn Type				Perm		Perm		NA	Perm		NA	Perm
Protected Phases								2			6	
Permitted Phases				8		8			2			6
Actuated Green, G (s)				12.2		12.2		16.1	16.1		16.1	16.1
Effective Green, g (s)				12.2		12.2		16.1	16.1		16.1	16.1
Actuated g/C Ratio				0.34		0.34		0.44	0.44		0.44	0.44
Clearance Time (s)				4.0		4.0		4.0	4.0		4.0	4.0
Vehicle Extension (s)				3.0		3.0		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)				1153		936		1569	702		2025	604
v/s Ratio Prot								c0.32			0.29	
v/s Ratio Perm				c0.18		0.10			0.14			0.17
v/c Ratio				0.52		0.31		0.72	0.32		0.66	0.37
Uniform Delay, d1				9.7		8.9		8.2	6.6		7.9	6.7
Progression Factor				1.00		1.00		1.00	1.00		1.00	1.00
Incremental Delay, d2				0.4		0.2		1.6	0.3		0.8	0.4
Delay (s)				10.1		9.1		9.8	6.8		8.7	7.1
Level of Service				B		A		A	A		A	A
Approach Delay (s)		0.0			9.8			8.9			8.3	
Approach LOS		A			A			A			A	

Intersection Summary

HCM 2000 Control Delay	8.8	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.63		
Actuated Cycle Length (s)	36.3	Sum of lost time (s)	8.0
Intersection Capacity Utilization	51.2%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 16: Santa Rita Rd & I-580 EB Ramps/Pimilco Dr

BART to Livermore Extension Project
 2025 DMU + INP + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	534	121	676	183	0	191	0	738	109	195	1245	0
Future Volume (vph)	534	121	676	183	0	191	0	738	109	195	1245	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0		4.0		4.0		4.0	4.0	
Lane Util. Factor	0.97	1.00	1.00	0.97		0.88		0.86		1.00	0.95	
Frt	1.00	1.00	0.85	1.00		0.85		0.98		1.00	1.00	
Flt Protected	0.95	1.00	1.00	0.95		1.00		1.00		0.95	1.00	
Satd. Flow (prot)	3433	1863	1583	3433		2787		6285		1770	3539	
Flt Permitted	0.95	1.00	1.00	0.95		1.00		1.00		0.95	1.00	
Satd. Flow (perm)	3433	1863	1583	3433		2787		6285		1770	3539	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	580	132	735	199	0	208	0	802	118	212	1353	0
RTOR Reduction (vph)	0	0	0	0	0	72	0	44	0	0	0	0
Lane Group Flow (vph)	580	132	735	199	0	136	0	876	0	212	1353	0
Turn Type	Perm	NA	Free	Prot		pm+ov		NA		Prot	NA	Perm
Protected Phases		4		3		1		2		1	6	
Permitted Phases	4		Free			3						6
Actuated Green, G (s)	14.3	14.3	57.2	4.0		12.1		14.8		8.1	26.9	
Effective Green, g (s)	14.3	14.3	57.2	4.0		12.1		14.8		8.1	26.9	
Actuated g/C Ratio	0.25	0.25	1.00	0.07		0.21		0.26		0.14	0.47	
Clearance Time (s)	4.0	4.0		4.0		4.0		4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0		3.0		3.0		3.0	3.0	
Lane Grp Cap (vph)	858	465	1583	240		589		1626		250	1664	
v/s Ratio Prot		0.07		0.06		0.03		0.14		0.12	c0.38	
v/s Ratio Perm	c0.17		c0.46			0.02						
v/c Ratio	0.68	0.28	0.46	0.83		0.23		0.54		0.85	0.81	
Uniform Delay, d1	19.4	17.3	0.0	26.3		18.7		18.3		23.9	13.0	
Progression Factor	1.00	1.00	1.00	1.00		1.00		1.00		1.00	1.00	
Incremental Delay, d2	2.1	0.3	1.0	20.5		0.2		0.3		22.5	3.2	
Delay (s)	21.5	17.7	1.0	46.7		18.9		18.6		46.4	16.2	
Level of Service	C	B	A	D		B		B		D	B	
Approach Delay (s)		10.7			32.5			18.6			20.3	
Approach LOS		B			C			B			C	

Intersection Summary		
HCM 2000 Control Delay	17.9	HCM 2000 Level of Service B
HCM 2000 Volume to Capacity ratio	0.86	
Actuated Cycle Length (s)	57.2	Sum of lost time (s) 16.0
Intersection Capacity Utilization	56.3%	ICU Level of Service B
Analysis Period (min)	15	

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
17: Santa Rita Rd & Valley Ave

BART to Livermore Extension Project
2025 DMU + INP + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↕	↖	↗	↕	↖	↖↗	↕		↖↗	↕	↖
Traffic Volume (vph)	189	223	78	177	328	831	95	492	74	573	915	155
Future Volume (vph)	189	223	78	177	328	831	95	492	74	573	915	155
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.97	0.95		0.97	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.98		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	3433	3470		3433	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	3433	3470		3433	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	205	242	85	192	357	903	103	535	80	623	995	168
RTOR Reduction (vph)	0	0	70	0	0	0	0	17	0	0	0	100
Lane Group Flow (vph)	205	242	15	192	357	903	103	598	0	623	995	68
Turn Type	Prot	NA	Perm	Prot	NA	Free	Prot	NA		Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1		6
Permitted Phases			4			Free						6
Actuated Green, G (s)	7.7	11.5	11.5	8.1	11.9	64.9	3.1	16.2		13.1	26.2	26.2
Effective Green, g (s)	7.7	11.5	11.5	8.1	11.9	64.9	3.1	16.2		13.1	26.2	26.2
Actuated g/C Ratio	0.12	0.18	0.18	0.12	0.18	1.00	0.05	0.25		0.20	0.40	0.40
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	407	627	280	220	648	1583	163	866		692	1428	639
v/s Ratio Prot	0.06	0.07		c0.11	0.10		0.03	0.17		c0.18	c0.28	
v/s Ratio Perm			0.01			c0.57						0.04
v/c Ratio	0.50	0.39	0.05	0.87	0.55	0.57	0.63	0.69		0.90	0.70	0.11
Uniform Delay, d1	26.8	23.6	22.2	27.9	24.1	0.0	30.3	22.1		25.3	16.1	12.1
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	1.0	0.4	0.1	29.4	1.0	1.5	7.8	2.4		14.8	1.5	0.1
Delay (s)	27.8	24.0	22.3	57.3	25.1	1.5	38.1	24.5		40.1	17.6	12.1
Level of Service	C	C	C	E	C	A	D	C		D	B	B
Approach Delay (s)		25.2			14.7			26.4			24.9	
Approach LOS		C			B			C			C	

Intersection Summary

HCM 2000 Control Delay	21.9	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.84		
Actuated Cycle Length (s)	64.9	Sum of lost time (s)	16.0
Intersection Capacity Utilization	61.6%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
18: Bernal Ave/Valley Ave & Stanley Blvd

BART to Livermore Extension Project
2025 DMU + INP + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	207	201	53	250	891	958	176	491	108	139	346	116
Future Volume (vph)	207	201	53	250	891	958	176	491	108	139	346	116
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.95	1.00	0.97	0.91	0.91	1.00	0.95	1.00	0.97	0.95	0.95
Frt	1.00	1.00	0.85	1.00	0.95	0.85	1.00	1.00	0.85	1.00	0.96	0.96
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	3433	3237	1441	1770	3539	1583	3433	3406	3406
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	3433	3237	1441	1770	3539	1583	3433	3406	3406
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	225	218	58	272	968	1041	191	534	117	151	376	126
RTOR Reduction (vph)	0	0	29	0	47	28	0	0	93	0	38	0
Lane Group Flow (vph)	225	218	29	272	1337	597	191	534	24	151	464	0
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	NA
Protected Phases	7	4	5	3	8	1	5	2		1	6	
Permitted Phases			4			8			2			
Actuated Green, G (s)	7.0	33.0	44.6	11.0	37.0	46.8	11.6	17.9	17.9	9.8	16.1	16.1
Effective Green, g (s)	7.0	33.0	44.6	11.0	37.0	46.8	11.6	17.9	17.9	9.8	16.1	16.1
Actuated g/C Ratio	0.08	0.38	0.51	0.13	0.42	0.53	0.13	0.20	0.20	0.11	0.18	0.18
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	274	1331	877	430	1365	834	234	722	323	383	625	625
v/s Ratio Prot	c0.07	0.06	0.00	0.08	c0.41	0.08	c0.11	c0.15		0.04	0.14	0.14
v/s Ratio Perm			0.01			0.33			0.02			
v/c Ratio	0.82	0.16	0.03	0.63	0.98	0.72	0.82	0.74	0.07	0.39	0.74	0.74
Uniform Delay, d1	39.7	18.2	10.8	36.4	25.0	15.4	37.0	32.7	28.2	36.2	33.8	33.8
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	17.6	0.1	0.0	3.0	19.3	2.9	19.3	4.0	0.1	0.7	4.8	4.8
Delay (s)	57.4	18.2	10.8	39.5	44.3	18.4	56.3	36.7	28.3	36.9	38.6	38.6
Level of Service	E	B	B	D	D	B	E	D	C	D	D	D
Approach Delay (s)		34.9			36.6			40.0			38.2	
Approach LOS		C			D			D			D	

Intersection Summary		
HCM 2000 Control Delay	37.3	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.90	D
Actuated Cycle Length (s)	87.7	Sum of lost time (s)
Intersection Capacity Utilization	77.1%	16.0
Analysis Period (min)	15	ICU Level of Service
		D

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
19: Fallon Rd & Dublin Blvd

BART to Livermore Extension Project
2025 DMU + INP + Garage AM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	45	53	84	275	1029	334	733	245	28	57	684	318
Future Volume (vph)	45	53	84	275	1029	334	733	245	28	57	684	318
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.3	5.3	5.3	4.0	4.0	4.0	5.3	4.9	4.9	5.3	4.9	4.9
Lane Util. Factor	0.97	0.91	0.88	0.94	0.91	1.00	0.97	0.91	0.88	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3090	4577	2508	4491	4577	1425	3090	4577	2508	3090	4577	1425
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3090	4577	2508	4491	4577	1425	3090	4577	2508	3090	4577	1425
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	49	58	91	299	1118	363	797	266	30	62	743	346
RTOR Reduction (vph)	0	0	58	0	0	271	0	0	15	0	0	148
Lane Group Flow (vph)	49	58	33	299	1118	92	797	266	15	62	743	198
Turn Type	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	5	2	3	1	6		3	8		7		4
Permitted Phases			2			6			8			4
Actuated Green, G (s)	3.1	9.3	39.9	22.1	28.3	28.3	30.6	55.8	55.8	4.6	29.8	29.8
Effective Green, g (s)	3.1	9.3	39.9	22.1	28.3	28.3	30.6	55.8	55.8	4.6	29.8	29.8
Actuated g/C Ratio	0.03	0.08	0.36	0.20	0.25	0.25	0.27	0.50	0.50	0.04	0.27	0.27
Clearance Time (s)	5.3	5.3	5.3	4.0	4.0	4.0	5.3	4.9	4.9	5.3	4.9	4.9
Vehicle Extension (s)	2.0	4.0	2.0	2.0	2.0	2.0	2.0	4.0	4.0	2.0	4.0	4.0
Lane Grp Cap (vph)	86	382	899	891	1163	362	849	2294	1257	127	1225	381
v/s Ratio Prot	0.02	0.01	0.01	c0.07	c0.24		c0.26	0.06		0.02	c0.16	
v/s Ratio Perm			0.00			0.06			0.01			0.14
v/c Ratio	0.57	0.15	0.04	0.34	0.96	0.25	0.94	0.12	0.01	0.49	0.61	0.52
Uniform Delay, d1	53.4	47.3	23.2	38.3	41.0	33.1	39.4	14.7	13.9	52.2	35.6	34.7
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	5.1	0.3	0.0	0.1	17.7	0.1	17.4	0.0	0.0	1.1	1.0	1.6
Delay (s)	58.5	47.6	23.2	38.4	58.7	33.2	56.8	14.7	13.9	53.3	36.6	36.3
Level of Service	E	D	C	D	E	C	E	B	B	D	D	D
Approach Delay (s)		39.1			50.1			45.4			37.4	
Approach LOS		D			D			D			D	

Intersection Summary		
HCM 2000 Control Delay	44.9	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.83	D
Actuated Cycle Length (s)	111.3	Sum of lost time (s)
Intersection Capacity Utilization	78.7%	19.5
Analysis Period (min)	15	ICU Level of Service
		D

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 20: El Charro Rd/Fallon Rd & I-580 WB Ramps

BART to Livermore Extension Project
 2025 DMU + INP + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↙	↖	↗		↖	↗		↕	↘
Traffic Volume (vph)	0	0	0	164	0	608	0	555	478	0	544	399
Future Volume (vph)	0	0	0	164	0	608	0	555	478	0	544	399
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0	4.0	4.0		4.0	4.0		4.0	4.0
Lane Util. Factor				0.95	0.95	0.88		0.95	0.95		0.95	1.00
Frt				1.00	1.00	0.85		0.99	0.85		1.00	0.85
Flt Protected				0.95	0.95	1.00		1.00	1.00		1.00	1.00
Satd. Flow (prot)				1681	1681	2787		1749	1504		3539	1583
Flt Permitted				0.95	0.95	1.00		1.00	1.00		1.00	1.00
Satd. Flow (perm)				1681	1681	2787		1749	1504		3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	178	0	661	0	603	520	0	591	434
RTOR Reduction (vph)	0	0	0	0	0	371	0	5	175	0	0	162
Lane Group Flow (vph)	0	0	0	91	87	290	0	650	293	0	591	272
Turn Type				Perm	NA	Perm		NA	Perm		NA	Perm
Protected Phases					8			2			6	
Permitted Phases				8		8			2			6
Actuated Green, G (s)				11.2	11.2	11.2		31.3	31.3		31.3	31.3
Effective Green, g (s)				10.7	10.7	10.7		31.3	31.3		31.3	31.3
Actuated g/C Ratio				0.21	0.21	0.21		0.63	0.63		0.63	0.63
Clearance Time (s)				3.5	3.5	3.5		4.0	4.0		4.0	4.0
Vehicle Extension (s)				2.0	2.0	2.0		2.0	2.0		2.0	2.0
Lane Grp Cap (vph)				359	359	596		1094	941		2215	990
v/s Ratio Prot								c0.37			0.17	
v/s Ratio Perm				0.05	0.05	c0.10			0.19			0.17
v/c Ratio				0.25	0.24	0.49		0.59	0.31		0.27	0.27
Uniform Delay, d1				16.3	16.3	17.2		5.6	4.3		4.2	4.2
Progression Factor				1.00	1.00	1.00		0.70	0.32		1.00	1.00
Incremental Delay, d2				0.1	0.1	0.2		2.3	0.8		0.3	0.7
Delay (s)				16.5	16.4	17.5		6.2	2.2		4.5	4.9
Level of Service				B	B	B		A	A		A	A
Approach Delay (s)		0.0			17.3			4.5			4.7	
Approach LOS		A			B			A			A	

Intersection Summary			
HCM 2000 Control Delay	8.1	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.57		
Actuated Cycle Length (s)	50.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	66.8%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 21: El Charro Rd & I-580 EB Ramps

BART to Livermore Extension Project
 2025 DMU + INP + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	245	0	413	0	0	0	0	775	146	0	373	0
Future Volume (vph)	245	0	413	0	0	0	0	775	146	0	373	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0					4.0	4.0		4.0	
Lane Util. Factor	0.97		0.88					0.91	0.91		0.91	
Frt	1.00		0.85					1.00	0.85		1.00	
Flt Protected	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (prot)	3433		2787					3379	1441		3390	
Flt Permitted	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (perm)	3433		2787					3379	1441		3390	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	266	0	449	0	0	0	0	842	159	0	405	0
RTOR Reduction (vph)	0	0	375	0	0	0	0	2	45	0	0	0
Lane Group Flow (vph)	266	0	74	0	0	0	0	859	95	0	405	0
Turn Type	Prot		Perm					NA	Perm		NA	Perm
Protected Phases	4							2			6	
Permitted Phases			4						2			6
Actuated Green, G (s)	8.2		8.2					33.8	33.8		33.8	
Effective Green, g (s)	8.2		8.2					33.8	33.8		33.8	
Actuated g/C Ratio	0.16		0.16					0.68	0.68		0.68	
Clearance Time (s)	4.0		4.0					4.0	4.0		4.0	
Vehicle Extension (s)	2.0		2.0					3.0	3.0		3.0	
Lane Grp Cap (vph)	563		457					2284	974		2291	
v/s Ratio Prot	c0.08							c0.25			0.12	
v/s Ratio Perm			0.03						0.07			
v/c Ratio	0.47		0.16					0.38	0.10		0.18	
Uniform Delay, d1	18.9		17.9					3.5	2.8		3.0	
Progression Factor	1.00		1.00					1.00	1.00		0.89	
Incremental Delay, d2	0.2		0.1					0.5	0.2		0.2	
Delay (s)	19.2		18.0					4.0	3.0		2.8	
Level of Service	B		B					A	A		A	
Approach Delay (s)		18.4			0.0			3.9			2.8	
Approach LOS		B			A			A			A	

Intersection Summary

HCM 2000 Control Delay	8.6	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.39		
Actuated Cycle Length (s)	50.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	36.6%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 22: El Charro Rd & Stoneridge Dr/Jack London Blvd

BART to Livermore Extension Project
 2025 DMU + INP + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔↔↔	↑↑	↗	↖	↑↑	↗↗	↖	↑↑		↖↖↖	↑	↗↗
Traffic Volume (vph)	144	102	8	17	592	635	7	97	3	212	89	166
Future Volume (vph)	144	102	8	17	592	635	7	97	3	212	89	166
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	0.94	0.95	1.00	1.00	0.95	0.88	1.00	0.95		0.94	1.00	0.88
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	4491	3185	1425	1593	3185	2508	1593	3172		4491	1676	2508
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	4491	3185	1425	1593	3185	2508	1593	3172		4491	1676	2508
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	157	111	9	18	643	690	8	105	3	230	97	180
RTOR Reduction (vph)	0	0	6	0	0	346	0	3	0	0	0	122
Lane Group Flow (vph)	157	111	3	18	643	344	8	105	0	230	97	58
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Prot	NA		Prot	NA	Perm
Protected Phases	7	4		3	8	1	5	2		1	NA	6
Permitted Phases			4			8						6
Actuated Green, G (s)	5.3	21.2	21.2	0.7	16.6	28.5	0.7	7.3		11.9	18.5	18.5
Effective Green, g (s)	5.3	21.2	21.2	0.7	16.6	28.5	0.7	7.3		11.9	18.5	18.5
Actuated g/C Ratio	0.09	0.37	0.37	0.01	0.29	0.50	0.01	0.13		0.21	0.32	0.32
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	416	1182	529	19	925	1427	19	405		935	543	812
v/s Ratio Prot	c0.03	0.03		0.01	c0.20	c0.05	0.01	c0.03		0.05	0.06	
v/s Ratio Perm			0.00			0.09						0.02
v/c Ratio	0.38	0.09	0.01	0.95	0.70	0.24	0.42	0.26		0.25	0.18	0.07
Uniform Delay, d1	24.3	11.7	11.3	28.2	18.0	8.1	28.0	22.5		18.9	13.8	13.4
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	0.6	0.0	0.0	179.6	2.3	0.1	14.4	0.3		0.1	0.2	0.0
Delay (s)	24.9	11.7	11.3	207.8	20.3	8.2	42.4	22.8		19.0	14.0	13.4
Level of Service	C	B	B	F	C	A	D	C		B	B	B
Approach Delay (s)		19.2			16.6			24.2			16.1	
Approach LOS		B			B			C			B	

Intersection Summary

HCM 2000 Control Delay	17.2	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.45		
Actuated Cycle Length (s)	57.1	Sum of lost time (s)	16.0
Intersection Capacity Utilization	42.7%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
24: Airway Blvd/Driveway & N Canyons Pkwy

BART to Livermore Extension Project
2025 DMU + INP + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑	↑	↑↑	↑	↑		↑	↑↑		↑	
Traffic Volume (vph)	0	61	84	691	480	0	1067	0	866	0	0	0
Future Volume (vph)	0	61	84	691	480	0	1067	0	866	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0	4.0	4.0			4.4	4.0			
Lane Util. Factor		0.95	1.00	0.97	1.00			1.00	0.88			
Frt		1.00	0.85	1.00	1.00			1.00	0.85			
Flt Protected		1.00	1.00	0.95	1.00			0.95	1.00			
Satd. Flow (prot)		3539	1583	3433	1863			1770	2787			
Flt Permitted		1.00	1.00	0.95	1.00			0.95	1.00			
Satd. Flow (perm)		3539	1583	3433	1863			1770	2787			
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	66	91	751	522	0	1160	0	941	0	0	0
RTOR Reduction (vph)	0	0	73	0	0	0	0	0	106	0	0	0
Lane Group Flow (vph)	0	66	18	751	522	0	0	1160	835	0	0	0
Turn Type		NA	Perm	Prot	NA	Perm	Split	NA	pm+ov			
Protected Phases		2		1	6		8	8	1	4	4	
Permitted Phases			2			6			8			
Actuated Green, G (s)		25.6	25.6	15.1	46.7			83.1	98.2			
Effective Green, g (s)		27.6	27.6	17.1	48.7			82.9	102.2			
Actuated g/C Ratio		0.20	0.20	0.12	0.35			0.59	0.73			
Clearance Time (s)		6.0	6.0	6.0	6.0			4.2	6.0			
Vehicle Extension (s)		3.0	3.0	3.0	3.0			3.0	3.0			
Lane Grp Cap (vph)		697	312	419	648			1048	2034			
v/s Ratio Prot		0.02		c0.22	c0.28			c0.66	0.05			
v/s Ratio Perm			0.01						0.25			
v/c Ratio		0.09	0.06	1.79	0.81			1.11	0.41			
Uniform Delay, d1		46.0	45.6	61.4	41.4			28.5	7.3			
Progression Factor		1.00	1.00	1.00	1.00			0.90	1.02			
Incremental Delay, d2		0.3	0.4	366.0	10.3			58.8	0.1			
Delay (s)		46.2	46.0	427.5	51.7			84.5	7.6			
Level of Service		D	D	F	D			F	A			
Approach Delay (s)		46.1			273.4			50.1			0.0	
Approach LOS		D			F			D			A	

Intersection Summary

HCM 2000 Control Delay	130.4	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.19		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	16.4
Intersection Capacity Utilization	92.5%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
25: Airway Blvd & I-580 WB Ramps

BART to Livermore Extension Project
2025 DMU + INP + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↙	↖	↗↘		↕	↗		↕↖↗	
Traffic Volume (vph)	0	0	0	61	40	745	0	1285	343	0	290	556
Future Volume (vph)	0	0	0	61	40	745	0	1285	343	0	290	556
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0	4.0	4.0		4.0	4.0		4.0	
Lane Util. Factor				0.95	0.95	0.88		0.95	1.00		0.91	
Frt				1.00	1.00	0.85		1.00	0.85		0.90	
Flt Protected				0.95	0.98	1.00		1.00	1.00		1.00	
Satd. Flow (prot)				1681	1733	2787		3539	1583		4584	
Flt Permitted				0.95	0.98	1.00		1.00	1.00		1.00	
Satd. Flow (perm)				1681	1733	2787		3539	1583		4584	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	66	43	810	0	1397	373	0	315	604
RTOR Reduction (vph)	0	0	0	0	0	44	0	0	121	0	208	0
Lane Group Flow (vph)	0	0	0	35	74	766	0	1397	252	0	711	0
Turn Type				Split	NA	Perm		NA	Perm		NA	
Protected Phases				8	8			2			6	
Permitted Phases						8			2			
Actuated Green, G (s)				44.3	44.3	44.3		86.4	86.4		86.4	
Effective Green, g (s)				44.3	44.3	44.3		87.7	87.7		87.7	
Actuated g/C Ratio				0.32	0.32	0.32		0.63	0.63		0.63	
Clearance Time (s)				4.0	4.0	4.0		5.3	5.3		5.3	
Vehicle Extension (s)				2.0	2.0	2.0		4.0	4.0		4.0	
Lane Grp Cap (vph)				531	548	881		2216	991		2871	
v/s Ratio Prot				0.02	0.04			c0.39			0.16	
v/s Ratio Perm						c0.27			0.16			
v/c Ratio				0.07	0.14	0.87		0.63	0.25		0.25	
Uniform Delay, d1				33.4	34.2	45.1		16.1	11.6		11.6	
Progression Factor				1.00	1.00	1.00		0.53	0.24		2.18	
Incremental Delay, d2				0.0	0.0	8.8		1.3	0.6		0.0	
Delay (s)				33.4	34.2	53.9		9.8	3.3		25.3	
Level of Service				C	C	D		A	A		C	
Approach Delay (s)		0.0			51.6			8.4			25.3	
Approach LOS		A			D			A			C	

Intersection Summary

HCM 2000 Control Delay	23.7	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.71		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	68.2%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 26: Airway Blvd & I-580 EB Ramps/Kitty Hawk Rd

BART to Livermore Extension Project
 2025 DMU + INP + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	645	193	181	24	35	98	28	509	160	80	125	155
Future Volume (vph)	645	193	181	24	35	98	28	509	160	80	125	155
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.4	4.4	4.4	4.0	4.0		4.0	4.0	
Lane Util. Factor	0.97	1.00	1.00	1.00	1.00	1.00	1.00	0.95		1.00	0.95	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.96		1.00	0.92	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	3433	1863	1583	1770	1863	1583	1770	3412		1770	3246	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	3433	1863	1583	1770	1863	1583	1770	3412		1770	3246	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	701	210	197	26	38	107	30	553	174	87	136	168
RTOR Reduction (vph)	0	0	148	0	0	86	0	18	0	0	99	0
Lane Group Flow (vph)	701	210	49	26	38	21	30	709	0	87	205	0
Turn Type	Split	NA	Perm	Split	NA	pm+ov	Prot	NA		Prot	NA	
Protected Phases	7	7		8	8	1	5	2		1	6	
Permitted Phases			7			8						
Actuated Green, G (s)	34.9	34.9	34.9	11.2	11.2	22.4	20.8	65.4		11.2	56.3	
Effective Green, g (s)	34.9	34.9	34.9	10.8	10.8	21.6	20.3	66.7		11.2	57.6	
Actuated g/C Ratio	0.25	0.25	0.25	0.08	0.08	0.15	0.15	0.48		0.08	0.41	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	3.5	5.3		4.0	5.3	
Vehicle Extension (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	3.5		2.0	4.0	
Lane Grp Cap (vph)	855	464	394	136	143	293	256	1625		141	1335	
v/s Ratio Prot	c0.20	0.11		0.01	c0.02	0.01	0.02	c0.21		c0.05	0.06	
v/s Ratio Perm			0.03			0.01						
v/c Ratio	0.82	0.45	0.12	0.19	0.27	0.07	0.12	0.44		0.62	0.15	
Uniform Delay, d1	49.6	44.5	40.7	60.5	60.9	50.6	52.1	24.2		62.3	25.9	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.10	1.65	
Incremental Delay, d2	5.9	0.3	0.1	0.3	0.4	0.0	0.1	0.9		5.4	0.2	
Delay (s)	55.5	44.7	40.8	60.8	61.2	50.7	52.1	25.1		73.7	42.8	
Level of Service	E	D	D	E	E	D	D	C		E	D	
Approach Delay (s)		50.8			54.5			26.2			49.7	
Approach LOS		D			D			C			D	

Intersection Summary

HCM 2000 Control Delay	43.2	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.55		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	16.8
Intersection Capacity Utilization	58.7%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 27: Collier Canyon Rd & N Canyons Pkwy/Portola Ave

BART to Livermore Extension Project
 2025 DMU + INP + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	198	235	80	171	833	60	12	1	29	100	16	194
Future Volume (vph)	198	235	80	171	833	60	12	1	29	100	16	194
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	5.2	5.2
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.85		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	1770	1592		1770	1863	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	1770	1592		1770	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	215	255	87	186	905	65	13	1	32	109	17	211
RTOR Reduction (vph)	0	0	61	0	0	40	0	28	0	0	0	157
Lane Group Flow (vph)	215	255	26	186	905	25	13	5	0	109	17	54
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA		Prot	NA	Perm
Protected Phases	1	6		5	2		3	8		7	NA	4
Permitted Phases			6			2						4
Actuated Green, G (s)	4.2	17.3	17.3	9.5	22.6	22.6	0.6	5.8		10.6	16.2	16.2
Effective Green, g (s)	4.2	18.6	18.6	9.5	23.9	23.9	0.6	6.8		10.6	15.6	15.6
Actuated g/C Ratio	0.07	0.30	0.30	0.15	0.39	0.39	0.01	0.11		0.17	0.25	0.25
Clearance Time (s)	4.0	5.3	5.3	4.0	5.3	5.3	4.0	5.0		4.0	4.6	4.6
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	234	1070	478	273	1375	615	17	176		305	472	401
v/s Ratio Prot	0.06	0.07		c0.11	c0.26		0.01	0.00		c0.06	0.01	
v/s Ratio Perm			0.02			0.02						c0.03
v/c Ratio	0.92	0.24	0.06	0.68	0.66	0.04	0.76	0.03		0.36	0.04	0.13
Uniform Delay, d1	28.5	16.1	15.2	24.6	15.4	11.7	30.4	24.4		22.4	17.3	17.7
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	37.0	0.1	0.0	6.8	1.2	0.0	106.9	0.1		0.7	0.0	0.2
Delay (s)	65.5	16.2	15.3	31.4	16.6	11.7	137.2	24.5		23.2	17.3	17.9
Level of Service	E	B	B	C	B	B	F	C		C	B	B
Approach Delay (s)		35.1			18.7			56.3			19.6	
Approach LOS		D			B			E			B	

Intersection Summary

HCM 2000 Control Delay	24.0	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.57		
Actuated Cycle Length (s)	61.5	Sum of lost time (s)	17.2
Intersection Capacity Utilization	51.9%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
28: Isabel Ave/Campus Hill Dr & Portola Ave

BART to Livermore Extension Project
2025 DMU + INP + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↘	↑↑	↗↗	↘↘↘	↑↑		↘↘	↑↑	↗	↘	↑↑	↗
Traffic Volume (vph)	1	186	253	604	593	144	483	297	80	60	217	2
Future Volume (vph)	1	186	253	604	593	144	483	297	80	60	217	2
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	5.8	5.8
Lane Util. Factor	1.00	0.95	0.88	0.94	0.95		0.97	0.95	1.00	1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	0.97		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3539	2787	4990	3435		3433	3539	1583	1770	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	3539	2787	4990	3435		3433	3539	1583	1770	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	1	202	275	657	645	157	525	323	87	65	236	2
RTOR Reduction (vph)	0	0	213	0	14	0	0	0	60	0	0	2
Lane Group Flow (vph)	1	202	62	657	788	0	525	323	27	65	236	0
Turn Type	Prot	NA	Perm	Prot	NA		Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4						2			6
Actuated Green, G (s)	1.5	18.3	18.3	17.1	33.9		20.2	25.8	25.8	7.5	13.5	13.5
Effective Green, g (s)	1.5	19.6	19.6	17.1	35.2		20.2	27.1	27.1	7.5	12.6	12.6
Actuated g/C Ratio	0.02	0.22	0.22	0.20	0.40		0.23	0.31	0.31	0.09	0.14	0.14
Clearance Time (s)	4.0	5.3	5.3	4.0	5.3		4.0	5.3	5.3	4.0	4.9	4.9
Vehicle Extension (s)	2.0	3.0	3.0	2.0	3.0		2.0	3.0	3.0	2.0	3.0	3.0
Lane Grp Cap (vph)	30	794	625	977	1385		794	1098	491	152	510	228
v/s Ratio Prot	0.00	0.06		c0.13	c0.23		c0.15	0.09		0.04	c0.07	
v/s Ratio Perm			0.02						0.02			0.00
v/c Ratio	0.03	0.25	0.10	0.67	0.57		0.66	0.29	0.06	0.43	0.46	0.00
Uniform Delay, d1	42.2	27.8	26.8	32.5	20.2		30.4	22.8	21.1	37.9	34.2	32.0
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.2	0.2	0.1	1.4	0.5		1.6	0.2	0.0	0.7	0.7	0.0
Delay (s)	42.4	28.0	26.9	34.0	20.7		32.1	23.0	21.2	38.6	34.9	32.0
Level of Service	D	C	C	C	C		C	C	C	D	C	C
Approach Delay (s)		27.4			26.7			27.9			35.7	
Approach LOS		C			C			C			D	

Intersection Summary

HCM 2000 Control Delay	28.0	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.62		
Actuated Cycle Length (s)	87.3	Sum of lost time (s)	17.8
Intersection Capacity Utilization	67.1%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 29: Isabel Ave & I-580 WB Ramps

BART to Livermore Extension Project
 2025 DMU + INP + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↖↗		↖		↕	↖↗		↕	↖
Traffic Volume (vph)	0	0	0	838	0	390	0	494	0	0	509	562
Future Volume (vph)	0	0	0	838	0	390	0	494	0	0	509	562
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0		4.0		5.6			5.6	5.6
Lane Util. Factor				0.97		1.00		0.95			0.95	1.00
Frt				1.00		0.85		1.00			1.00	0.85
Flt Protected				0.95		1.00		1.00			1.00	1.00
Satd. Flow (prot)				3433		1583		3539			3539	1583
Flt Permitted				0.95		1.00		1.00			1.00	1.00
Satd. Flow (perm)				3433		1583		3539			3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	911	0	424	0	537	0	0	553	611
RTOR Reduction (vph)	0	0	0	0	0	161	0	0	0	0	0	285
Lane Group Flow (vph)	0	0	0	911	0	263	0	537	0	0	553	326
Turn Type				Prot		Prot		NA	Free		NA	Prot
Protected Phases				8		8		2			6	6
Permitted Phases									Free			
Actuated Green, G (s)				23.1		23.1		38.1			38.1	38.1
Effective Green, g (s)				23.1		23.1		37.3			37.3	37.3
Actuated g/C Ratio				0.33		0.33		0.53			0.53	0.53
Clearance Time (s)				4.0		4.0		4.8			4.8	4.8
Vehicle Extension (s)				2.0		2.0		4.0			4.0	4.0
Lane Grp Cap (vph)				1132		522		1885			1885	843
v/s Ratio Prot				c0.27		0.17		0.15			0.16	c0.21
v/s Ratio Perm												
v/c Ratio				0.80		0.50		0.28			0.29	0.39
Uniform Delay, d1				21.4		18.8		9.0			9.1	9.6
Progression Factor				1.00		1.00		1.35			1.00	1.00
Incremental Delay, d2				4.0		0.3		0.4			0.1	0.4
Delay (s)				25.4		19.1		12.5			9.2	10.0
Level of Service				C		B		B			A	B
Approach Delay (s)		0.0			23.4			12.5			9.6	
Approach LOS		A			C			B			A	

Intersection Summary			
HCM 2000 Control Delay	16.2	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.55		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	9.6
Intersection Capacity Utilization	46.0%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 30: Isabel Ave & I-580 EB Ramps

BART to Livermore Extension Project
 2025 DMU + INP + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗		↖↗					↕↕	↖		↕↕	↖
Traffic Volume (vph)	203	0	459	0	0	0	0	723	614	0	1179	268
Future Volume (vph)	203	0	459	0	0	0	0	723	614	0	1179	268
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0					4.0	4.0		4.0	4.0
Lane Util. Factor	0.97		0.88					0.95	1.00		0.95	1.00
Frt	1.00		0.85					1.00	0.85		1.00	0.85
Flt Protected	0.95		1.00					1.00	1.00		1.00	1.00
Satd. Flow (prot)	3433		2787					3539	1583		3539	1583
Flt Permitted	0.95		1.00					1.00	1.00		1.00	1.00
Satd. Flow (perm)	3433		2787					3539	1583		3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	221	0	499	0	0	0	0	786	667	0	1282	291
RTOR Reduction (vph)	0	0	87	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	221	0	412	0	0	0	0	786	667	0	1282	291
Turn Type	Prot		Perm					NA	Free		NA	Free
Protected Phases	4							2			6	
Permitted Phases			4						Free			Free
Actuated Green, G (s)	14.4		14.4					46.6	70.0		46.6	70.0
Effective Green, g (s)	14.4		14.4					47.6	70.0		47.6	70.0
Actuated g/C Ratio	0.21		0.21					0.68	1.00		0.68	1.00
Clearance Time (s)	4.0		4.0					5.0			5.0	
Vehicle Extension (s)	2.0		2.0					4.0			4.0	
Lane Grp Cap (vph)	706		573					2406	1583		2406	1583
v/s Ratio Prot	0.06							0.22			c0.36	
v/s Ratio Perm			c0.15						0.42			0.18
v/c Ratio	0.31		0.72					0.33	0.42		0.53	0.18
Uniform Delay, d1	23.6		25.9					4.6	0.0		5.6	0.0
Progression Factor	1.00		1.00					1.00	1.00		0.39	1.00
Incremental Delay, d2	0.1		3.6					0.1	0.8		0.8	0.2
Delay (s)	23.7		29.5					4.7	0.8		2.9	0.2
Level of Service	C		C					A	A		A	A
Approach Delay (s)		27.7			0.0			2.9			2.4	
Approach LOS		C			A			A			A	

Intersection Summary		
HCM 2000 Control Delay	7.5	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.58	A
Actuated Cycle Length (s)	70.0	Sum of lost time (s)
Intersection Capacity Utilization	55.3%	8.0
Analysis Period (min)	15	ICU Level of Service
		B

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 31: Isabel Ave & Airway Blvd

BART to Livermore Extension Project
 2025 DMU + INP + Garage AM




































Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↑	↗	↖	↑	↗	↖	↑↑↑	↗	↖↗	↑↑↑	↗
Traffic Volume (vph)	0	75	210	136	226	194	318	1136	86	567	1241	28
Future Volume (vph)	0	75	210	136	226	194	318	1136	86	567	1241	28
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.2	5.6	5.2	5.2	5.6	4.0	4.0	4.0	4.0	4.0	5.0
Lane Util. Factor		1.00	1.00	1.00	1.00	1.00	1.00	0.91	1.00	0.97	0.91	1.00
Frt		1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1863	1583	1770	1863	1583	1770	5085	1583	3433	5085	1583
Flt Permitted		1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)		1863	1583	1770	1863	1583	1770	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	82	228	148	246	211	346	1235	93	616	1349	30
RTOR Reduction (vph)	0	0	72	0	0	69	0	0	59	0	0	19
Lane Group Flow (vph)	0	82	156	148	246	142	346	1235	34	616	1349	11
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4	5	3	8	1	5	2		1	NA	6
Permitted Phases			4			8			2			6
Actuated Green, G (s)		7.7	26.8	9.7	22.0	41.1	19.1	30.5	30.5	19.1	30.5	30.5
Effective Green, g (s)		7.1	25.6	9.1	21.4	39.9	20.1	31.5	31.5	20.1	31.5	30.5
Actuated g/C Ratio		0.08	0.30	0.11	0.25	0.46	0.23	0.37	0.37	0.23	0.37	0.35
Clearance Time (s)		4.6	5.0	4.6	4.6	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Extension (s)		3.0	3.0	3.0	3.0	3.0	3.0	5.0	5.0	3.0	5.0	5.0
Lane Grp Cap (vph)		153	470	186	462	732	412	1858	578	800	1858	560
v/s Ratio Prot		0.04	0.07	c0.08	c0.13	0.04	c0.20	0.24		0.18	c0.27	
v/s Ratio Perm			0.03			0.05			0.02			0.01
v/c Ratio		0.54	0.33	0.80	0.53	0.19	0.84	0.66	0.06	0.77	0.73	0.02
Uniform Delay, d1		38.0	23.6	37.6	28.1	13.7	31.5	22.9	17.7	30.9	23.6	18.1
Progression Factor		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2		3.6	0.4	20.5	1.2	0.1	14.0	1.2	0.1	4.6	1.8	0.0
Delay (s)		41.5	24.1	58.2	29.2	13.8	45.5	24.1	17.8	35.5	25.4	18.1
Level of Service		D	C	E	C	B	D	C	B	D	C	B
Approach Delay (s)		28.7			30.9			28.2			28.4	
Approach LOS		C			C			C			C	

Intersection Summary		
HCM 2000 Control Delay	28.7	HCM 2000 Level of Service C
HCM 2000 Volume to Capacity ratio	0.79	
Actuated Cycle Length (s)	86.2	Sum of lost time (s) 20.0
Intersection Capacity Utilization	66.8%	ICU Level of Service C
Analysis Period (min)	15	

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
32: Isabel Ave & Jack London Blvd

BART to Livermore Extension Project
2025 DMU + INP + Garage AM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 	 			 		 	  		 	  	
Traffic Volume (vph)	27	53	52	204	753	315	357	899	99	155	1108	278
Future Volume (vph)	27	53	52	204	753	315	357	899	99	155	1108	278
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.97	0.91	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	3433	5085	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	3433	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	29	58	57	222	818	342	388	977	108	168	1204	302
RTOR Reduction (vph)	0	0	46	0	0	70	0	0	71	0	0	121
Lane Group Flow (vph)	29	58	11	222	818	272	388	977	37	168	1204	181
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8	1	5	2		1	6	
Permitted Phases			4			8			2			6
Actuated Green, G (s)	3.7	17.6	17.6	13.7	27.6	37.1	11.1	32.4	32.4	9.5	30.8	30.8
Effective Green, g (s)	3.7	17.6	17.6	13.7	27.6	37.1	11.1	32.4	32.4	9.5	30.8	30.8
Actuated g/C Ratio	0.04	0.19	0.19	0.15	0.29	0.39	0.12	0.34	0.34	0.10	0.33	0.33
Clearance Time (s)	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	134	659	295	256	1034	711	403	1745	543	345	1659	516
v/s Ratio Prot	0.01	0.02		c0.13	c0.23	0.04	c0.11	0.19		0.05	c0.24	
v/s Ratio Perm			0.01			0.13			0.02			0.11
v/c Ratio	0.22	0.09	0.04	0.87	0.79	0.38	0.96	0.56	0.07	0.49	0.73	0.35
Uniform Delay, d1	43.9	31.8	31.5	39.5	30.7	20.5	41.4	25.2	20.8	40.1	28.1	24.2
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.8	0.1	0.1	25.1	4.2	0.3	35.0	0.4	0.1	1.1	1.6	0.4
Delay (s)	44.8	31.8	31.5	64.6	34.9	20.8	76.4	25.6	20.9	41.2	29.7	24.6
Level of Service	D	C	C	E	C	C	E	C	C	D	C	C
Approach Delay (s)		34.3			36.2			38.6			29.9	
Approach LOS		C			D			D			C	
Intersection Summary												
HCM 2000 Control Delay			34.7								HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio			0.83									
Actuated Cycle Length (s)			94.4								Sum of lost time (s)	21.2
Intersection Capacity Utilization			65.7%								ICU Level of Service	C
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis
33: Isabel Ave Connector & Stanley Blvd

BART to Livermore Extension Project
2025 DMU + INP + Garage AM



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑	↑	↑↓	↑↑	↑↓	↑↓
Traffic Volume (vph)	345	171	322	1953	389	204
Future Volume (vph)	345	171	322	1953	389	204
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	3.8	4.0	4.0	4.0	2.5
Lane Util. Factor	0.95	1.00	0.97	0.95	0.97	0.88
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	3539	1583	3433	3539	3433	2787
Flt Permitted	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (perm)	3539	1583	3433	3539	3433	2787
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	375	186	350	2123	423	222
RTOR Reduction (vph)	0	17	0	0	0	141
Lane Group Flow (vph)	375	169	350	2123	423	81
Turn Type	NA	pm+ov	Prot	NA	Prot	pm+ov
Protected Phases	2	8	1	6	8	1
Permitted Phases		2				8
Actuated Green, G (s)	37.9	51.9	12.0	53.9	14.0	26.0
Effective Green, g (s)	39.6	55.3	12.0	55.6	15.5	29.0
Actuated g/C Ratio	0.50	0.70	0.15	0.70	0.20	0.37
Clearance Time (s)	5.7	5.5	4.0	5.7	5.5	4.0
Vehicle Extension (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Grp Cap (vph)	1771	1106	520	2487	672	1021
v/s Ratio Prot	0.11	0.03	0.10	c0.60	c0.12	0.01
v/s Ratio Perm		0.08				0.02
v/c Ratio	0.21	0.15	0.67	0.85	0.63	0.08
Uniform Delay, d1	11.0	4.0	31.7	8.7	29.2	16.3
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.0	0.0	2.7	2.9	1.3	0.0
Delay (s)	11.1	4.0	34.4	11.7	30.5	16.4
Level of Service	B	A	C	B	C	B
Approach Delay (s)	8.7			14.9	25.6	
Approach LOS	A			B	C	

Intersection Summary

HCM 2000 Control Delay	15.8	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.85		
Actuated Cycle Length (s)	79.1	Sum of lost time (s)	12.0
Intersection Capacity Utilization	71.8%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 34: Murrieta Blvd/Driveway & Portola Ave

BART to Livermore Extension Project
 2025 DMU + INP + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗		↖	↗		↖	↗	↗		↗	
Traffic Volume (vph)	0	471	98	266	1371	1	186	6	150	1	3	0
Future Volume (vph)	0	471	98	266	1371	1	186	6	150	1	3	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.8		4.0	5.8		5.2	5.2	5.2		4.0	
Lane Util. Factor		0.95		1.00	0.95		0.95	0.95	1.00		1.00	
Frt		0.97		1.00	1.00		1.00	1.00	0.85		1.00	
Flt Protected		1.00		0.95	1.00		0.95	0.96	1.00		0.99	
Satd. Flow (prot)		3447		1770	3539		1681	1691	1583		1840	
Flt Permitted		1.00		0.95	1.00		0.95	0.96	1.00		0.99	
Satd. Flow (perm)		3447		1770	3539		1681	1691	1583		1840	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	512	107	289	1490	1	202	7	163	1	3	0
RTOR Reduction (vph)	0	22	0	0	0	0	0	0	141	0	0	0
Lane Group Flow (vph)	0	597	0	289	1491	0	105	104	22	0	4	0
Turn Type	Prot	NA		Prot	NA		Split	NA	Perm		Split	NA
Protected Phases	5	2		1	6		8	8			4	4
Permitted Phases									8			
Actuated Green, G (s)		14.5		14.5	33.0		8.2	8.2	8.2		0.6	
Effective Green, g (s)		13.6		14.5	32.1		7.6	7.6	7.6		0.6	
Actuated g/C Ratio		0.25		0.26	0.58		0.14	0.14	0.14		0.01	
Clearance Time (s)		4.9		4.0	4.9		4.6	4.6	4.6		4.0	
Vehicle Extension (s)		2.0		2.0	2.0		2.0	2.0	2.0		2.0	
Lane Grp Cap (vph)		847		464	2054		231	232	217		19	
v/s Ratio Prot		0.17		0.16	c0.42		c0.06	0.06			c0.00	
v/s Ratio Perm									0.01			
v/c Ratio		0.70		0.62	0.73		0.45	0.45	0.10		0.21	
Uniform Delay, d1		19.0		18.0	8.4		21.9	21.9	20.9		27.1	
Progression Factor		1.00		1.00	1.00		1.00	1.00	1.00		1.00	
Incremental Delay, d2		2.2		1.9	1.1		0.5	0.5	0.1		2.0	
Delay (s)		21.2		19.9	9.5		22.5	22.4	20.9		29.1	
Level of Service		C		B	A		C	C	C		C	
Approach Delay (s)		21.2			11.2			21.8			29.1	
Approach LOS		C			B			C			C	

Intersection Summary

HCM 2000 Control Delay	14.9	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.74		
Actuated Cycle Length (s)	55.3	Sum of lost time (s)	19.0
Intersection Capacity Utilization	65.7%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
35: Murrieta Blvd & Jack London Blvd

BART to Livermore Extension Project
2025 DMU + INP + Garage AM



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	77	259	623	206	244	167
Future Volume (vph)	77	259	623	206	244	167
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00	1.00	0.95	0.91	
Frt	1.00	0.85	1.00	1.00	0.94	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1770	1583	1770	3539	4775	
Flt Permitted	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	1770	1583	1770	3539	4775	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	84	282	677	224	265	182
RTOR Reduction (vph)	0	240	0	0	152	0
Lane Group Flow (vph)	84	42	677	224	295	0
Turn Type	Prot	Perm	Prot	NA	NA	
Protected Phases	4		5	2	6	
Permitted Phases		4				
Actuated Green, G (s)	8.5	8.5	27.3	40.8	9.5	
Effective Green, g (s)	8.5	8.5	27.3	40.8	9.5	
Actuated g/C Ratio	0.15	0.15	0.48	0.71	0.17	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	262	234	843	2519	791	
v/s Ratio Prot	c0.05		c0.38	0.06	c0.06	
v/s Ratio Perm		0.03				
v/c Ratio	0.32	0.18	0.80	0.09	0.37	
Uniform Delay, d1	21.8	21.3	12.7	2.5	21.3	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.7	0.4	5.6	0.0	0.3	
Delay (s)	22.5	21.7	18.3	2.6	21.6	
Level of Service	C	C	B	A	C	
Approach Delay (s)	21.9			14.4	21.6	
Approach LOS	C			B	C	

Intersection Summary

HCM 2000 Control Delay	17.9	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.62		
Actuated Cycle Length (s)	57.3	Sum of lost time (s)	12.0
Intersection Capacity Utilization	57.2%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 36: Murrieta Blvd & Stanley Blvd

BART to Livermore Extension Project
 2025 DMU + INP + Garage AM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	211	438	224	17	819	113	432	334	8	153	224	446
Future Volume (vph)	211	438	224	17	819	113	432	334	8	153	224	446
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.9	4.9	4.0	4.9	4.9	4.9	4.9		4.9	4.9	4.0
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.97	0.95		1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	3433	3526		1770	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	3433	3526		1770	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	229	476	243	18	890	123	470	363	9	166	243	485
RTOR Reduction (vph)	0	0	159	0	0	70	0	2	0	0	0	90
Lane Group Flow (vph)	229	476	84	18	890	53	470	370	0	166	243	395
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Prot	NA		Prot	NA	Perm
Protected Phases	7	4		3	8	1	5	2		1		6
Permitted Phases			4			8						6
Actuated Green, G (s)	6.0	28.9	28.9	1.6	24.5	36.6	12.9	22.5		12.1	21.7	21.7
Effective Green, g (s)	6.0	28.0	28.0	1.6	23.6	34.8	12.0	21.6		11.2	20.8	21.7
Actuated g/C Ratio	0.07	0.35	0.35	0.02	0.29	0.43	0.15	0.27		0.14	0.26	0.27
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	253	1221	546	34	1029	774	507	939		244	907	423
v/s Ratio Prot	c0.07	0.13		0.01	c0.25	0.01	c0.14	0.10		0.09	0.07	
v/s Ratio Perm			0.05			0.02						c0.25
v/c Ratio	0.91	0.39	0.15	0.53	0.86	0.07	0.93	0.39		0.68	0.27	0.93
Uniform Delay, d1	37.3	20.1	18.4	39.4	27.2	13.6	34.1	24.4		33.2	24.1	29.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	32.4	0.2	0.1	14.1	7.7	0.0	23.1	0.3		7.6	0.2	27.6
Delay (s)	69.7	20.3	18.5	53.5	35.0	13.7	57.2	24.7		40.8	24.2	56.6
Level of Service	E	C	B	D	C	B	E	C		D	C	E
Approach Delay (s)		31.8			32.7			42.8			44.9	
Approach LOS		C			C			D			D	

Intersection Summary		
HCM 2000 Control Delay	37.7	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.92	D
Actuated Cycle Length (s)	81.1	Sum of lost time (s)
Intersection Capacity Utilization	74.1%	18.7
Analysis Period (min)	15	ICU Level of Service
		D

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
37: Livermore Ave & I-580 WB Ramps



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↖	↔		↗	↑			↕	
Traffic Volume (vph)	0	0	0	358	88	28	444	79	0	0	151	0
Future Volume (vph)	0	0	0	358	88	28	444	79	0	0	151	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)					4.0		4.0	4.0			4.0	
Lane Util. Factor					0.95		0.97	1.00			0.95	
Frt					0.99		1.00	1.00			1.00	
Flt Protected					0.96		0.95	1.00			1.00	
Satd. Flow (prot)					1690		3433	1863			3539	
Flt Permitted					0.96		0.95	1.00			1.00	
Satd. Flow (perm)					1690		3433	1863			3539	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	389	96	30	483	86	0	0	164	0
RTOR Reduction (vph)	0	0	0	0	4	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	0	511	0	483	86	0	0	164	0
Turn Type				Split	NA		Prot	NA			NA	
Protected Phases				8	8		5	2			6	
Permitted Phases												
Actuated Green, G (s)					21.5		12.0	28.8			13.3	
Effective Green, g (s)					21.5		11.5	30.5			15.0	
Actuated g/C Ratio					0.36		0.19	0.51			0.25	
Clearance Time (s)					4.0		3.5	5.7			5.7	
Vehicle Extension (s)					2.0		2.0	2.5			2.5	
Lane Grp Cap (vph)					605		657	947			884	
v/s Ratio Prot					c0.30		c0.14	0.05			c0.05	
v/s Ratio Perm												
v/c Ratio					0.84		0.74	0.09			0.19	
Uniform Delay, d1					17.7		22.8	7.6			17.7	
Progression Factor					1.00		0.74	0.33			1.00	
Incremental Delay, d2					10.1		3.4	0.2			0.5	
Delay (s)					27.8		20.2	2.7			18.2	
Level of Service					C		C	A			B	
Approach Delay (s)		0.0			27.8			17.5			18.2	
Approach LOS		A			C			B			B	

Intersection Summary

HCM 2000 Control Delay	21.8	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.61		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	50.1%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 38: Livermore Ave & I-580 EB Ramps



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕	↗					↕		↘	↕	
Traffic Volume (vph)	13	1	612	0	0	0	0	509	291	21	493	0
Future Volume (vph)	13	1	612	0	0	0	0	509	291	21	493	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0					4.0		4.0	4.0	
Lane Util. Factor		0.95	0.95					0.95		1.00	0.95	
Frt		0.86	0.85					0.95		1.00	1.00	
Flt Protected		1.00	1.00					1.00		0.95	1.00	
Satd. Flow (prot)		1513	1504					3346		1770	3539	
Flt Permitted		1.00	1.00					1.00		0.95	1.00	
Satd. Flow (perm)		1513	1504					3346		1770	3539	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	14	1	665	0	0	0	0	553	316	23	536	0
RTOR Reduction (vph)	0	218	218	0	0	0	0	100	0	0	0	0
Lane Group Flow (vph)	0	123	121	0	0	0	0	769	0	23	536	0
Turn Type	Prot	NA	Perm					NA		Prot	NA	
Protected Phases	7	4						2		1	6	
Permitted Phases			4									
Actuated Green, G (s)		15.8	15.8					30.8		1.4	35.2	
Effective Green, g (s)		15.8	15.8					31.8		0.4	36.2	
Actuated g/C Ratio		0.26	0.26					0.53		0.01	0.60	
Clearance Time (s)		4.0	4.0					5.0		3.0	5.0	
Vehicle Extension (s)		2.0	2.0					2.5		2.0	2.5	
Lane Grp Cap (vph)		398	396					1773		11	2135	
v/s Ratio Prot								c0.23		c0.01	0.15	
v/s Ratio Perm		0.08	0.08									
v/c Ratio		0.31	0.31					0.43		2.09	0.25	
Uniform Delay, d1		17.7	17.7					8.6		29.8	5.6	
Progression Factor		1.00	1.00					1.00		1.08	0.22	
Incremental Delay, d2		0.2	0.2					0.8		680.1	0.2	
Delay (s)		17.9	17.9					9.4		712.3	1.5	
Level of Service		B	B					A		F	A	
Approach Delay (s)		17.9			0.0			9.4			30.7	
Approach LOS		B			A			A			C	

Intersection Summary		
HCM 2000 Control Delay	17.8	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.41	B
Actuated Cycle Length (s)	60.0	Sum of lost time (s)
Intersection Capacity Utilization	50.1%	12.0
Analysis Period (min)	15	ICU Level of Service
		A

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 39: Livermore Ave & Portola Ave

BART to Livermore Extension Project
 2025 DMU + INP + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔↔	↑↑	↗	↖	↑↑	↗	↖	↑↔		↖	↑↑	↗
Traffic Volume (vph)	270	280	111	28	771	65	351	453	76	93	539	386
Future Volume (vph)	270	280	111	28	771	65	351	453	76	93	539	386
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	5.3	4.0	4.0	5.3	4.0	5.8		4.0	5.8	4.9
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	1.00	0.95		1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.98		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	1770	3463		1770	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	1770	3463		1770	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	293	304	121	30	838	71	382	492	83	101	586	420
RTOR Reduction (vph)	0	0	78	0	0	51	0	12	0	0	0	90
Lane Group Flow (vph)	293	304	43	30	838	20	382	563	0	101	586	330
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA		Prot	NA	pm+ov
Protected Phases	3	8		7	4		1	6		5	2	3
Permitted Phases			8			4						2
Actuated Green, G (s)	11.9	39.3	39.3	3.4	30.8	30.8	25.2	38.6		10.7	24.1	36.0
Effective Green, g (s)	11.9	40.6	39.3	3.4	32.1	30.8	25.2	37.7		10.7	23.2	34.2
Actuated g/C Ratio	0.11	0.37	0.36	0.03	0.29	0.28	0.23	0.34		0.10	0.21	0.31
Clearance Time (s)	4.0	5.3	5.3	4.0	5.3	5.3	4.0	4.9		4.0	4.9	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	370	1303	564	54	1030	442	404	1184		171	745	491
v/s Ratio Prot	c0.09	0.09		0.02	c0.24		c0.22	0.16		0.06	c0.17	0.07
v/s Ratio Perm			0.03			0.01						0.14
v/c Ratio	0.79	0.23	0.08	0.56	0.81	0.04	0.95	0.48		0.59	0.79	0.67
Uniform Delay, d1	47.9	24.0	23.4	52.7	36.3	29.0	41.8	28.5		47.7	41.2	33.1
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	11.0	0.1	0.1	11.8	5.0	0.0	30.9	0.3		5.4	5.5	3.6
Delay (s)	59.0	24.1	23.5	64.5	41.3	29.0	72.7	28.8		53.0	46.6	36.7
Level of Service	E	C	C	E	D	C	E	C		D	D	D
Approach Delay (s)		38.2			41.1			46.3			43.5	
Approach LOS		D			D			D			D	

Intersection Summary		
HCM 2000 Control Delay	42.6	HCM 2000 Level of Service D
HCM 2000 Volume to Capacity ratio	0.85	
Actuated Cycle Length (s)	110.2	Sum of lost time (s) 18.7
Intersection Capacity Utilization	78.2%	ICU Level of Service D
Analysis Period (min)	15	

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
40: First St/Springtown Blvd & I-580 WB Ramps

BART to Livermore Extension Project
2025 DMU + INP + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations			↗↘			↗	↗↘	↑			↗↘	↗
Traffic Volume (vph)	0	0	443	0	0	0	342	375	0	0	875	632
Future Volume (vph)	0	0	443	0	0	0	342	375	0	0	875	632
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)			4.0				4.0	4.0			5.0	5.0
Lane Util. Factor			0.88				0.97	1.00			0.95	1.00
Frt			0.85				1.00	1.00			1.00	0.85
Flt Protected			1.00				0.95	1.00			1.00	1.00
Satd. Flow (prot)			2787				3433	1863			3539	1583
Flt Permitted			1.00				0.95	1.00			1.00	1.00
Satd. Flow (perm)			2787				3433	1863			3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	482	0	0	0	372	408	0	0	951	687
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	66
Lane Group Flow (vph)	0	0	482	0	0	0	372	408	0	0	951	621
Turn Type			Over			Free	Prot	NA			NA	Perm
Protected Phases			5				5	2			6	
Permitted Phases						Free						6
Actuated Green, G (s)			16.1				16.1	70.0			45.9	45.9
Effective Green, g (s)			15.6				15.6	70.0			45.4	45.4
Actuated g/C Ratio			0.22				0.22	1.00			0.65	0.65
Clearance Time (s)			3.5				3.5	4.0			4.5	4.5
Vehicle Extension (s)			2.0				2.0	0.2			4.0	4.0
Lane Grp Cap (vph)			621				765	1863			2295	1026
v/s Ratio Prot			c0.17				0.11	0.22			0.27	
v/s Ratio Perm												c0.39
v/c Ratio			0.78				0.49	0.22			0.41	0.61
Uniform Delay, d1			25.6				23.7	0.0			5.9	7.1
Progression Factor			1.00				0.84	1.00			1.00	1.00
Incremental Delay, d2			5.5				0.2	0.3			0.2	1.2
Delay (s)			31.1				20.0	0.3			6.1	8.3
Level of Service			C				C	A			A	A
Approach Delay (s)		31.1			0.0			9.7			7.0	
Approach LOS		C			A			A			A	

Intersection Summary		
HCM 2000 Control Delay	11.7	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.65	B
Actuated Cycle Length (s)	70.0	Sum of lost time (s)
Intersection Capacity Utilization	56.4%	9.0
Analysis Period (min)	15	ICU Level of Service
		B

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
41: First St & I-580 EB Ramps

BART to Livermore Extension Project
2025 DMU + INP + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕	↗↗					↕↕	↗	↘	↕↕	
Traffic Volume (vph)	97	1	339	0	0	0	0	628	292	65	1223	0
Future Volume (vph)	97	1	339	0	0	0	0	628	292	65	1223	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0					5.0	5.0	4.0	5.0	
Lane Util. Factor		1.00	0.88					0.95	1.00	1.00	0.95	
Frt		1.00	0.85					1.00	0.85	1.00	1.00	
Flt Protected		0.95	1.00					1.00	1.00	0.95	1.00	
Satd. Flow (prot)		1775	2787					3539	1583	1770	3539	
Flt Permitted		0.95	1.00					1.00	1.00	0.95	1.00	
Satd. Flow (perm)		1775	2787					3539	1583	1770	3539	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	105	1	368	0	0	0	0	683	317	71	1329	0
RTOR Reduction (vph)	0	0	103	0	0	0	0	0	132	0	0	0
Lane Group Flow (vph)	0	106	265	0	0	0	0	683	185	71	1329	0
Turn Type	Perm	NA	Perm					NA	Perm	Prot	NA	
Protected Phases		4						2		1	6	
Permitted Phases	4		4						2			
Actuated Green, G (s)		11.4	11.4					41.3	41.3	6.3	50.6	
Effective Green, g (s)		10.9	10.9					40.8	40.8	5.3	50.1	
Actuated g/C Ratio		0.16	0.16					0.58	0.58	0.08	0.72	
Clearance Time (s)		3.5	3.5					4.5	4.5	3.0	4.5	
Vehicle Extension (s)		2.5	2.5					4.0	4.0	2.0	4.0	
Lane Grp Cap (vph)		276	433					2062	922	134	2532	
v/s Ratio Prot								0.19		0.04	c0.38	
v/s Ratio Perm		0.06	c0.10						0.12			
v/c Ratio		0.38	0.61					0.33	0.20	0.53	0.52	
Uniform Delay, d1		26.5	27.6					7.5	6.9	31.2	4.5	
Progression Factor		1.00	1.00					1.00	1.00	1.14	0.62	
Incremental Delay, d2		0.6	2.2					0.4	0.5	1.5	0.7	
Delay (s)		27.2	29.8					8.0	7.4	37.0	3.5	
Level of Service		C	C					A	A	D	A	
Approach Delay (s)		29.2			0.0			7.8			5.2	
Approach LOS		C			A			A			A	

Intersection Summary

HCM 2000 Control Delay	10.1	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.58		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	13.0
Intersection Capacity Utilization	53.2%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

42: 1st St & Mines Rd



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	34	71	41	496	106	324	18	834	298	221	1236	22
Future Volume (vph)	34	71	41	496	106	324	18	834	298	221	1236	22
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		0.97	1.00	1.00	1.00	0.91		0.97	0.91	
Frt	1.00	0.94		1.00	1.00	0.85	1.00	0.96		1.00	1.00	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1760		3433	1863	1583	1770	4885		3433	5072	
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	1760		3433	1863	1583	1770	4885		3433	5072	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	37	77	45	539	115	352	20	907	324	240	1343	24
RTOR Reduction (vph)	0	34	0	0	0	76	0	84	0	0	2	0
Lane Group Flow (vph)	37	88	0	539	115	276	20	1147	0	240	1365	0
Turn Type	Prot	NA		Prot	NA	pm+ov	Prot	NA		Prot	NA	
Protected Phases	7	4		3	8	1	5	2		1	6	
Permitted Phases						8						
Actuated Green, G (s)	1.8	8.5		12.1	18.8	24.9	0.7	22.7		6.1	28.1	
Effective Green, g (s)	1.8	8.5		12.1	18.8	24.9	0.7	22.7		6.1	28.1	
Actuated g/C Ratio	0.03	0.13		0.19	0.29	0.38	0.01	0.35		0.09	0.43	
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	48	228		635	535	699	18	1695		320	2179	
v/s Ratio Prot	0.02	0.05		c0.16	0.06	c0.04	0.01	0.23		c0.07	c0.27	
v/s Ratio Perm						0.14						
v/c Ratio	0.77	0.39		0.85	0.21	0.39	1.11	0.68		0.75	0.63	
Uniform Delay, d1	31.6	26.1		25.8	17.7	14.8	32.4	18.2		28.9	14.6	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	53.1	1.1		10.3	0.2	0.4	250.0	1.1		9.5	0.6	
Delay (s)	84.7	27.1		36.1	17.9	15.1	282.4	19.3		38.4	15.1	
Level of Service	F	C		D	B	B	F	B		D	B	
Approach Delay (s)		40.5			26.7			23.5			18.6	
Approach LOS		D			C			C			B	



















Intersection Summary

HCM 2000 Control Delay	23.0	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.72		
Actuated Cycle Length (s)	65.4	Sum of lost time (s)	16.0
Intersection Capacity Utilization	59.9%	ICU Level of Service	B
Analysis Period (min)	15		



















c Critical Lane Group

HCM Unsignalized Intersection Capacity Analysis
 43: Vasco Rd & I-580 WB Ramps

BART to Livermore Extension Project
 2025 DMU + INP + Garage AM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	0	0	166	0	848	0	0	1532	0
Future Volume (Veh/h)	0	0	0	0	0	166	0	848	0	0	1532	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	0	0	0	180	0	922	0	0	1665	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage (veh)												
Upstream signal (ft)											487	
pX, platoon unblocked												
vC, conflicting volume	2306	2587	1665	2587	2587	461	1665			922		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	2306	2587	1665	2587	2587	461	1665			922		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	100	100	67	100			100		
cM capacity (veh/h)	14	25	86	12	25	547	382			736		
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	SB 1	SB 2					
Volume Total	0	180	461	461	0	1665	0					
Volume Left	0	0	0	0	0	0	0					
Volume Right	0	180	0	0	0	0	0					
cSH	1700	547	1700	1700	1700	1700	1700					
Volume to Capacity	0.00	0.33	0.27	0.27	0.00	0.98	0.00					
Queue Length 95th (ft)	0	36	0	0	0	0	0					
Control Delay (s)	0.0	14.8	0.0	0.0	0.0	0.0	0.0					
Lane LOS	A	B										
Approach Delay (s)	0.0	14.8	0.0			0.0						
Approach LOS	A	B										
Intersection Summary												
Average Delay			1.0									
Intersection Capacity Utilization			84.0%	ICU Level of Service	E							
Analysis Period (min)			15									

HCM Unsignalized Intersection Capacity Analysis
 44: Vasco Rd & I-580 EB Ramps

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	0	0	0	0	1122	0	73	1744	0
Future Volume (Veh/h)	0	0	0	0	0	0	0	1122	0	73	1744	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	0	0	0	0	0	1220	0	79	1896	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	2664	3274	1896	3274	3274	610	1896			1220		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	2664	3274	1896	3274	3274	610	1896			1220		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	100	100	100	100			86		
cM capacity (veh/h)	10	8	59	3	8	437	311			567		
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2						
Volume Total	0	0	813	407	79	1896						
Volume Left	0	0	0	0	79	0						
Volume Right	0	0	0	0	0	0						
cSH	1700	1700	1700	1700	567	1700						
Volume to Capacity	0.00	0.00	0.48	0.24	0.14	1.12						
Queue Length 95th (ft)	0	0	0	0	12	0						
Control Delay (s)	0.0	0.0	0.0	0.0	12.4	0.0						
Lane LOS	A	A			B							
Approach Delay (s)	0.0	0.0	0.0		0.5							
Approach LOS	A	A										
Intersection Summary												
Average Delay			0.3									
Intersection Capacity Utilization			95.1%	ICU Level of Service		F						
Analysis Period (min)			15									

HCM Signalized Intersection Capacity Analysis
45: Vasco Rd & East Ave

BART to Livermore Extension Project
2025 DMU + INP + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	277	325	51	8	16	14	56	254	185	228	284	240
Future Volume (vph)	277	325	51	8	16	14	56	254	185	228	284	240
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	0.95		0.97	1.00	1.00
Frt	1.00	0.98		1.00	0.93		1.00	0.94		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	3468		1770	3290		1770	3316		3433	1863	1583
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1770	3468		1770	3290		1770	3316		3433	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	301	353	55	9	17	15	61	276	201	248	309	261
RTOR Reduction (vph)	0	21	0	0	14	0	0	147	0	0	0	175
Lane Group Flow (vph)	301	387	0	9	18	0	61	330	0	248	309	86
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												6
Actuated Green, G (s)	12.2	14.3		0.6	2.7		2.2	13.2		5.2	16.2	16.2
Effective Green, g (s)	12.2	14.3		0.6	2.7		2.2	13.2		5.2	16.2	16.2
Actuated g/C Ratio	0.25	0.29		0.01	0.05		0.04	0.27		0.11	0.33	0.33
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	438	1005		21	180		78	887		362	612	520
v/s Ratio Prot	c0.17	c0.11		0.01	0.01		0.03	0.10		c0.07	c0.17	
v/s Ratio Perm												0.05
v/c Ratio	0.69	0.38		0.43	0.10		0.78	0.37		0.69	0.50	0.16
Uniform Delay, d1	16.8	14.0		24.2	22.1		23.3	14.7		21.3	13.3	11.7
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	4.4	0.2		13.4	0.2		38.7	0.3		5.3	0.7	0.2
Delay (s)	21.3	14.2		37.6	22.4		62.0	14.9		26.6	14.0	11.9
Level of Service	C	B		D	C		E	B		C	B	B
Approach Delay (s)		17.2			25.7			20.3			17.1	
Approach LOS		B			C			C			B	

Intersection Summary

HCM 2000 Control Delay	18.1	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.63		
Actuated Cycle Length (s)	49.3	Sum of lost time (s)	16.0
Intersection Capacity Utilization	51.5%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Unsignalized Intersection Capacity Analysis
 46: I-580 WB Ramps & Northfront Rd/Northfront Road



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	121	233	1369	120	68	585
Future Volume (Veh/h)	121	233	1369	120	68	585
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	132	253	1488	130	74	636
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage (veh)						
Upstream signal (ft)	1007					
pX, platoon unblocked					0.50	
vC, conflicting volume			132	3364		258
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			132	5262		258
tC, single (s)			4.1	6.4		6.2
tC, 2 stage (s)						
tF (s)			2.2	3.5		3.3
p0 queue free %			0	0		18
cM capacity (veh/h)			1453	0		780
Direction, Lane #	EB 1	WB 1	NB 1	NB 2		
Volume Total	385	1618	74	636		
Volume Left	0	1488	74	0		
Volume Right	253	0	0	636		
cSH	1700	1453	0	780		
Volume to Capacity	0.23	1.02	Err	0.82		
Queue Length 95th (ft)	0	648	Err	222		
Control Delay (s)	0.0	47.1	Err	26.5		
Lane LOS	E		F	D		
Approach Delay (s)	0.0	47.1	Err			
Approach LOS			F			
Intersection Summary						
Average Delay			Err			
Intersection Capacity Utilization			116.6%	ICU Level of Service		H
Analysis Period (min)			15			

Intersection	
Intersection Delay, s/veh	9.9
Intersection LOS	A

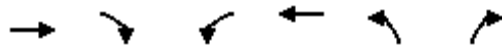
Movement	EBU	EBL	EBT	WBU	WBT	WBR	SBU	SBL	SBR
Lane Configurations		↘	↕↕		↕	↘		↘↘	↘
Traffic Vol, veh/h	0	48	21	0	147	121	0	307	90
Future Vol, veh/h	0	48	21	0	147	121	0	307	90
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	52	23	0	160	132	0	334	98
Number of Lanes	0	1	2	0	1	1	0	2	1

Approach	EB	WB	SB
Opposing Approach	WB	EB	
Opposing Lanes	2	3	0
Conflicting Approach Left	SB		WB
Conflicting Lanes Left	3	0	2
Conflicting Approach Right		SB	EB
Conflicting Lanes Right	0	3	3
HCM Control Delay	9.7	10	9.9
HCM LOS	A	A	A

Lane	EBLn1	EBLn2	EBLn3	WBLn1	WBLn2	SBLn1	SBLn2	SBLn3
Vol Left, %	100%	0%	0%	0%	0%	100%	100%	0%
Vol Thru, %	0%	100%	100%	100%	0%	0%	0%	0%
Vol Right, %	0%	0%	0%	0%	100%	0%	0%	100%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	48	11	11	147	121	154	154	90
LT Vol	48	0	0	0	0	154	154	0
Through Vol	0	11	11	147	0	0	0	0
RT Vol	0	0	0	0	121	0	0	90
Lane Flow Rate	52	11	11	160	132	167	167	98
Geometry Grp	8	8	8	8	8	7	7	7
Degree of Util (X)	0.1	0.02	0.015	0.259	0.188	0.275	0.275	0.082
Departure Headway (Hd)	6.873	6.367	4.614	5.84	5.134	5.941	5.941	3.005
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cap	524	566	780	610	692	601	601	1168
Service Time	4.573	4.067	2.314	3.627	2.921	3.724	3.724	0.787
HCM Lane V/C Ratio	0.099	0.019	0.014	0.262	0.191	0.278	0.278	0.084
HCM Control Delay	10.3	9.2	7.4	10.7	9.1	11	11	6.1
HCM Lane LOS	B	A	A	B	A	B	B	A
HCM 95th-tile Q	0.3	0.1	0	1	0.7	1.1	1.1	0.3

HCM Signalized Intersection Capacity Analysis
 48: Greenville Rd & Northfront Road/Altamont Pass Road

BART to Livermore Extension Project
 2025 DMU + INP + Garage AM



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↗	↖	↑	↘	↗
Traffic Volume (vph)	4	652	270	879	625	63
Future Volume (vph)	4	652	270	879	625	63
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	1863	1583	1770	1863	1770	1583
Flt Permitted	1.00	1.00	0.76	1.00	0.95	1.00
Satd. Flow (perm)	1863	1583	1407	1863	1770	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	4	709	293	955	679	68
RTOR Reduction (vph)	0	335	0	0	0	21
Lane Group Flow (vph)	4	374	293	955	679	47
Turn Type	NA	Perm	Perm	NA	Prot	Perm
Protected Phases	4			8	2	
Permitted Phases		4	8			2
Actuated Green, G (s)	61.6	61.6	61.6	61.6	47.1	47.1
Effective Green, g (s)	61.6	61.6	61.6	61.6	47.1	47.1
Actuated g/C Ratio	0.53	0.53	0.53	0.53	0.40	0.40
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	983	835	742	983	714	638
v/s Ratio Prot	0.00			c0.51	c0.38	
v/s Ratio Perm		0.24	0.21			0.03
v/c Ratio	0.00	0.45	0.39	0.97	0.95	0.07
Uniform Delay, d1	13.0	17.0	16.4	26.7	33.7	21.4
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.0	0.4	0.3	21.9	22.3	0.0
Delay (s)	13.0	17.4	16.8	48.6	56.0	21.4
Level of Service	B	B	B	D	E	C
Approach Delay (s)	17.4			41.2	52.9	
Approach LOS	B			D	D	

Intersection Summary

HCM 2000 Control Delay	38.1	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.96		
Actuated Cycle Length (s)	116.7	Sum of lost time (s)	8.0
Intersection Capacity Utilization	87.6%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
49: Greenville Rd & Southfront Rd

BART to Livermore Extension Project
2025 DMU + INP + Garage AM



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	←←	→→	←←	↑↑	↑↑	←
Traffic Volume (vph)	120	232	139	607	747	118
Future Volume (vph)	120	232	139	607	747	118
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.2	5.2	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.88	0.97	0.95	0.95	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	3433	2787	3433	3539	3539	1583
Flt Permitted	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (perm)	3433	2787	3433	3539	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	130	252	151	660	812	128
RTOR Reduction (vph)	0	220	0	0	0	68
Lane Group Flow (vph)	130	32	151	660	812	60
Turn Type	Prot	Perm	Prot	NA	NA	Perm
Protected Phases	8		1	6	2	
Permitted Phases		8				2
Actuated Green, G (s)	5.7	5.7	3.1	24.4	17.3	17.3
Effective Green, g (s)	5.1	5.1	3.1	26.1	19.0	19.0
Actuated g/C Ratio	0.13	0.13	0.08	0.65	0.47	0.47
Clearance Time (s)	4.6	4.6	4.0	5.7	5.7	5.7
Vehicle Extension (s)	5.0	5.0	6.0	2.5	2.5	2.5
Lane Grp Cap (vph)	433	351	263	2286	1664	744
v/s Ratio Prot	c0.04		c0.04	0.19	c0.23	
v/s Ratio Perm		0.01				0.04
v/c Ratio	0.30	0.09	0.57	0.29	0.49	0.08
Uniform Delay, d1	16.0	15.6	18.0	3.1	7.4	5.9
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.8	0.2	5.9	0.1	0.2	0.0
Delay (s)	16.8	15.8	23.9	3.2	7.5	5.9
Level of Service	B	B	C	A	A	A
Approach Delay (s)	16.2			7.0	7.3	
Approach LOS	B			A	A	

Intersection Summary

HCM 2000 Control Delay	8.8	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.46		
Actuated Cycle Length (s)	40.4	Sum of lost time (s)	13.2
Intersection Capacity Utilization	39.0%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

BART to Livermore Extension Project

50: Greenville Rd & Patterson Pass Rd

2025 DMU + INP + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔		↔	↔		↔	↔		↔	↔	
Traffic Volume (vph)	30	3	25	221	379	607	9	146	1	9	339	51
Future Volume (vph)	30	3	25	221	379	607	9	146	1	9	339	51
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.86		1.00	0.91		1.00	1.00		1.00	0.98	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1611		1770	1691		1770	1861		1770	1826	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	1611		1770	1691		1770	1861		1770	1826	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	33	3	27	240	412	660	10	159	1	10	368	55
RTOR Reduction (vph)	0	20	0	0	45	0	0	0	0	0	5	0
Lane Group Flow (vph)	33	10	0	240	1027	0	10	160	0	10	418	0
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												
Actuated Green, G (s)	2.3	30.1		40.4	68.2		0.7	28.1		0.7	28.1	
Effective Green, g (s)	2.3	30.1		40.4	68.2		0.7	28.1		0.7	28.1	
Actuated g/C Ratio	0.02	0.26		0.35	0.59		0.01	0.24		0.01	0.24	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	35	420		620	1000		10	453		10	445	
v/s Ratio Prot	c0.02	0.01		0.14	c0.61		c0.01	0.09		0.01	c0.23	
v/s Ratio Perm												
v/c Ratio	0.94	0.02		0.39	1.03		1.00	0.35		1.00	0.94	
Uniform Delay, d1	56.4	31.7		28.1	23.5		57.3	36.1		57.3	42.8	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	128.2	0.0		0.4	35.5		284.6	2.2		284.6	30.1	
Delay (s)	184.6	31.7		28.5	59.0		341.9	38.2		341.9	72.9	
Level of Service	F	C		C	E		F	D		F	E	
Approach Delay (s)		111.8			53.4			56.1			79.1	
Approach LOS		F			D			E			E	

Intersection Summary

HCM 2000 Control Delay	61.1	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.00		
Actuated Cycle Length (s)	115.3	Sum of lost time (s)	16.0
Intersection Capacity Utilization	84.8%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
1: Dougherty Rd & Amador Valley Rd



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	326	457	656	1981	1074	216
Future Volume (vph)	326	457	656	1981	1074	216
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5	5.7	5.7	
Lane Util. Factor	1.00	1.00	0.97	0.91	0.91	
Frt	1.00	0.85	1.00	1.00	0.97	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1770	1583	3433	5085	4957	
Flt Permitted	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	1770	1583	3433	5085	4957	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	354	497	713	2153	1167	235
RTOR Reduction (vph)	0	229	0	0	30	0
Lane Group Flow (vph)	354	268	713	2153	1372	0
Turn Type	Perm	Perm	Prot	NA	NA	
Protected Phases			5	2	6	
Permitted Phases	4	4				
Actuated Green, G (s)	20.9	20.9	13.6	55.5	37.4	
Effective Green, g (s)	20.9	20.9	13.6	55.5	37.4	
Actuated g/C Ratio	0.24	0.24	0.16	0.64	0.43	
Clearance Time (s)	4.5	4.5	4.5	5.7	5.7	
Vehicle Extension (s)	1.8	1.8	2.0	4.0	4.0	
Lane Grp Cap (vph)	427	382	539	3258	2140	
v/s Ratio Prot			c0.21	c0.42	0.28	
v/s Ratio Perm	c0.20	0.17				
v/c Ratio	0.83	0.70	1.32	0.66	0.64	
Uniform Delay, d1	31.2	30.0	36.5	9.7	19.3	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	12.0	4.7	157.9	0.6	0.7	
Delay (s)	43.1	34.7	194.4	10.2	20.1	
Level of Service	D	C	F	B	C	
Approach Delay (s)	38.2			56.1	20.1	
Approach LOS	D			E	C	

Intersection Summary

HCM 2000 Control Delay	43.2	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.86		
Actuated Cycle Length (s)	86.6	Sum of lost time (s)	14.7
Intersection Capacity Utilization	74.6%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
2: Dougherty Rd & Dublin Blvd

BART to Livermore Extension Project
2025 DMU + INP + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔↔	↑↑↑	↔↔	↔↔↔	↑↑↑	↔	↔↔↔	↑↑↑	↔↔	↔↔	↑↑↑	↔↔
Traffic Volume (vph)	84	1014	902	556	832	720	815	1896	303	627	1245	35
Future Volume (vph)	84	1014	902	556	832	720	815	1896	303	627	1245	35
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	6.0	5.0	5.0	5.5	5.0	5.0	5.5	5.0	5.0	5.5	
Lane Util. Factor	0.97	0.91	0.88	0.94	0.91	1.00	0.94	0.91	0.88	0.97	0.86	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	3433	5085	2787	4990	5085	1583	4990	5085	2787	3433	6382	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	3433	5085	2787	4990	5085	1583	4990	5085	2787	3433	6382	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	91	1102	980	604	904	783	886	2061	329	682	1353	38
RTOR Reduction (vph)	0	0	35	0	0	62	0	0	35	0	3	0
Lane Group Flow (vph)	91	1102	945	604	904	721	886	2061	294	682	1388	0
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	
Protected Phases	5	2	3	1	6	7	3	8	1	7	4	
Permitted Phases			2			6			8			
Actuated Green, G (s)	15.0	35.9	56.7	15.0	36.4	50.4	20.8	45.0	60.0	14.0	38.2	
Effective Green, g (s)	15.0	35.9	56.7	15.0	36.4	50.4	20.8	45.0	60.0	14.0	38.2	
Actuated g/C Ratio	0.11	0.27	0.43	0.11	0.28	0.38	0.16	0.34	0.46	0.11	0.29	
Clearance Time (s)	5.0	6.0	5.0	5.0	5.5	5.0	5.0	5.5	5.0	5.0	5.5	
Vehicle Extension (s)	2.0	4.5	2.0	2.0	4.5	2.0	2.0	4.5	2.0	2.0	4.5	
Lane Grp Cap (vph)	391	1389	1202	569	1408	607	789	1741	1272	365	1855	
v/s Ratio Prot	0.03	0.22	0.12	c0.12	0.18	c0.13	c0.18	c0.41	0.03	c0.20	0.22	
v/s Ratio Perm			0.21			0.33			0.08			
v/c Ratio	0.23	0.79	0.79	1.06	0.64	1.19	1.12	1.18	0.23	1.87	0.75	
Uniform Delay, d1	53.0	44.3	32.1	58.2	41.8	40.5	55.3	43.2	21.7	58.7	42.2	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.1	3.6	3.2	55.1	1.2	100.5	71.5	88.9	0.0	401.2	1.9	
Delay (s)	53.1	47.9	35.3	113.3	43.0	141.0	126.8	132.1	21.7	459.9	44.2	
Level of Service	D	D	D	F	D	F	F	F	C	F	D	
Approach Delay (s)		42.4			95.1			119.6			180.9	
Approach LOS		D			F			F			F	

Intersection Summary

HCM 2000 Control Delay	109.7	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.26		
Actuated Cycle Length (s)	131.4	Sum of lost time (s)	21.5
Intersection Capacity Utilization	106.6%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

3: Dougherty Rd & I-580 WB Ramps

BART to Livermore Extension Project
2025 DMU + INP + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↔↔		↔↔		↑↑↑			↑↑↑	↔
Traffic Volume (vph)	0	0	0	313	0	664	0	2377	0	0	1626	0
Future Volume (vph)	0	0	0	313	0	664	0	2377	0	0	1626	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0		4.0		4.0			4.0	
Lane Util. Factor				0.97		0.88		0.91			0.86	
Frt				1.00		0.85		1.00			1.00	
Flt Protected				0.95		1.00		1.00			1.00	
Satd. Flow (prot)				3433		2787		5085			4806	
Flt Permitted				0.95		1.00		1.00			1.00	
Satd. Flow (perm)				3433		2787		5085			4806	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	340	0	722	0	2584	0	0	1767	0
RTOR Reduction (vph)	0	0	0	0	0	30	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	340	0	692	0	2584	0	0	1767	0
Turn Type				Prot		Prot		NA			NA	Perm
Protected Phases				4		4		2			6	
Permitted Phases												6
Actuated Green, G (s)				17.7		17.7		31.5			31.5	
Effective Green, g (s)				19.1		19.1		32.9			32.9	
Actuated g/C Ratio				0.32		0.32		0.55			0.55	
Clearance Time (s)				5.4		5.4		5.4			5.4	
Vehicle Extension (s)				3.0		3.0		3.0			3.0	
Lane Grp Cap (vph)				1092		887		2788			2635	
v/s Ratio Prot				0.10		c0.25		c0.51			0.37	
v/s Ratio Perm												
v/c Ratio				0.31		0.78		0.93			0.67	
Uniform Delay, d1				15.5		18.5		12.4			9.7	
Progression Factor				1.00		1.00		1.00			1.00	
Incremental Delay, d2				0.2		4.5		6.8			1.4	
Delay (s)				15.6		23.0		19.2			11.1	
Level of Service				B		C		B			B	
Approach Delay (s)		0.0			20.7			19.2			11.1	
Approach LOS		A			C			B			B	

Intersection Summary

HCM 2000 Control Delay	16.8	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.87		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	75.8%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

4: Hopyard Rd/Dougherty Rd & I-580 EB Ramps

BART to Livermore Extension Project
2025 DMU + INP + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗		↖↗					↑↑↑	↖		↑↑↑	↖
Traffic Volume (vph)	1110	0	828	0	0	0	0	2473	0	0	1158	0
Future Volume (vph)	1110	0	828	0	0	0	0	2473	0	0	1158	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0					4.0			4.0	
Lane Util. Factor	0.97		0.88					0.91			0.86	
Frt	1.00		0.85					1.00			1.00	
Flt Protected	0.95		1.00					1.00			1.00	
Satd. Flow (prot)	3433		2787					5085			4806	
Flt Permitted	0.95		1.00					1.00			1.00	
Satd. Flow (perm)	3433		2787					5085			4806	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	1207	0	900	0	0	0	0	2688	0	0	1259	0
RTOR Reduction (vph)	0	0	58	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	1207	0	842	0	0	0	0	2688	0	0	1259	0
Turn Type	Prot		Prot					NA	Free		NA	Perm
Protected Phases	4		4					2			6	
Permitted Phases									Free			6
Actuated Green, G (s)	26.6		26.6					42.6			42.6	
Effective Green, g (s)	28.0		28.0					44.0			44.0	
Actuated g/C Ratio	0.35		0.35					0.55			0.55	
Clearance Time (s)	5.4		5.4					5.4			5.4	
Vehicle Extension (s)	3.0		3.0					3.0			3.0	
Lane Grp Cap (vph)	1201		975					2796			2643	
v/s Ratio Prot	c0.35		0.30					c0.53			0.26	
v/s Ratio Perm												
v/c Ratio	1.00		0.86					0.96			0.48	
Uniform Delay, d1	26.0		24.2					17.2			11.0	
Progression Factor	1.00		1.00					1.00			1.00	
Incremental Delay, d2	27.2		8.0					10.1			0.6	
Delay (s)	53.2		32.3					27.3			11.6	
Level of Service	D		C					C			B	
Approach Delay (s)		44.2			0.0			27.3			11.6	
Approach LOS		D			A			C			B	

Intersection Summary

HCM 2000 Control Delay	29.9	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.98		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	86.1%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

5: Hopyard Rd & Owens Rd

BART to Livermore Extension Project
2025 DMU + INP + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	365	235	313	554	289	288	278	903	252	312	1488	233
Future Volume (vph)	365	235	313	554	289	288	278	903	252	312	1488	233
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	2.7	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	0.91	0.91		1.00	0.95	0.95	1.00	0.91	1.00	0.97	0.91	
Frt	1.00	0.93		1.00	0.96	0.85	1.00	1.00	0.85	1.00	0.98	
Flt Protected	0.95	0.99		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1610	3131		1770	1707	1504	1770	5085	1583	3433	4982	
Flt Permitted	0.95	0.99		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1610	3131		1770	1707	1504	1770	5085	1583	3433	4982	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	397	255	340	602	314	313	302	982	274	339	1617	253
RTOR Reduction (vph)	0	118	0	0	9	41	0	0	194	0	18	0
Lane Group Flow (vph)	218	656	0	602	402	175	302	982	80	339	1852	0
Turn Type	Split	NA		Split	NA	pm+ov	Prot	NA	Perm	Prot	NA	
Protected Phases	8	8		4	4	1	5	2		1	6	
Permitted Phases						4			2			
Actuated Green, G (s)	15.7	15.7		28.7	28.7	50.6	15.0	33.4	33.4	21.9	40.3	
Effective Green, g (s)	17.0	17.0		30.0	30.0	53.2	15.0	35.1	35.1	21.9	42.0	
Actuated g/C Ratio	0.14	0.14		0.25	0.25	0.44	0.12	0.29	0.29	0.18	0.35	
Clearance Time (s)	5.3	5.3		5.3	5.3	4.0	4.0	5.7	5.7	4.0	5.7	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	228	443		442	426	700	221	1487	463	626	1743	
v/s Ratio Prot	0.14	c0.21		c0.34	0.24	0.05	c0.17	0.19		0.10	c0.37	
v/s Ratio Perm						0.07			0.05			
v/c Ratio	0.96	1.48		1.36	0.94	0.25	1.37	0.66	0.17	0.54	1.06	
Uniform Delay, d1	51.1	51.5		45.0	44.2	20.9	52.5	37.2	31.6	44.5	39.0	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	46.9	227.8		177.0	29.5	0.2	191.1	1.1	0.2	1.0	40.5	
Delay (s)	98.0	279.3		222.0	73.7	21.1	243.6	38.3	31.8	45.5	79.5	
Level of Service	F	F		F	E	C	F	D	C	D	E	
Approach Delay (s)		239.5			137.1			77.0			74.2	
Approach LOS		F			F			E			E	

Intersection Summary

HCM 2000 Control Delay	115.2	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.26		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	111.5%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
6: Hopyard Rd & Stoneridge Dr

BART to Livermore Extension Project
2025 DMU + INP + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	268	1328	708	119	1304	189	592	828	98	292	904	196
Future Volume (vph)	268	1328	708	119	1304	189	592	828	98	292	904	196
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.91	1.00	0.97	0.91	1.00	0.94	0.95	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5085	1583	3433	5085	1583	4990	3539	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5085	1583	3433	5085	1583	4990	3539	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	291	1443	770	129	1417	205	643	900	107	317	983	213
RTOR Reduction (vph)	0	0	197	0	0	142	0	0	78	0	0	101
Lane Group Flow (vph)	291	1443	573	129	1417	63	643	900	29	317	983	112
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8			2			6
Actuated Green, G (s)	8.0	27.0	27.0	4.0	23.0	23.0	11.0	20.0	20.0	8.0	17.0	17.0
Effective Green, g (s)	8.0	27.0	27.0	4.0	23.0	23.0	11.0	20.0	20.0	8.0	17.0	17.0
Actuated g/C Ratio	0.11	0.36	0.36	0.05	0.31	0.31	0.15	0.27	0.27	0.11	0.23	0.23
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	366	1830	569	183	1559	485	731	943	422	366	1152	358
v/s Ratio Prot	c0.08	0.28		0.04	0.28		c0.13	c0.25		0.09	0.19	
v/s Ratio Perm			c0.36			0.04			0.02			0.07
v/c Ratio	0.80	0.79	1.01	0.70	0.91	0.13	0.88	0.95	0.07	0.87	0.85	0.31
Uniform Delay, d1	32.7	21.4	24.0	34.9	25.0	18.8	31.4	27.1	20.5	33.0	27.8	24.1
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	11.3	2.3	39.4	11.7	8.1	0.1	11.7	19.1	0.1	18.8	6.3	0.5
Delay (s)	44.0	23.8	63.4	46.6	33.1	18.9	43.1	46.1	20.6	51.8	34.1	24.6
Level of Service	D	C	E	D	C	B	D	D	C	D	C	C
Approach Delay (s)		38.3			32.4			43.3			36.5	
Approach LOS		D			C			D			D	

Intersection Summary

HCM 2000 Control Delay	37.7	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	1.00		
Actuated Cycle Length (s)	75.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	77.4%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
7: Hopyard Rd & Las Positas Blvd

BART to Livermore Extension Project
2025 DMU + INP + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↕	↖	↖↗	↕	↖	↖↗	↕↕↕	↖	↖↗	↕↕↕	↖
Traffic Volume (vph)	100	249	429	540	407	50	345	936	243	71	1388	73
Future Volume (vph)	100	249	429	540	407	50	345	936	243	71	1388	73
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.95	1.00	0.97	0.95	1.00	0.97	0.91	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	3433	3539	1583	3433	5085	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	3433	3539	1583	3433	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	109	271	466	587	442	54	375	1017	264	77	1509	79
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	50
Lane Group Flow (vph)	109	271	466	587	442	54	375	1017	264	77	1509	29
Turn Type	Prot	NA	Free	Prot	NA	Free	Prot	NA	Free	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1		6
Permitted Phases			Free			Free			Free			6
Actuated Green, G (s)	4.7	12.7	86.9	16.7	24.7	86.9	10.0	37.6	86.9	3.9	31.5	31.5
Effective Green, g (s)	4.7	12.7	86.9	16.7	24.7	86.9	10.0	37.6	86.9	3.9	31.5	31.5
Actuated g/C Ratio	0.05	0.15	1.00	0.19	0.28	1.00	0.12	0.43	1.00	0.04	0.36	0.36
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	185	517	1583	659	1005	1583	395	2200	1583	154	1843	573
v/s Ratio Prot	0.03	0.08		c0.17	c0.12		c0.11	0.20		0.02	c0.30	
v/s Ratio Perm			0.29			0.03			0.17			0.02
v/c Ratio	0.59	0.52	0.29	0.89	0.44	0.03	0.95	0.46	0.17	0.50	0.82	0.05
Uniform Delay, d1	40.2	34.3	0.0	34.2	25.4	0.0	38.2	17.5	0.0	40.5	25.1	18.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	4.7	1.0	0.5	14.2	0.3	0.0	32.1	0.2	0.2	2.5	3.0	0.0
Delay (s)	44.9	35.3	0.5	48.4	25.7	0.0	70.3	17.6	0.2	43.1	28.1	18.0
Level of Service	D	D	A	D	C	A	E	B	A	D	C	B
Approach Delay (s)		17.3			36.8			26.8			28.3	
Approach LOS		B			D			C			C	

Intersection Summary

HCM 2000 Control Delay	27.8	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.80		
Actuated Cycle Length (s)	86.9	Sum of lost time (s)	16.0
Intersection Capacity Utilization	72.3%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
8: Willow Rd & Owens Rd

BART to Livermore Extension Project
2025 DMU + INP + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↕↗		↖↗	↕↕	↗	↖	↕↕	↗	↖	↕	↗
Traffic Volume (vph)	91	580	163	112	626	89	159	81	0	182	77	140
Future Volume (vph)	91	580	163	112	626	89	159	81	0	182	77	140
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	5.3	4.0		5.3	4.0	4.0
Lane Util. Factor	0.97	0.91		0.97	0.91	1.00	1.00	0.95		1.00	1.00	1.00
Frt	1.00	0.97		1.00	1.00	0.85	1.00	1.00		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	4918		3433	5085	1583	1770	3539		1770	1863	1583
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.70	1.00		0.70	1.00	1.00
Satd. Flow (perm)	3433	4918		3433	5085	1583	1308	3539		1298	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	99	630	177	122	680	97	173	88	0	198	84	152
RTOR Reduction (vph)	0	76	0	0	0	62	0	0	0	0	0	105
Lane Group Flow (vph)	99	731	0	122	680	35	173	88	0	198	84	47
Turn Type	Prot	NA		Prot	NA	Perm	Perm	NA	Perm	Perm	NA	Perm
Protected Phases	1	6		5	2			4			8	
Permitted Phases						2	4		4	8		8
Actuated Green, G (s)	3.7	15.1		3.7	15.1	15.1	13.2	13.2		13.2	13.2	13.2
Effective Green, g (s)	3.7	16.8		3.7	16.8	16.8	13.2	14.5		13.2	14.5	14.5
Actuated g/C Ratio	0.08	0.36		0.08	0.36	0.36	0.28	0.31		0.28	0.31	0.31
Clearance Time (s)	4.0	5.7		4.0	5.7	5.7	5.3	5.3		5.3	5.3	5.3
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	270	1757		270	1817	565	367	1091		364	574	488
v/s Ratio Prot	0.03	c0.15		c0.04	0.13			0.02			0.05	
v/s Ratio Perm						0.02	0.13			c0.15		0.03
v/c Ratio	0.37	0.42		0.45	0.37	0.06	0.47	0.08		0.54	0.15	0.10
Uniform Delay, d1	20.5	11.4		20.7	11.2	9.9	14.0	11.5		14.3	11.8	11.6
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	0.8	0.2		1.2	0.1	0.0	1.0	0.0		1.7	0.1	0.1
Delay (s)	21.4	11.6		21.9	11.3	10.0	15.0	11.6		16.0	11.9	11.7
Level of Service	C	B		C	B	A	B	B		B	B	B
Approach Delay (s)		12.6			12.6			13.8			13.7	
Approach LOS		B			B			B			B	

Intersection Summary		
HCM 2000 Control Delay	12.9	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.45	B
Actuated Cycle Length (s)	47.0	Sum of lost time (s)
Intersection Capacity Utilization	44.9%	12.0
Analysis Period (min)	15	ICU Level of Service
		A

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 9: Hacienda Dr & Dublin Blvd

BART to Livermore Extension Project
 2025 DMU + INP + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↑↑↑	↖↗	↖↗	↑↑↑		↖↗	↑↑	↖↗	↖↗	↑↑↑	↖↗
Traffic Volume (vph)	50	1015	128	228	488	34	223	584	466	43	631	166
Future Volume (vph)	50	1015	128	228	488	34	223	584	466	43	631	166
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	6.0	5.0	4.5	6.0		5.0	6.0	6.0	4.5	5.5	5.5
Lane Util. Factor	0.97	0.91	0.88	0.97	0.91		0.94	0.95	0.88	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5085	2787	3433	5036		4990	3539	2787	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5085	2787	3433	5036		4990	3539	2787	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	54	1103	139	248	530	37	242	635	507	47	686	180
RTOR Reduction (vph)	0	0	65	0	7	0	0	0	253	0	0	138
Lane Group Flow (vph)	54	1103	74	248	560	0	242	635	254	47	686	42
Turn Type	Prot	NA	pm+ov	Prot	NA		Prot	NA	Perm	Prot	NA	Perm
Protected Phases	5	2	3	1	6		3	8		7	NA	4
Permitted Phases			2						8			4
Actuated Green, G (s)	4.7	29.7	39.6	11.6	36.6		9.9	29.4	29.4	2.2	21.7	21.7
Effective Green, g (s)	4.7	29.7	39.6	11.6	36.6		9.9	29.4	29.4	2.2	21.7	21.7
Actuated g/C Ratio	0.05	0.32	0.42	0.12	0.39		0.11	0.31	0.31	0.02	0.23	0.23
Clearance Time (s)	4.5	6.0	5.0	4.5	6.0		5.0	6.0	6.0	4.5	5.5	5.5
Vehicle Extension (s)	2.0	3.5	2.0	2.0	3.5		2.0	3.5	3.5	2.0	3.5	3.5
Lane Grp Cap (vph)	171	1608	1323	424	1962		526	1108	872	80	1175	365
v/s Ratio Prot	0.02	c0.22	0.01	c0.07	0.11		0.05	c0.18		0.01	c0.13	
v/s Ratio Perm			0.02						0.09			0.03
v/c Ratio	0.32	0.69	0.06	0.58	0.29		0.46	0.57	0.29	0.59	0.58	0.11
Uniform Delay, d1	43.0	28.0	16.1	38.9	19.7		39.5	27.0	24.4	45.4	32.1	28.5
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.4	1.3	0.0	1.3	0.1		0.2	0.8	0.2	6.9	0.8	0.2
Delay (s)	43.4	29.3	16.1	40.2	19.8		39.7	27.8	24.6	52.3	32.9	28.7
Level of Service	D	C	B	D	B		D	C	C	D	C	C
Approach Delay (s)		28.5			26.0			28.7			33.1	
Approach LOS		C			C			C			C	

Intersection Summary

HCM 2000 Control Delay	29.0	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.64		
Actuated Cycle Length (s)	93.9	Sum of lost time (s)	21.0
Intersection Capacity Utilization	63.3%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 10: Hacienda Dr & Martinelli Blvd/Hacienda Crossings

BART to Livermore Extension Project
 2025 DMU + INP + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗	↖↗	↖↗	↗		↖↗↘	↖↗↘	↖	↖↗	↖↗↘	
Traffic Volume (vph)	27	57	431	293	33	22	357	1254	459	61	918	64
Future Volume (vph)	27	57	431	293	33	22	357	1254	459	61	918	64
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	3.0	3.0	5.5	3.0		3.5	3.0	3.0	5.0	3.5	
Lane Util. Factor	1.00	0.91	0.91	0.97	1.00		0.94	0.91	1.00	0.97	0.86	
Frt	1.00	0.94	0.85	1.00	0.94		1.00	1.00	0.85	1.00	0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1770	1585	2882	3433	1751		4990	5085	1583	3433	6345	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1770	1585	2882	3433	1751		4990	5085	1583	3433	6345	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	29	62	468	318	36	24	388	1363	499	66	998	70
RTOR Reduction (vph)	0	31	204	0	18	0	0	0	223	0	8	0
Lane Group Flow (vph)	29	78	217	318	42	0	388	1363	276	66	1060	0
Turn Type	Prot	NA	Perm	Prot	NA		Prot	NA	pm+ov	Prot	NA	
Protected Phases	5	2		1	6		3	8	1	7	4	
Permitted Phases			2						8			
Actuated Green, G (s)	5.4	17.2	17.2	8.1	20.4		8.6	33.9	42.0	4.6	29.9	
Effective Green, g (s)	4.9	19.2	19.2	7.6	22.4		9.6	35.9	46.0	4.1	31.4	
Actuated g/C Ratio	0.06	0.23	0.23	0.09	0.27		0.12	0.43	0.55	0.05	0.38	
Clearance Time (s)	4.5	5.0	5.0	5.0	5.0		4.5	5.0	5.0	4.5	5.0	
Vehicle Extension (s)	3.0	4.0	4.0	2.0	4.0		3.0	4.0	2.0	3.0	4.0	
Lane Grp Cap (vph)	104	365	664	313	470		575	2191	931	168	2391	
v/s Ratio Prot	0.02	0.05		c0.09	0.02		c0.08	c0.27	0.04	0.02	0.17	
v/s Ratio Perm			c0.08						0.14			
v/c Ratio	0.28	0.21	0.33	1.02	0.09		0.67	0.62	0.30	0.39	0.44	
Uniform Delay, d1	37.5	25.9	26.7	37.9	22.8		35.4	18.4	10.0	38.4	19.4	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	1.5	0.4	0.4	55.0	0.1		3.1	0.6	0.1	1.5	0.2	
Delay (s)	39.0	26.3	27.1	92.8	22.9		38.5	19.1	10.0	39.9	19.6	
Level of Service	D	C	C	F	C		D	B	B	D	B	
Approach Delay (s)		27.5			81.7			20.4			20.8	
Approach LOS		C			F			C			C	

Intersection Summary		
HCM 2000 Control Delay	26.8	HCM 2000 Level of Service C
HCM 2000 Volume to Capacity ratio	0.63	
Actuated Cycle Length (s)	83.3	Sum of lost time (s) 16.5
Intersection Capacity Utilization	62.6%	ICU Level of Service B
Analysis Period (min)	15	

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 11: Hacienda Dr & I-580 WB Ramps

BART to Livermore Extension Project
 2025 DMU + INP + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↔↔		↔↔		↑↑↑			↑↑↑	↔
Traffic Volume (vph)	0	0	0	348	0	299	0	1509	755	0	858	757
Future Volume (vph)	0	0	0	348	0	299	0	1509	755	0	858	757
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0		4.0		4.0			4.0	4.0
Lane Util. Factor				0.97		0.88		0.91			0.86	0.86
Frt				1.00		0.85		0.95			0.95	0.85
Flt Protected				0.95		1.00		1.00			1.00	1.00
Satd. Flow (prot)				3433		2787		4831			4585	1362
Flt Permitted				0.95		1.00		1.00			1.00	1.00
Satd. Flow (perm)				3433		2787		4831			4585	1362
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	378	0	325	0	1640	821	0	933	823
RTOR Reduction (vph)	0	0	0	0	0	41	0	125	0	0	111	149
Lane Group Flow (vph)	0	0	0	378	0	284	0	2336	0	0	1234	262
Turn Type				Prot		Prot		NA			NA	Perm
Protected Phases				4		4		2			6	
Permitted Phases												6
Actuated Green, G (s)				12.3		12.3		36.4			36.4	36.4
Effective Green, g (s)				13.7		13.7		38.3			38.3	38.3
Actuated g/C Ratio				0.23		0.23		0.64			0.64	0.64
Clearance Time (s)				5.4		5.4		5.9			5.9	5.9
Vehicle Extension (s)				3.0		3.0		3.0			3.0	3.0
Lane Grp Cap (vph)				783		636		3083			2926	869
v/s Ratio Prot				c0.11		0.10		c0.48			0.27	
v/s Ratio Perm												0.19
v/c Ratio				0.48		0.45		0.76			0.42	0.30
Uniform Delay, d1				20.1		19.9		7.6			5.4	4.9
Progression Factor				1.00		1.00		1.00			1.00	1.00
Incremental Delay, d2				0.5		0.5		1.1			0.4	0.9
Delay (s)				20.5		20.4		8.6			5.8	5.8
Level of Service				C		C		A			A	A
Approach Delay (s)		0.0			20.5			8.6			5.8	
Approach LOS		A			C			A			A	

Intersection Summary			
HCM 2000 Control Delay	9.3	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.68		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	63.2%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 12: Hacienda Dr & I-580 EB Ramps

BART to Livermore Extension Project
 2025 DMU + INP + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗		↖↗					↑↑↑	↖		↑↑↑	
Traffic Volume (vph)	891	0	462	0	0	0	0	1552	808	0	769	319
Future Volume (vph)	891	0	462	0	0	0	0	1552	808	0	769	319
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0					4.0	4.0		4.0	
Lane Util. Factor	0.97		0.88					0.86	0.86		0.91	
Frt	1.00		0.85					0.98	0.85		0.96	
Flt Protected	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (prot)	3433		2787					4706	1362		4862	
Flt Permitted	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (perm)	3433		2787					4706	1362		4862	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	968	0	502	0	0	0	0	1687	878	0	836	347
RTOR Reduction (vph)	0	0	120	0	0	0	0	32	300	0	118	0
Lane Group Flow (vph)	968	0	382	0	0	0	0	1927	306	0	1065	0
Turn Type	Prot		Prot					NA	Perm		NA	
Protected Phases	4		4					2			6	
Permitted Phases									2			
Actuated Green, G (s)	20.3		20.3					28.4	28.4		28.4	
Effective Green, g (s)	21.7		21.7					30.3	30.3		30.3	
Actuated g/C Ratio	0.36		0.36					0.51	0.51		0.51	
Clearance Time (s)	5.4		5.4					5.9	5.9		5.9	
Vehicle Extension (s)	2.0		2.0					2.0	2.0		2.0	
Lane Grp Cap (vph)	1241		1007					2376	687		2455	
v/s Ratio Prot	c0.28		0.14					c0.41			0.22	
v/s Ratio Perm									0.22			
v/c Ratio	0.78		0.38					0.81	0.45		0.43	
Uniform Delay, d1	17.0		14.2					12.5	9.5		9.4	
Progression Factor	1.00		1.00					0.86	3.90		0.82	
Incremental Delay, d2	3.0		0.1					2.1	1.4		0.5	
Delay (s)	20.0		14.3					12.7	38.4		8.2	
Level of Service	C		B					B	D		A	
Approach Delay (s)		18.1			0.0			18.8			8.2	
Approach LOS		B			A			B			A	

Intersection Summary

HCM 2000 Control Delay	16.2	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.80		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	68.1%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
13: Hacienda Dr & Owens Rd

BART to Livermore Extension Project
2025 DMU + INP + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↑↑↑	↖	↖↗	↑↑↑	↖	↖↗	↑↑↑	↖	↖↗	↑↑↑	↖
Traffic Volume (vph)	670	772	51	119	309	752	34	925	276	480	469	266
Future Volume (vph)	670	772	51	119	309	752	34	925	276	480	469	266
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	2.3	4.0	4.0	2.3	4.0	4.0	2.7	4.0	4.0	2.7
Lane Util. Factor	0.97	0.91	1.00	0.97	0.91	1.00	0.97	0.91	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5085	1583	3433	5085	1583	3433	5085	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5085	1583	3433	5085	1583	3433	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	728	839	55	129	336	817	37	1005	300	522	510	289
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	728	839	55	129	336	817	37	1005	300	522	510	289
Turn Type	Prot	NA	Free	Prot	NA	Free	Prot	NA	Free	Prot	NA	Free
Protected Phases	1	6		5	2		7	4		3	8	
Permitted Phases			Free			Free			Free			Free
Actuated Green, G (s)	22.7	29.3	120.0	8.3	14.9	120.0	4.4	32.6	120.0	30.8	59.0	120.0
Effective Green, g (s)	22.7	31.0	120.0	8.3	16.6	120.0	4.4	33.9	120.0	30.8	60.3	120.0
Actuated g/C Ratio	0.19	0.26	1.00	0.07	0.14	1.00	0.04	0.28	1.00	0.26	0.50	1.00
Clearance Time (s)	4.0	5.7		4.0	5.7		4.0	5.3		4.0	5.3	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	649	1313	1583	237	703	1583	125	1436	1583	881	2555	1583
v/s Ratio Prot	c0.21	c0.16		0.04	0.07		0.01	c0.20		c0.15	0.10	
v/s Ratio Perm			0.03			c0.52			0.19			0.18
v/c Ratio	1.12	0.64	0.03	0.54	0.48	0.52	0.30	0.70	0.19	0.59	0.20	0.18
Uniform Delay, d1	48.6	39.5	0.0	54.0	47.7	0.0	56.3	38.5	0.0	39.1	16.5	0.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.93	1.00
Incremental Delay, d2	73.8	2.4	0.0	2.5	2.3	1.2	1.3	1.5	0.3	1.0	0.0	0.2
Delay (s)	122.4	41.9	0.0	56.6	50.0	1.2	57.6	40.0	0.3	38.2	15.4	0.2
Level of Service	F	D	A	E	D	A	E	D	A	D	B	A
Approach Delay (s)		76.6			19.6			31.6			21.1	
Approach LOS		E			B			C			C	

Intersection Summary

HCM 2000 Control Delay	39.5	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.77		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	70.0%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
14: Tassajara Rd & Dublin Blvd

BART to Livermore Extension Project
2025 DMU + INP + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	264	902	457	241	297	20	374	867	523	33	782	141
Future Volume (vph)	264	902	457	241	297	20	374	867	523	33	782	141
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	6.0	6.0	5.0	6.0		5.0	6.0	6.0	5.0	6.0	6.0
Lane Util. Factor	0.97	0.95	0.88	0.94	0.95		0.94	0.91	1.00	0.97	0.86	0.88
Frt	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	2787	4990	3505		4990	5085	1583	3433	6408	2787
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	2787	4990	3505		4990	5085	1583	3433	6408	2787
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	287	980	497	262	323	22	407	942	568	36	850	153
RTOR Reduction (vph)	0	0	242	0	3	0	0	0	276	0	0	109
Lane Group Flow (vph)	287	980	255	262	342	0	407	942	292	36	850	44
Turn Type	Prot	NA	Perm	Prot	NA		Prot	NA	Perm	Prot	NA	Perm
Protected Phases	5	2		1	6		3	8		7		4
Permitted Phases			2						8			4
Actuated Green, G (s)	16.1	42.2	42.2	16.1	42.2		16.1	42.8	42.8	11.6	38.3	38.3
Effective Green, g (s)	16.1	42.2	42.2	16.1	42.2		16.1	42.8	42.8	11.6	38.3	38.3
Actuated g/C Ratio	0.12	0.31	0.31	0.12	0.31		0.12	0.32	0.32	0.09	0.28	0.28
Clearance Time (s)	5.0	6.0	6.0	5.0	6.0		5.0	6.0	6.0	5.0	6.0	6.0
Vehicle Extension (s)	2.0	3.0	3.0	2.0	3.0		2.0	4.0	4.0	2.0	4.0	4.0
Lane Grp Cap (vph)	410	1108	873	596	1098		596	1615	502	295	1822	792
v/s Ratio Prot	c0.08	c0.28		0.05	0.10		c0.08	c0.19		0.01	0.13	
v/s Ratio Perm			0.09						0.18			0.02
v/c Ratio	0.70	0.88	0.29	0.44	0.31		0.68	0.58	0.58	0.12	0.47	0.05
Uniform Delay, d1	57.0	43.9	35.0	55.1	35.2		56.9	38.5	38.4	56.8	39.8	35.0
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	4.2	8.6	0.2	0.2	0.2		2.6	0.6	2.0	0.1	0.3	0.0
Delay (s)	61.2	52.6	35.1	55.3	35.4		59.4	39.1	40.5	56.9	40.0	35.1
Level of Service	E	D	D	E	D		E	D	D	E	D	D
Approach Delay (s)		49.1			44.0			43.8			39.9	
Approach LOS		D			D			D			D	

Intersection Summary

HCM 2000 Control Delay	44.8	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.74		
Actuated Cycle Length (s)	134.7	Sum of lost time (s)	22.0
Intersection Capacity Utilization	85.9%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
15: Tassajara Rd & I-580 WB Ramps

BART to Livermore Extension Project
2025 DMU + INP + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↔↔		↔↔		↑↑	↔		↑↑↔	↔
Traffic Volume (vph)	0	0	0	494	0	242	0	1378	643	0	1165	614
Future Volume (vph)	0	0	0	494	0	242	0	1378	643	0	1165	614
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0		4.0		4.0	4.0		4.0	4.0
Lane Util. Factor				0.97		0.88		0.95	1.00		0.86	0.86
Frt				1.00		0.85		1.00	0.85		0.98	0.85
Flt Protected				0.95		1.00		1.00	1.00		1.00	1.00
Satd. Flow (prot)				3433		2787		3539	1583		4694	1362
Flt Permitted				0.95		1.00		1.00	1.00		1.00	1.00
Satd. Flow (perm)				3433		2787		3539	1583		4694	1362
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	537	0	263	0	1498	699	0	1266	667
RTOR Reduction (vph)	0	0	0	0	0	36	0	0	268	0	34	166
Lane Group Flow (vph)	0	0	0	537	0	227	0	1498	431	0	1465	268
Turn Type				Perm		Perm		NA	Perm		NA	Perm
Protected Phases								2			6	
Permitted Phases				8		8			2			6
Actuated Green, G (s)				15.0		15.0		37.0	37.0		37.0	37.0
Effective Green, g (s)				15.0		15.0		37.0	37.0		37.0	37.0
Actuated g/C Ratio				0.25		0.25		0.62	0.62		0.62	0.62
Clearance Time (s)				4.0		4.0		4.0	4.0		4.0	4.0
Vehicle Extension (s)				3.0		3.0		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)				858		696		2182	976		2894	839
v/s Ratio Prot								c0.42			0.31	
v/s Ratio Perm				c0.16		0.08			0.27			0.20
v/c Ratio				0.63		0.33		0.69	0.44		0.51	0.32
Uniform Delay, d1				20.0		18.4		7.6	6.1		6.4	5.5
Progression Factor				1.00		1.00		1.00	1.00		1.00	1.00
Incremental Delay, d2				1.4		0.3		1.8	1.5		0.6	1.0
Delay (s)				21.4		18.6		9.4	7.5		7.0	6.5
Level of Service				C		B		A	A		A	A
Approach Delay (s)		0.0			20.5			8.8			6.9	
Approach LOS		A			C			A			A	

Intersection Summary			
HCM 2000 Control Delay	10.0	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.67		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	58.9%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 16: Santa Rita Rd & I-580 EB Ramps/Pimilco Dr

BART to Livermore Extension Project
 2025 DMU + INP + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	375	97	242	150	0	308	0	1235	209	330	942	0
Future Volume (vph)	375	97	242	150	0	308	0	1235	209	330	942	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0		4.0		4.0		4.0	4.0	
Lane Util. Factor	0.97	1.00	1.00	0.97		0.88		0.86		1.00	0.95	
Frt	1.00	1.00	0.85	1.00		0.85		0.98		1.00	1.00	
Flt Protected	0.95	1.00	1.00	0.95		1.00		1.00		0.95	1.00	
Satd. Flow (prot)	3433	1863	1583	3433		2787		6269		1770	3539	
Flt Permitted	0.95	1.00	1.00	0.95		1.00		1.00		0.95	1.00	
Satd. Flow (perm)	3433	1863	1583	3433		2787		6269		1770	3539	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	408	105	263	163	0	335	0	1342	227	359	1024	0
RTOR Reduction (vph)	0	0	125	0	0	131	0	51	0	0	0	0
Lane Group Flow (vph)	408	105	138	163	0	204	0	1518	0	359	1024	0
Turn Type	Perm	NA	Perm	Prot		pm+ov		NA		Prot	NA	Perm
Protected Phases		4		3		1		2		1	6	
Permitted Phases	4		4			3						6
Actuated Green, G (s)	14.1	14.1	14.1	4.0		12.9		17.0		8.9	29.9	
Effective Green, g (s)	14.1	14.1	14.1	4.0		12.9		17.0		8.9	29.9	
Actuated g/C Ratio	0.23	0.23	0.23	0.07		0.22		0.28		0.15	0.50	
Clearance Time (s)	4.0	4.0	4.0	4.0		4.0		4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0		3.0		3.0		3.0	3.0	
Lane Grp Cap (vph)	806	437	372	228		599		1776		262	1763	
v/s Ratio Prot		0.06		c0.05		0.05		c0.24		c0.20	0.29	
v/s Ratio Perm	c0.12		0.09			0.02						
v/c Ratio	0.51	0.24	0.37	0.71		0.34		0.85		1.37	0.58	
Uniform Delay, d1	19.9	18.6	19.2	27.4		19.9		20.3		25.6	10.6	
Progression Factor	1.00	1.00	1.00	1.00		1.00		1.00		1.00	1.00	
Incremental Delay, d2	0.5	0.3	0.6	10.2		0.3		5.5		189.0	1.4	
Delay (s)	20.4	18.9	19.9	37.6		20.3		25.8		214.6	12.0	
Level of Service	C	B	B	D		C		C		F	B	
Approach Delay (s)		20.0			26.0			25.8			64.6	
Approach LOS		C			C			C			E	

Intersection Summary

HCM 2000 Control Delay	37.5	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.83		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	62.4%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 17: Santa Rita Rd & Valley Ave

BART to Livermore Extension Project
 2025 DMU + INP + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↕	↖	↗	↕	↖	↖↗	↕		↖↗	↕	↖
Traffic Volume (vph)	347	479	114	132	310	784	154	799	140	1040	1124	242
Future Volume (vph)	347	479	114	132	310	784	154	799	140	1040	1124	242
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.97	0.95		0.97	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.98		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	3433	3460		3433	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	3433	3460		3433	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	377	521	124	143	337	852	167	868	152	1130	1222	263
RTOR Reduction (vph)	0	0	99	0	0	0	0	12	0	0	0	110
Lane Group Flow (vph)	377	521	25	143	337	852	167	1008	0	1130	1222	153
Turn Type	Prot	NA	Perm	Prot	NA	Free	Prot	NA		Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1		6
Permitted Phases			4			Free						6
Actuated Green, G (s)	13.0	19.0	19.0	10.0	16.0	120.0	9.6	36.0		39.0	65.4	65.4
Effective Green, g (s)	13.0	19.0	19.0	10.0	16.0	120.0	9.6	36.0		39.0	65.4	65.4
Actuated g/C Ratio	0.11	0.16	0.16	0.08	0.13	1.00	0.08	0.30		0.32	0.55	0.55
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	371	560	250	147	471	1583	274	1038		1115	1928	862
v/s Ratio Prot	c0.11	c0.15		0.08	0.10		0.05	c0.29		c0.33	0.35	
v/s Ratio Perm			0.02			c0.54						0.10
v/c Ratio	1.02	0.93	0.10	0.97	0.72	0.54	0.61	0.97		1.01	0.63	0.18
Uniform Delay, d1	53.5	49.8	43.2	54.9	49.8	0.0	53.4	41.5		40.5	19.0	13.8
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	50.9	22.3	0.2	65.6	5.1	1.3	3.8	21.2		30.3	0.7	0.1
Delay (s)	104.4	72.1	43.4	120.4	54.9	1.3	57.2	62.6		70.8	19.7	13.9
Level of Service	F	E	D	F	D	A	E	E		E	B	B
Approach Delay (s)		80.5			27.7			61.9			41.2	
Approach LOS		F			C			E			D	

























Intersection Summary

HCM 2000 Control Delay	48.8	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	1.01		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	90.1%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group









































HCM Signalized Intersection Capacity Analysis
18: Bernal Ave/Valley Ave & Stanley Blvd

BART to Livermore Extension Project
2025 DMU + INP + Garage AM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	204	832	61	105	232	341	87	330	303	826	580	121
Future Volume (vph)	204	832	61	105	232	341	87	330	303	826	580	121
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.95	1.00	0.97	0.91	0.91	1.00	0.95	1.00	0.97	0.95	0.95
Frt	1.00	1.00	0.85	1.00	0.94	0.85	1.00	1.00	0.85	1.00	0.97	0.97
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	3433	3182	1441	1770	3539	1583	3433	3447	3447
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	3433	3182	1441	1770	3539	1583	3433	3447	3447
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	222	904	66	114	252	371	95	359	329	898	630	132
RTOR Reduction (vph)	0	0	42	0	130	63	0	0	187	0	21	0
Lane Group Flow (vph)	222	904	24	114	296	134	95	359	142	898	741	0
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	NA
Protected Phases	7	4	5	3	8	1	5	2		1	6	
Permitted Phases			4			8			2			
Actuated Green, G (s)	8.6	21.2	27.9	3.1	15.7	37.4	6.7	14.8	14.8	21.7	29.8	
Effective Green, g (s)	8.6	21.2	27.9	3.1	15.7	37.4	6.7	14.8	14.8	21.7	29.8	
Actuated g/C Ratio	0.11	0.28	0.36	0.04	0.20	0.49	0.09	0.19	0.19	0.28	0.39	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	384	976	657	138	650	776	154	681	305	970	1337	
v/s Ratio Prot	c0.06	c0.26	0.00	0.03	0.09	0.05	0.05	0.10		c0.26	c0.21	
v/s Ratio Perm			0.01			0.04			0.09			
v/c Ratio	0.58	0.93	0.04	0.83	0.46	0.17	0.62	0.53	0.46	0.93	0.55	
Uniform Delay, d1	32.4	27.0	15.8	36.6	26.8	11.0	33.8	27.9	27.5	26.8	18.3	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	2.1	14.2	0.0	31.5	0.5	0.1	7.2	0.7	1.1	14.2	0.5	
Delay (s)	34.5	41.2	15.8	68.0	27.3	11.1	41.0	28.6	28.6	40.9	18.8	
Level of Service	C	D	B	E	C	B	D	C	C	D	B	
Approach Delay (s)		38.5			29.3			30.1			30.8	
Approach LOS		D			C			C			C	
Intersection Summary												
HCM 2000 Control Delay			32.5			HCM 2000 Level of Service				C		
HCM 2000 Volume to Capacity ratio			0.85									
Actuated Cycle Length (s)			76.8			Sum of lost time (s)				16.0		
Intersection Capacity Utilization			75.3%			ICU Level of Service				D		
Analysis Period (min)			15									
c	Critical Lane Group											

HCM Signalized Intersection Capacity Analysis
19: Fallon Rd & Dublin Blvd

BART to Livermore Extension Project
2025 DMU + INP + Garage AM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 	  	 	  	  		 	  	 	  	  	
Traffic Volume (vph)	225	714	432	48	18	56	194	616	186	125	579	27
Future Volume (vph)	225	714	432	48	18	56	194	616	186	125	579	27
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.3	5.3	5.3	4.0	4.0	4.0	5.3	4.9	4.9	5.3	4.9	4.9
Lane Util. Factor	0.97	0.91	0.88	0.94	0.91	1.00	0.97	0.91	0.88	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3090	4577	2508	4491	4577	1425	3090	4577	2508	3090	4577	1425
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3090	4577	2508	4491	4577	1425	3090	4577	2508	3090	4577	1425
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	245	776	470	52	20	61	211	670	202	136	629	29
RTOR Reduction (vph)	0	0	166	0	0	58	0	0	139	0	0	21
Lane Group Flow (vph)	245	776	304	52	20	3	211	670	63	136	629	8
Turn Type	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	5	2	3	1	6		3	8		7	4	
Permitted Phases			2			6			8			4
Actuated Green, G (s)	20.0	20.7	30.3	3.1	3.8	3.8	9.6	22.1	22.1	6.0	18.5	18.5
Effective Green, g (s)	20.0	20.7	30.3	3.1	3.8	3.8	9.6	22.1	22.1	6.0	18.5	18.5
Actuated g/C Ratio	0.28	0.29	0.42	0.04	0.05	0.05	0.13	0.31	0.31	0.08	0.26	0.26
Clearance Time (s)	5.3	5.3	5.3	4.0	4.0	4.0	5.3	4.9	4.9	5.3	4.9	4.9
Vehicle Extension (s)	2.0	4.0	2.0	2.0	2.0	2.0	2.0	4.0	4.0	2.0	4.0	4.0
Lane Grp Cap (vph)	865	1326	1064	194	243	75	415	1416	776	259	1185	369
v/s Ratio Prot	c0.08	c0.17	0.04	0.01	0.00		c0.07	c0.15		0.04	0.14	
v/s Ratio Perm			0.08			0.00			0.02			0.01
v/c Ratio	0.28	0.59	0.29	0.27	0.08	0.04	0.51	0.47	0.08	0.53	0.53	0.02
Uniform Delay, d1	20.1	21.7	13.5	33.1	32.1	32.1	28.7	19.9	17.5	31.3	22.7	19.7
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.1	0.8	0.1	0.3	0.1	0.1	0.4	0.3	0.1	0.9	0.6	0.0
Delay (s)	20.2	22.5	13.5	33.3	32.2	32.2	29.1	20.3	17.5	32.2	23.3	19.7
Level of Service	C	C	B	C	C	C	C	C	B	C	C	B
Approach Delay (s)		19.3			32.6			21.5			24.7	
Approach LOS		B			C			C			C	
Intersection Summary												
HCM 2000 Control Delay			21.7			HCM 2000 Level of Service			C			
HCM 2000 Volume to Capacity ratio			0.54									
Actuated Cycle Length (s)			71.4	Sum of lost time (s)					19.5			
Intersection Capacity Utilization			46.8%	ICU Level of Service			A					
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis
20: El Charro Rd/Fallon Rd & I-580 WB Ramps

BART to Livermore Extension Project
2025 DMU + INP + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↖	↖	↖↖		↖	↖		↗↗	↗
Traffic Volume (vph)	0	0	0	272	0	444	0	674	245	0	857	374
Future Volume (vph)	0	0	0	272	0	444	0	674	245	0	857	374
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0	4.0	4.0		4.0	4.0		4.0	4.0
Lane Util. Factor				0.95	0.95	0.88		0.95	0.95		0.95	1.00
Frt				1.00	1.00	0.85		0.99	0.85		1.00	0.85
Flt Protected				0.95	0.95	1.00		1.00	1.00		1.00	1.00
Satd. Flow (prot)				1681	1681	2787		1760	1504		3539	1583
Flt Permitted				0.95	0.95	1.00		1.00	1.00		1.00	1.00
Satd. Flow (perm)				1681	1681	2787		1760	1504		3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	296	0	483	0	733	266	0	932	407
RTOR Reduction (vph)	0	0	0	0	0	255	0	3	105	0	0	179
Lane Group Flow (vph)	0	0	0	151	145	228	0	757	134	0	932	228
Turn Type				Perm	NA	Perm		NA	Perm		NA	Perm
Protected Phases					8			2			6	
Permitted Phases				8		8			2			6
Actuated Green, G (s)				10.1	10.1	10.1		22.4	22.4		22.4	22.4
Effective Green, g (s)				9.6	9.6	9.6		22.4	22.4		22.4	22.4
Actuated g/C Ratio				0.24	0.24	0.24		0.56	0.56		0.56	0.56
Clearance Time (s)				3.5	3.5	3.5		4.0	4.0		4.0	4.0
Vehicle Extension (s)				2.0	2.0	2.0		2.0	2.0		2.0	2.0
Lane Grp Cap (vph)				403	403	668		985	842		1981	886
v/s Ratio Prot								c0.43			0.26	
v/s Ratio Perm				c0.09	0.09	0.08			0.09			0.14
v/c Ratio				0.37	0.36	0.34		0.77	0.16		0.47	0.26
Uniform Delay, d1				12.7	12.6	12.6		6.8	4.3		5.3	4.5
Progression Factor				1.00	1.00	1.00		1.00	1.00		1.00	1.00
Incremental Delay, d2				0.2	0.2	0.1		5.7	0.4		0.8	0.7
Delay (s)				12.9	12.8	12.7		12.5	4.7		6.1	5.2
Level of Service				B	B	B		B	A		A	A
Approach Delay (s)		0.0			12.8			10.7			5.8	
Approach LOS		A			B			B			A	

Intersection Summary

HCM 2000 Control Delay	9.1	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.65		
Actuated Cycle Length (s)	40.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	62.6%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

21: El Charro Rd & I-580 EB Ramps

BART to Livermore Extension Project
2025 DMU + INP + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	322	0	357	0	0	0	0	918	281	0	876	0
Future Volume (vph)	322	0	357	0	0	0	0	918	281	0	876	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0					4.0	4.0		4.0	
Lane Util. Factor	0.97		0.88					0.91	0.91		0.91	
Frt	1.00		0.85					0.99	0.85		1.00	
Flt Protected	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (prot)	3433		2787					3372	1441		3390	
Flt Permitted	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (perm)	3433		2787					3372	1441		3390	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	350	0	388	0	0	0	0	998	305	0	952	0
RTOR Reduction (vph)	0	0	172	0	0	0	0	3	83	0	0	0
Lane Group Flow (vph)	350	0	216	0	0	0	0	1032	185	0	952	0
Turn Type	Prot		Perm					NA	Perm		NA	Perm
Protected Phases	4							2			6	
Permitted Phases			4						2			6
Actuated Green, G (s)	10.5		10.5					41.5	41.5		41.5	
Effective Green, g (s)	10.5		10.5					41.5	41.5		41.5	
Actuated g/C Ratio	0.18		0.18					0.69	0.69		0.69	
Clearance Time (s)	4.0		4.0					4.0	4.0		4.0	
Vehicle Extension (s)	2.0		2.0					3.0	3.0		3.0	
Lane Grp Cap (vph)	600		487					2332	996		2344	
v/s Ratio Prot	c0.10							c0.31			0.28	
v/s Ratio Perm			0.08						0.13			
v/c Ratio	0.58		0.44					0.44	0.19		0.41	
Uniform Delay, d1	22.7		22.1					4.1	3.3		4.0	
Progression Factor	1.00		1.00					1.00	1.00		1.00	
Incremental Delay, d2	0.9		0.2					0.6	0.4		0.5	
Delay (s)	23.7		22.4					4.7	3.7		4.5	
Level of Service	C		C					A	A		A	
Approach Delay (s)		23.0			0.0			4.5			4.5	
Approach LOS		C			A			A			A	

Intersection Summary

HCM 2000 Control Delay	9.1	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.47		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	44.2%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 22: El Charro Rd & Stoneridge Dr/Jack London Blvd

BART to Livermore Extension Project
 2025 DMU + INP + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔↔↔	↑↑	↗	↖	↑↑	↗↗	↖	↑↑		↖↖↖	↑	↗↗
Traffic Volume (vph)	262	578	4	3	318	477	2	34	3	748	26	135
Future Volume (vph)	262	578	4	3	318	477	2	34	3	748	26	135
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	0.94	0.95	1.00	1.00	0.95	0.88	1.00	0.95		0.94	1.00	0.88
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	4491	3185	1425	1593	3185	2508	1593	3149		4491	1676	2508
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	4491	3185	1425	1593	3185	2508	1593	3149		4491	1676	2508
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	285	628	4	3	346	518	2	37	3	813	28	147
RTOR Reduction (vph)	0	0	3	0	0	295	0	3	0	0	0	98
Lane Group Flow (vph)	285	628	1	3	346	223	2	37	0	813	28	49
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Prot	NA		Prot	NA	Perm
Protected Phases	7	4		3	8	1	5	2		1	6	
Permitted Phases			4			8						6
Actuated Green, G (s)	10.4	20.6	20.6	0.8	11.0	24.5	0.7	6.1		13.5	18.9	18.9
Effective Green, g (s)	10.4	20.6	20.6	0.8	11.0	24.5	0.7	6.1		13.5	18.9	18.9
Actuated g/C Ratio	0.18	0.36	0.36	0.01	0.19	0.43	0.01	0.11		0.24	0.33	0.33
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	819	1151	515	22	614	1254	19	336		1063	555	831
v/s Ratio Prot	0.06	c0.20		0.00	c0.11	0.04	0.00	c0.01		c0.18	0.02	
v/s Ratio Perm			0.00			0.05						0.02
v/c Ratio	0.35	0.55	0.00	0.14	0.56	0.18	0.11	0.11		0.76	0.05	0.06
Uniform Delay, d1	20.3	14.5	11.6	27.8	20.8	10.0	27.8	23.0		20.3	13.0	13.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	0.3	0.5	0.0	2.8	1.2	0.1	2.4	0.1		3.3	0.0	0.0
Delay (s)	20.6	15.0	11.6	30.6	22.0	10.1	30.3	23.1		23.6	13.0	13.0
Level of Service	C	B	B	C	C	B	C	C		C	B	B
Approach Delay (s)		16.7			14.9			23.5			21.7	
Approach LOS		B			B			C			C	

Intersection Summary		
HCM 2000 Control Delay	18.0	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.59	B
Actuated Cycle Length (s)	57.0	Sum of lost time (s)
Intersection Capacity Utilization	53.6%	16.0
Analysis Period (min)	15	ICU Level of Service
		A

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
24: Airway Blvd/Driveway & N Canyons Pkwy

BART to Livermore Extension Project
2025 DMU + INP + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑	↑	↑↑	↑	↑		↑	↑↑		↑	
Traffic Volume (vph)	0	583	388	792	69	0	56	0	743	0	0	0
Future Volume (vph)	0	583	388	792	69	0	56	0	743	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0	4.0	4.0			4.4	4.0			
Lane Util. Factor		0.95	1.00	0.97	1.00			1.00	0.88			
Frt		1.00	0.85	1.00	1.00			1.00	0.85			
Flt Protected		1.00	1.00	0.95	1.00			0.95	1.00			
Satd. Flow (prot)		3539	1583	3433	1863			1770	2787			
Flt Permitted		1.00	1.00	0.95	1.00			0.95	1.00			
Satd. Flow (perm)		3539	1583	3433	1863			1770	2787			
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	634	422	861	75	0	61	0	808	0	0	0
RTOR Reduction (vph)	0	0	218	0	0	0	0	0	463	0	0	0
Lane Group Flow (vph)	0	634	204	861	75	0	0	61	345	0	0	0
Turn Type		NA	Perm	Prot	NA	Perm	Split	NA	pm+ov			
Protected Phases		2		1	6		8	8	1	4	4	
Permitted Phases			2			6			8			
Actuated Green, G (s)		53.7	53.7	33.8	93.5			11.3	45.1			
Effective Green, g (s)		55.7	55.7	35.8	95.5			11.1	49.1			
Actuated g/C Ratio		0.48	0.48	0.31	0.83			0.10	0.43			
Clearance Time (s)		6.0	6.0	6.0	6.0			4.2	6.0			
Vehicle Extension (s)		3.0	3.0	3.0	3.0			3.0	3.0			
Lane Grp Cap (vph)		1714	766	1068	1547			170	1286			
v/s Ratio Prot		c0.18		c0.25	0.04			0.03	c0.08			
v/s Ratio Perm			0.13						0.04			
v/c Ratio		0.37	0.27	0.81	0.05			0.36	0.27			
Uniform Delay, d1		18.6	17.6	36.4	1.7			48.6	21.3			
Progression Factor		1.00	1.00	1.00	1.00			1.00	1.00			
Incremental Delay, d2		0.6	0.9	4.5	0.1			1.3	0.1			
Delay (s)		19.2	18.4	40.9	1.8			49.9	21.4			
Level of Service		B	B	D	A			D	C			
Approach Delay (s)		18.9			37.8			23.4			0.0	
Approach LOS		B			D			C			A	

Intersection Summary

HCM 2000 Control Delay	26.5	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.54		
Actuated Cycle Length (s)	115.0	Sum of lost time (s)	16.4
Intersection Capacity Utilization	53.3%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
25: Airway Blvd & I-580 WB Ramps

BART to Livermore Extension Project
2025 DMU + INP + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↙	↖	↗		↑↑	↗		↑↑↑	
Traffic Volume (vph)	0	0	0	75	26	154	0	699	386	0	634	642
Future Volume (vph)	0	0	0	75	26	154	0	699	386	0	634	642
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0	4.0	4.0		4.0	4.0		4.0	
Lane Util. Factor				0.95	0.95	0.88		0.95	1.00		0.91	
Frt				1.00	1.00	0.85		1.00	0.85		0.92	
Flt Protected				0.95	0.97	1.00		1.00	1.00		1.00	
Satd. Flow (prot)				1681	1720	2787		3539	1583		4701	
Flt Permitted				0.95	0.97	1.00		1.00	1.00		1.00	
Satd. Flow (perm)				1681	1720	2787		3539	1583		4701	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	82	28	167	0	760	420	0	689	698
RTOR Reduction (vph)	0	0	0	0	0	154	0	0	64	0	54	0
Lane Group Flow (vph)	0	0	0	43	67	13	0	760	356	0	1333	0
Turn Type				Split	NA	Perm		NA	Perm		NA	
Protected Phases				8	8			2			6	
Permitted Phases						8			2			
Actuated Green, G (s)				8.7	8.7	8.7		92.0	92.0		92.0	
Effective Green, g (s)				8.7	8.7	8.7		93.3	93.3		93.3	
Actuated g/C Ratio				0.08	0.08	0.08		0.85	0.85		0.85	
Clearance Time (s)				4.0	4.0	4.0		5.3	5.3		5.3	
Vehicle Extension (s)				2.0	2.0	2.0		4.0	4.0		4.0	
Lane Grp Cap (vph)				132	136	220		3001	1342		3987	
v/s Ratio Prot				0.03	c0.04			0.21			c0.28	
v/s Ratio Perm						0.00			0.22			
v/c Ratio				0.33	0.49	0.06		0.25	0.27		0.33	
Uniform Delay, d1				47.9	48.5	46.9		1.6	1.6		1.8	
Progression Factor				1.00	1.00	1.00		3.58	20.63		1.00	
Incremental Delay, d2				0.5	1.0	0.0		0.2	0.4		0.2	
Delay (s)				48.4	49.6	46.9		5.9	34.2		2.0	
Level of Service				D	D	D		A	C		A	
Approach Delay (s)		0.0			47.8			16.0			2.0	
Approach LOS		A			D			B			A	

Intersection Summary

HCM 2000 Control Delay	12.3	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.35		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	36.7%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 26: Airway Blvd & I-580 EB Ramps/Kitty Hawk Rd

BART to Livermore Extension Project
 2025 DMU + INP + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↑	↖	↖	↑	↖	↖	↕↔		↖	↕↔	
Traffic Volume (vph)	603	209	290	61	72	149	27	374	136	122	281	276
Future Volume (vph)	603	209	290	61	72	149	27	374	136	122	281	276
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.4	4.4	4.4	4.0	4.0		4.0	4.0	
Lane Util. Factor	0.97	1.00	1.00	1.00	1.00	1.00	1.00	0.95		1.00	0.95	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.96		1.00	0.93	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	3433	1863	1583	1770	1863	1583	1770	3398		1770	3276	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	3433	1863	1583	1770	1863	1583	1770	3398		1770	3276	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	655	227	315	66	78	162	29	407	148	133	305	300
RTOR Reduction (vph)	0	0	237	0	0	107	0	31	0	0	151	0
Lane Group Flow (vph)	655	227	78	66	78	55	29	524	0	133	454	0
Turn Type	Split	NA	Perm	Split	NA	pm+ov	Prot	NA		Prot	NA	
Protected Phases	7	7		8	8	1	5	2		1	6	
Permitted Phases			7			8						
Actuated Green, G (s)	27.2	27.2	27.2	11.2	11.2	23.7	9.2	41.8		12.5	45.6	
Effective Green, g (s)	27.2	27.2	27.2	10.8	10.8	22.9	8.7	43.1		12.5	46.9	
Actuated g/C Ratio	0.25	0.25	0.25	0.10	0.10	0.21	0.08	0.39		0.11	0.43	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	3.5	5.3		4.0	5.3	
Vehicle Extension (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	3.5		2.0	4.0	
Lane Grp Cap (vph)	848	460	391	173	182	392	139	1331		201	1396	
v/s Ratio Prot	c0.19	0.12		0.04	c0.04	0.02	0.02	c0.15		c0.08	0.14	
v/s Ratio Perm			0.05			0.02						
v/c Ratio	0.77	0.49	0.20	0.38	0.43	0.14	0.21	0.39		0.66	0.32	
Uniform Delay, d1	38.5	35.5	32.8	46.5	46.7	35.5	47.4	24.1		46.7	21.0	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		0.96	0.83	
Incremental Delay, d2	4.0	0.3	0.1	0.5	0.6	0.1	0.3	0.9		6.0	0.6	
Delay (s)	42.5	35.8	32.9	47.0	47.3	35.6	47.7	24.9		50.7	18.0	
Level of Service	D	D	C	D	D	D	D	C		D	B	
Approach Delay (s)		38.7			41.0			26.1			23.8	
Approach LOS		D			D			C			C	

Intersection Summary

HCM 2000 Control Delay	32.5	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.55		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	16.8
Intersection Capacity Utilization	64.0%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 27: Collier Canyon Rd & N Canyons Pkwy/Portola Ave

BART to Livermore Extension Project
 2025 DMU + INP + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↑↑	↖	↖	↑↑	↖	↖	↖		↖	↑	↖
Traffic Volume (vph)	405	802	34	17	256	30	28	5	181	132	3	96
Future Volume (vph)	405	802	34	17	256	30	28	5	181	132	3	96
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	5.2	5.2
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.85		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	1770	1590		1770	1863	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	1770	1590		1770	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	440	872	37	18	278	33	30	5	197	143	3	104
RTOR Reduction (vph)	0	0	22	0	0	25	0	141	0	0	0	71
Lane Group Flow (vph)	440	872	15	18	278	8	30	61	0	143	3	33
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA		Prot	NA	Perm
Protected Phases	1	6		5	2		3	8		7	NA	4
Permitted Phases			6			2						4
Actuated Green, G (s)	13.8	29.8	29.8	0.7	16.7	16.7	2.2	16.7		9.3	24.2	24.2
Effective Green, g (s)	13.8	31.1	31.1	0.7	18.0	18.0	2.2	17.7		9.3	23.6	23.6
Actuated g/C Ratio	0.18	0.42	0.42	0.01	0.24	0.24	0.03	0.24		0.12	0.32	0.32
Clearance Time (s)	4.0	5.3	5.3	4.0	5.3	5.3	4.0	5.0		4.0	4.6	4.6
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	633	1471	658	16	851	380	52	376		220	587	499
v/s Ratio Prot	c0.13	c0.25		0.01	0.08		0.02	c0.04		c0.08	0.00	
v/s Ratio Perm			0.01			0.01						0.02
v/c Ratio	0.70	0.59	0.02	1.12	0.33	0.02	0.58	0.16		0.65	0.01	0.07
Uniform Delay, d1	28.5	16.9	12.9	37.0	23.4	21.7	35.8	22.7		31.2	17.6	17.9
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	3.3	0.6	0.0	268.4	0.2	0.0	14.6	0.2		6.7	0.0	0.1
Delay (s)	31.8	17.6	12.9	305.5	23.6	21.7	50.4	22.9		37.9	17.6	18.0
Level of Service	C	B	B	F	C	C	D	C		D	B	B
Approach Delay (s)		22.1			38.9			26.4			29.4	
Approach LOS		C			D			C			C	

Intersection Summary

HCM 2000 Control Delay	26.0	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.53		
Actuated Cycle Length (s)	74.8	Sum of lost time (s)	17.2
Intersection Capacity Utilization	57.6%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
28: Isabel Ave/Campus Hill Dr & Portola Ave

BART to Livermore Extension Project
2025 DMU + INP + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗	↘	↖↗	↖↗		↖↗	↖↗	↖	↖	↗	↖
Traffic Volume (vph)	5	639	493	309	174	161	180	420	91	156	322	2
Future Volume (vph)	5	639	493	309	174	161	180	420	91	156	322	2
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	5.8	5.8
Lane Util. Factor	1.00	0.95	0.88	0.94	0.95		0.97	0.95	1.00	1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	0.93		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3539	2787	4990	3284		3433	3539	1583	1770	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	3539	2787	4990	3284		3433	3539	1583	1770	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	5	695	536	336	189	175	196	457	99	170	350	2
RTOR Reduction (vph)	0	0	348	0	98	0	0	0	78	0	0	2
Lane Group Flow (vph)	5	695	188	336	266	0	196	457	21	170	350	0
Turn Type	Prot	NA	Perm	Prot	NA		Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4						2			6
Actuated Green, G (s)	1.5	29.1	29.1	9.2	36.8		9.2	17.0	17.0	12.7	20.9	20.9
Effective Green, g (s)	1.5	30.4	30.4	9.2	38.1		9.2	18.3	18.3	12.7	20.0	20.0
Actuated g/C Ratio	0.02	0.35	0.35	0.11	0.44		0.11	0.21	0.21	0.15	0.23	0.23
Clearance Time (s)	4.0	5.3	5.3	4.0	5.3		4.0	5.3	5.3	4.0	4.9	4.9
Vehicle Extension (s)	2.0	3.0	3.0	2.0	3.0		2.0	3.0	3.0	2.0	3.0	3.0
Lane Grp Cap (vph)	30	1242	978	530	1444		364	747	334	259	817	365
v/s Ratio Prot	0.00	c0.20		c0.07	0.08		0.06	c0.13		c0.10	c0.10	
v/s Ratio Perm			0.07						0.01			0.00
v/c Ratio	0.17	0.56	0.19	0.63	0.18		0.54	0.61	0.06	0.66	0.43	0.00
Uniform Delay, d1	41.9	22.7	19.6	37.1	14.8		36.7	30.9	27.3	34.9	28.4	25.6
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.0	0.6	0.1	1.8	0.1		0.8	1.5	0.1	4.5	0.4	0.0
Delay (s)	42.9	23.2	19.7	38.9	14.8		37.5	32.4	27.4	39.4	28.8	25.6
Level of Service	D	C	B	D	B		D	C	C	D	C	C
Approach Delay (s)		21.8			26.4			33.1			32.2	
Approach LOS		C			C			C			C	

Intersection Summary

HCM 2000 Control Delay	27.1	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.60		
Actuated Cycle Length (s)	86.6	Sum of lost time (s)	17.8
Intersection Capacity Utilization	58.7%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group























HCM Signalized Intersection Capacity Analysis
 29: Isabel Ave & I-580 WB Ramps

BART to Livermore Extension Project
 2025 DMU + INP + Garage AM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	680	0	261	0	364	0	0	624	464
Future Volume (vph)	0	0	0	680	0	261	0	364	0	0	624	464
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0		4.0		5.6			5.6	5.6
Lane Util. Factor				0.97		1.00		0.95			0.95	1.00
Frt				1.00		0.85		1.00			1.00	0.85
Flt Protected				0.95		1.00		1.00			1.00	1.00
Satd. Flow (prot)				3433		1583		3539			3539	1583
Flt Permitted				0.95		1.00		1.00			1.00	1.00
Satd. Flow (perm)				3433		1583		3539			3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	739	0	284	0	396	0	0	678	504
RTOR Reduction (vph)	0	0	0	0	0	200	0	0	0	0	0	270
Lane Group Flow (vph)	0	0	0	739	0	84	0	396	0	0	678	234
Turn Type				Prot		Prot		NA	Free		NA	Prot
Protected Phases				8		8		2			6	6
Permitted Phases									Free			
Actuated Green, G (s)				11.8		11.8		19.4			19.4	19.4
Effective Green, g (s)				11.8		11.8		18.6			18.6	18.6
Actuated g/C Ratio				0.30		0.30		0.47			0.47	0.47
Clearance Time (s)				4.0		4.0		4.8			4.8	4.8
Vehicle Extension (s)				2.0		2.0		4.0			4.0	4.0
Lane Grp Cap (vph)				1012		466		1645			1645	736
v/s Ratio Prot				c0.22		0.05		0.11			c0.19	0.15
v/s Ratio Perm												
v/c Ratio				0.73		0.18		0.24			0.41	0.32
Uniform Delay, d1				12.7		10.5		6.4			7.1	6.7
Progression Factor				1.00		1.00		1.00			1.00	1.00
Incremental Delay, d2				2.4		0.1		0.3			0.2	0.3
Delay (s)				15.0		10.6		6.8			7.3	7.1
Level of Service				B		B		A			A	A
Approach Delay (s)		0.0			13.8			6.8			7.2	
Approach LOS		A			B			A			A	
Intersection Summary												
HCM 2000 Control Delay			9.7									A
HCM 2000 Volume to Capacity ratio			0.54									
Actuated Cycle Length (s)			40.0								9.6	
Intersection Capacity Utilization			44.6%									A
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis
 30: Isabel Ave & I-580 EB Ramps

BART to Livermore Extension Project
 2025 DMU + INP + Garage AM

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations	 		 					 			 		
Traffic Volume (vph)	186	0	386	0	0	0	0	693	947	0	888	645	
Future Volume (vph)	186	0	386	0	0	0	0	693	947	0	888	645	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)	4.0		4.0					4.0	4.0		4.0	4.0	
Lane Util. Factor	0.97		0.88					0.95	1.00		0.95	1.00	
Frt	1.00		0.85					1.00	0.85		1.00	0.85	
Flt Protected	0.95		1.00					1.00	1.00		1.00	1.00	
Satd. Flow (prot)	3433		2787					3539	1583		3539	1583	
Flt Permitted	0.95		1.00					1.00	1.00		1.00	1.00	
Satd. Flow (perm)	3433		2787					3539	1583		3539	1583	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	
Adj. Flow (vph)	202	0	420	0	0	0	0	753	1029	0	965	701	
RTOR Reduction (vph)	0	0	189	0	0	0	0	0	0	0	0	0	
Lane Group Flow (vph)	202	0	231	0	0	0	0	753	1029	0	965	701	
Turn Type	Prot		Perm					NA	Free		NA	Free	
Protected Phases	4							2			6		
Permitted Phases			4						Free			Free	
Actuated Green, G (s)	13.4		13.4					87.6	110.0		87.6	110.0	
Effective Green, g (s)	13.4		13.4					88.6	110.0		88.6	110.0	
Actuated g/C Ratio	0.12		0.12					0.81	1.00		0.81	1.00	
Clearance Time (s)	4.0		4.0					5.0			5.0		
Vehicle Extension (s)	2.0		2.0					4.0			4.0		
Lane Grp Cap (vph)	418		339					2850	1583		2850	1583	
v/s Ratio Prot	0.06							0.21			0.27		
v/s Ratio Perm			0.08						c0.65			0.44	
v/c Ratio	0.48		0.68					0.26	0.65		0.34	0.44	
Uniform Delay, d1	45.1		46.3					2.6	0.0		2.9	0.0	
Progression Factor	1.00		1.00					1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.3		4.5					0.1	2.1		0.3	0.9	
Delay (s)	45.4		50.7					2.7	2.1		3.2	0.9	
Level of Service	D		D					A	A		A	A	
Approach Delay (s)		49.0			0.0			2.3			2.2		
Approach LOS		D			A			A			A		
Intersection Summary													
HCM 2000 Control Delay			9.4									HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio			0.70										
Actuated Cycle Length (s)			110.0									Sum of lost time (s)	8.0
Intersection Capacity Utilization			44.7%									ICU Level of Service	A
Analysis Period (min)			15										
c Critical Lane Group													

HCM Signalized Intersection Capacity Analysis
 31: Isabel Ave & Airway Blvd

BART to Livermore Extension Project
 2025 DMU + INP + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↘	↑	↗	↘	↑	↗	↘	↑↑↑	↗	↘↗	↑↑↑	↗
Traffic Volume (vph)	8	110	552	94	67	416	358	1104	114	365	1352	16
Future Volume (vph)	8	110	552	94	67	416	358	1104	114	365	1352	16
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.2	5.2	5.6	5.2	5.2	5.6	4.0	4.0	4.0	4.0	4.0	5.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.91	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	1863	1583	1770	1863	1583	1770	5085	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	1863	1583	1770	1863	1583	1770	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	9	120	600	102	73	452	389	1200	124	397	1470	17
RTOR Reduction (vph)	0	0	66	0	0	68	0	0	71	0	0	11
Lane Group Flow (vph)	9	120	534	102	73	384	389	1200	53	397	1470	6
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4	5	3	8	1	5	2		1	6	
Permitted Phases			4			8			2			6
Actuated Green, G (s)	0.8	14.8	33.8	9.1	23.1	34.1	19.0	38.4	38.4	11.0	30.4	30.4
Effective Green, g (s)	0.2	14.2	32.6	8.5	22.5	32.9	20.0	39.4	39.4	12.0	31.4	30.4
Actuated g/C Ratio	0.00	0.15	0.35	0.09	0.24	0.36	0.22	0.43	0.43	0.13	0.34	0.33
Clearance Time (s)	4.6	4.6	5.0	4.6	4.6	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	5.0	5.0	3.0	5.0	5.0
Lane Grp Cap (vph)	3	285	557	162	453	563	382	2165	674	445	1726	520
v/s Ratio Prot	0.01	0.06	c0.19	c0.06	0.04	c0.08	c0.22	0.24		0.12	c0.29	
v/s Ratio Perm			0.15			0.17			0.03			0.00
v/c Ratio	3.00	0.42	0.96	0.63	0.16	0.68	1.02	0.55	0.08	0.89	0.85	0.01
Uniform Delay, d1	46.1	35.4	29.3	40.5	27.6	25.4	36.2	20.0	15.8	39.6	28.4	20.9
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1456.2	1.0	27.7	7.4	0.2	3.4	50.8	0.5	0.1	19.6	4.7	0.0
Delay (s)	1502.4	36.4	57.0	47.9	27.7	28.8	87.0	20.5	15.9	59.2	33.1	20.9
Level of Service	F	D	E	D	C	C	F	C	B	E	C	C
Approach Delay (s)		71.4			31.8			35.3			38.5	
Approach LOS		E			C			D			D	

Intersection Summary		
HCM 2000 Control Delay	41.4	HCM 2000 Level of Service D
HCM 2000 Volume to Capacity ratio	0.92	
Actuated Cycle Length (s)	92.5	Sum of lost time (s) 20.0
Intersection Capacity Utilization	77.8%	ICU Level of Service D
Analysis Period (min)	15	

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
32: Isabel Ave & Jack London Blvd

BART to Livermore Extension Project
2025 DMU + INP + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↕	↖	↗	↕	↖	↖↗	↕	↖	↖↗	↕	↖
Traffic Volume (vph)	119	690	245	209	146	297	95	1160	378	480	1251	60
Future Volume (vph)	119	690	245	209	146	297	95	1160	378	480	1251	60
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.97	0.91	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	3433	5085	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	3433	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	129	750	266	227	159	323	103	1261	411	522	1360	65
RTOR Reduction (vph)	0	0	160	0	0	36	0	0	159	0	0	41
Lane Group Flow (vph)	129	750	106	227	159	287	103	1261	252	522	1360	24
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8	1	5	2		1	6	
Permitted Phases			4			8			2			6
Actuated Green, G (s)	8.4	29.1	29.1	15.7	36.4	55.1	7.3	31.5	31.5	18.7	42.9	42.9
Effective Green, g (s)	8.4	29.1	29.1	15.7	36.4	55.1	7.3	31.5	31.5	18.7	42.9	42.9
Actuated g/C Ratio	0.07	0.25	0.25	0.14	0.31	0.47	0.06	0.27	0.27	0.16	0.37	0.37
Clearance Time (s)	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	248	886	396	239	1108	822	215	1378	429	552	1877	584
v/s Ratio Prot	0.04	c0.21		c0.13	0.04	0.06	0.03	c0.25		c0.15	0.27	
v/s Ratio Perm			0.07			0.13			0.16			0.02
v/c Ratio	0.52	0.85	0.27	0.95	0.14	0.35	0.48	0.92	0.59	0.95	0.72	0.04
Uniform Delay, d1	52.0	41.4	35.0	49.9	28.7	19.2	52.6	41.1	36.7	48.2	31.6	23.5
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	2.0	7.5	0.4	43.8	0.1	0.3	1.7	9.6	2.1	25.2	1.4	0.0
Delay (s)	53.9	48.9	35.3	93.7	28.8	19.5	54.3	50.7	38.8	73.5	33.0	23.5
Level of Service	D	D	D	F	C	B	D	D	D	E	C	C
Approach Delay (s)		46.3			45.3			48.1			43.5	
Approach LOS		D			D			D			D	

Intersection Summary

HCM 2000 Control Delay	45.8	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.91		
Actuated Cycle Length (s)	116.2	Sum of lost time (s)	21.2
Intersection Capacity Utilization	84.4%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
33: Isabel Ave Connector & Stanley Blvd



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑	↑	↔	↑↑	↔	↔
Traffic Volume (vph)	1677	473	239	577	166	387
Future Volume (vph)	1677	473	239	577	166	387
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	3.8	4.0	4.0	4.0	2.5
Lane Util. Factor	0.95	1.00	0.97	0.95	0.97	0.88
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	3539	1583	3433	3539	3433	2787
Flt Permitted	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (perm)	3539	1583	3433	3539	3433	2787
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	1823	514	260	627	180	421
RTOR Reduction (vph)	0	39	0	0	0	1
Lane Group Flow (vph)	1823	475	260	627	180	420
Turn Type	NA	pm+ov	Prot	NA	Prot	pm+ov
Protected Phases	2	8	1	6	8	1
Permitted Phases		2				8
Actuated Green, G (s)	34.9	43.6	9.5	48.4	8.7	18.2
Effective Green, g (s)	36.6	47.0	9.5	50.1	10.2	21.2
Actuated g/C Ratio	0.54	0.69	0.14	0.73	0.15	0.31
Clearance Time (s)	5.7	5.5	4.0	5.7	5.5	4.0
Vehicle Extension (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Grp Cap (vph)	1896	1089	477	2595	512	865
v/s Ratio Prot	c0.52	0.07	0.08	0.18	0.05	c0.08
v/s Ratio Perm		0.23				0.07
v/c Ratio	0.96	0.44	0.55	0.24	0.35	0.49
Uniform Delay, d1	15.2	4.7	27.4	2.9	26.1	19.1
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	12.7	0.1	0.7	0.0	0.2	0.2
Delay (s)	27.9	4.8	28.1	3.0	26.2	19.3
Level of Service	C	A	C	A	C	B
Approach Delay (s)	22.8			10.3	21.4	
Approach LOS	C			B	C	

Intersection Summary

HCM 2000 Control Delay	19.7	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.81		
Actuated Cycle Length (s)	68.3	Sum of lost time (s)	12.0
Intersection Capacity Utilization	69.8%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 34: Murrieta Blvd/Driveway & Portola Ave



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗		↖	↗		↖	↗	↗		↗	
Traffic Volume (vph)	0	1322	140	221	769	1	142	5	332	5	6	0
Future Volume (vph)	0	1322	140	221	769	1	142	5	332	5	6	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.8		4.0	5.8		5.2	5.2	5.2		4.0	
Lane Util. Factor		0.95		1.00	0.95		0.95	0.95	1.00		1.00	
Frt		0.99		1.00	1.00		1.00	1.00	0.85		1.00	
Flt Protected		1.00		0.95	1.00		0.95	0.96	1.00		0.98	
Satd. Flow (prot)		3488		1770	3539		1681	1690	1583		1825	
Flt Permitted		1.00		0.95	1.00		0.95	0.96	1.00		0.98	
Satd. Flow (perm)		3488		1770	3539		1681	1690	1583		1825	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	1437	152	240	836	1	154	5	361	5	7	0
RTOR Reduction (vph)	0	6	0	0	0	0	0	0	208	0	0	0
Lane Group Flow (vph)	0	1583	0	240	837	0	80	79	154	0	12	0
Turn Type	Prot	NA		Prot	NA		Split	NA	Perm		Split	NA
Protected Phases	5	2		1	6		8	8			4	4
Permitted Phases									8			
Actuated Green, G (s)		50.1		14.1	68.2		13.2	13.2	13.2		0.7	
Effective Green, g (s)		49.2		14.1	67.3		12.6	12.6	12.6		0.7	
Actuated g/C Ratio		0.51		0.15	0.70		0.13	0.13	0.13		0.01	
Clearance Time (s)		4.9		4.0	4.9		4.6	4.6	4.6		4.0	
Vehicle Extension (s)		2.0		2.0	2.0		2.0	2.0	2.0		2.0	
Lane Grp Cap (vph)		1795		261	2491		221	222	208		13	
v/s Ratio Prot		c0.45		c0.14	0.24		0.05	0.05			c0.01	
v/s Ratio Perm									c0.10			
v/c Ratio		0.88		0.92	0.34		0.36	0.36	0.74		0.92	
Uniform Delay, d1		20.6		40.2	5.5		37.8	37.8	39.9		47.4	
Progression Factor		1.00		1.00	1.00		1.00	1.00	1.00		1.00	
Incremental Delay, d2		5.3		34.0	0.0		0.4	0.4	11.1		205.3	
Delay (s)		25.9		74.2	5.5		38.2	38.2	51.0		252.7	
Level of Service		C		E	A		D	D	D		F	
Approach Delay (s)		25.9			20.8			47.1			252.7	
Approach LOS		C			C			D			F	

Intersection Summary		
HCM 2000 Control Delay	28.5	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.86	C
Actuated Cycle Length (s)	95.6	Sum of lost time (s)
Intersection Capacity Utilization	77.4%	19.0
Analysis Period (min)	15	ICU Level of Service
		D

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
35: Murrieta Blvd & Jack London Blvd

BART to Livermore Extension Project
2025 DMU + INP + Garage AM



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	279	842	444	245	279	128
Future Volume (vph)	279	842	444	245	279	128
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00	1.00	0.95	0.91	
Frt	1.00	0.85	1.00	1.00	0.95	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1770	1583	1770	3539	4845	
Flt Permitted	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	1770	1583	1770	3539	4845	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	303	915	483	266	303	139
RTOR Reduction (vph)	0	472	0	0	111	0
Lane Group Flow (vph)	303	443	483	266	331	0
Turn Type	Prot	Perm	Prot	NA	NA	
Protected Phases	4		5	2	6	
Permitted Phases		4				
Actuated Green, G (s)	22.2	22.2	22.1	36.5	10.4	
Effective Green, g (s)	22.2	22.2	22.1	36.5	10.4	
Actuated g/C Ratio	0.33	0.33	0.33	0.55	0.16	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	589	526	586	1936	755	
v/s Ratio Prot	0.17		c0.27	0.08	c0.07	
v/s Ratio Perm		c0.28				
v/c Ratio	0.51	0.84	0.82	0.14	0.44	
Uniform Delay, d1	17.9	20.6	20.5	7.4	25.5	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.8	11.6	9.2	0.0	0.4	
Delay (s)	18.7	32.2	29.7	7.4	25.9	
Level of Service	B	C	C	A	C	
Approach Delay (s)	28.9			21.8	25.9	
Approach LOS	C			C	C	

Intersection Summary

HCM 2000 Control Delay	26.1	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.76		
Actuated Cycle Length (s)	66.7	Sum of lost time (s)	12.0
Intersection Capacity Utilization	67.1%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 36: Murrieta Blvd & Stanley Blvd

BART to Livermore Extension Project
 2025 DMU + INP + Garage AM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	275	1070	532	45	563	158	238	375	18	241	343	184
Future Volume (vph)	275	1070	532	45	563	158	238	375	18	241	343	184
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.9	4.9	4.0	4.9	4.9	4.9	4.9		4.9	4.9	4.0
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.97	0.95		1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	3433	3514		1770	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	3433	3514		1770	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	299	1163	578	49	612	172	259	408	20	262	373	200
RTOR Reduction (vph)	0	0	309	0	0	70	0	4	0	0	0	154
Lane Group Flow (vph)	299	1163	269	49	612	102	259	424	0	262	373	46
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Prot	NA		Prot	NA	Perm
Protected Phases	7	4		3	8	1	5	2		1	6	
Permitted Phases			4			8						6
Actuated Green, G (s)	10.8	29.2	29.2	2.2	20.6	34.3	10.3	13.9		13.7	17.3	17.3
Effective Green, g (s)	10.8	28.3	28.3	2.2	19.7	32.5	9.4	13.0		12.8	16.4	17.3
Actuated g/C Ratio	0.14	0.38	0.38	0.03	0.26	0.43	0.13	0.17		0.17	0.22	0.23
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	494	1335	597	51	929	789	430	609		302	773	365
v/s Ratio Prot	c0.09	c0.33		0.03	0.17	0.02	0.08	c0.12		c0.15	c0.11	
v/s Ratio Perm			0.17			0.04						0.03
v/c Ratio	0.61	0.87	0.45	0.96	0.66	0.13	0.60	0.70		0.87	0.48	0.13
Uniform Delay, d1	30.1	21.7	17.5	36.4	24.7	12.8	31.0	29.1		30.3	25.6	22.9
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	2.1	6.5	0.5	111.0	1.7	0.1	2.4	3.5		22.1	0.5	0.2
Delay (s)	32.2	28.2	18.1	147.4	26.4	12.8	33.4	32.6		52.4	26.1	23.0
Level of Service	C	C	B	F	C	B	C	C		D	C	C
Approach Delay (s)		25.9			30.7			32.9			33.6	
Approach LOS		C			C			C			C	

Intersection Summary		
HCM 2000 Control Delay	29.4	HCM 2000 Level of Service C
HCM 2000 Volume to Capacity ratio	0.83	
Actuated Cycle Length (s)	75.0	Sum of lost time (s) 18.7
Intersection Capacity Utilization	72.8%	ICU Level of Service C
Analysis Period (min)	15	

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
37: Livermore Ave & I-580 WB Ramps



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↖	↔		↗	↑			↕	
Traffic Volume (vph)	0	0	0	388	19	21	751	463	0	0	112	0
Future Volume (vph)	0	0	0	388	19	21	751	463	0	0	112	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)					4.0		4.0	4.0			4.0	
Lane Util. Factor					0.95		0.97	1.00			0.95	
Frt					0.99		1.00	1.00			1.00	
Flt Protected					0.96		0.95	1.00			1.00	
Satd. Flow (prot)					1680		3433	1863			3539	
Flt Permitted					0.96		0.95	1.00			1.00	
Satd. Flow (perm)					1680		3433	1863			3539	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	422	21	23	816	503	0	0	122	0
RTOR Reduction (vph)	0	0	0	0	3	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	0	463	0	816	503	0	0	122	0
Turn Type				Split	NA		Prot	NA			NA	
Protected Phases				8	8		5	2			6	
Permitted Phases												
Actuated Green, G (s)					20.3		14.4	30.0			12.1	
Effective Green, g (s)					20.3		13.9	31.7			13.8	
Actuated g/C Ratio					0.34		0.23	0.53			0.23	
Clearance Time (s)					4.0		3.5	5.7			5.7	
Vehicle Extension (s)					2.0		2.0	2.5			2.5	
Lane Grp Cap (vph)					568		795	984			813	
v/s Ratio Prot					c0.28		c0.24	c0.27			0.03	
v/s Ratio Perm												
v/c Ratio					0.81		1.03	0.51			0.15	
Uniform Delay, d1					18.1		23.1	9.1			18.4	
Progression Factor					1.00		0.45	0.25			1.00	
Incremental Delay, d2					8.3		17.3	0.2			0.4	
Delay (s)					26.5		27.8	2.4			18.8	
Level of Service					C		C	A			B	
Approach Delay (s)		0.0			26.5			18.1			18.8	
Approach LOS		A			C			B			B	

Intersection Summary

HCM 2000 Control Delay	20.2	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.80		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	104.2%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 38: Livermore Ave & I-580 EB Ramps



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕↕	↗					↕↕		↗	↕↕	
Traffic Volume (vph)	255	12	1261	0	0	0	0	980	273	81	417	0
Future Volume (vph)	255	12	1261	0	0	0	0	980	273	81	417	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0					4.0		4.0	4.0	
Lane Util. Factor		0.95	0.95					0.95		1.00	0.95	
Frt		0.90	0.85					0.97		1.00	1.00	
Flt Protected		0.99	1.00					1.00		0.95	1.00	
Satd. Flow (prot)		1562	1504					3423		1770	3539	
Flt Permitted		0.99	1.00					1.00		0.95	1.00	
Satd. Flow (perm)		1562	1504					3423		1770	3539	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	277	13	1371	0	0	0	0	1065	297	88	453	0
RTOR Reduction (vph)	0	139	242	0	0	0	0	41	0	0	0	0
Lane Group Flow (vph)	0	823	457	0	0	0	0	1321	0	88	453	0
Turn Type	Prot	NA	Perm					NA		Prot	NA	
Protected Phases	7	4						2		1	6	
Permitted Phases			4									
Actuated Green, G (s)		20.0	20.0					22.6		5.4	31.0	
Effective Green, g (s)		20.0	20.0					23.6		4.4	32.0	
Actuated g/C Ratio		0.33	0.33					0.39		0.07	0.53	
Clearance Time (s)		4.0	4.0					5.0		3.0	5.0	
Vehicle Extension (s)		2.0	2.0					2.5		2.0	2.5	
Lane Grp Cap (vph)		520	501					1346		129	1887	
v/s Ratio Prot								c0.39		c0.05	0.13	
v/s Ratio Perm		0.53	0.30									
v/c Ratio		1.58	0.91					0.98		0.68	0.24	
Uniform Delay, d1		20.0	19.2					18.0		27.1	7.5	
Progression Factor		1.00	1.00					1.00		0.90	0.25	
Incremental Delay, d2		271.0	20.6					20.5		9.6	0.3	
Delay (s)		291.0	39.7					38.5		34.1	2.1	
Level of Service		F	D					D		C	A	
Approach Delay (s)		185.3			0.0			38.5			7.3	
Approach LOS		F			A			D			A	

Intersection Summary

HCM 2000 Control Delay	102.2	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.20		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	104.2%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 39: Livermore Ave & Portola Ave

BART to Livermore Extension Project
 2025 DMU + INP + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↕	↖	↖	↕	↖	↖	↕		↖	↕	↖
Traffic Volume (vph)	661	602	156	15	347	62	206	560	82	228	868	514
Future Volume (vph)	661	602	156	15	347	62	206	560	82	228	868	514
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	5.3	4.0	4.0	5.3	4.0	5.8		4.0	5.8	4.9
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	1.00	0.95		1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.98		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	1770	3472		1770	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	1770	3472		1770	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	718	654	170	16	377	67	224	609	89	248	943	559
RTOR Reduction (vph)	0	0	108	0	0	56	0	9	0	0	0	80
Lane Group Flow (vph)	718	654	62	16	377	11	224	689	0	248	943	479
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA		Prot	NA	pm+ov
Protected Phases	3	8		7	4		1	6		5	2	3
Permitted Phases			8			4						2
Actuated Green, G (s)	23.5	38.2	38.2	1.9	16.6	16.6	14.0	32.8		14.0	32.8	56.3
Effective Green, g (s)	23.5	39.5	38.2	1.9	17.9	16.6	14.0	31.9		14.0	31.9	54.5
Actuated g/C Ratio	0.22	0.38	0.36	0.02	0.17	0.16	0.13	0.30		0.13	0.30	0.52
Clearance Time (s)	4.0	5.3	5.3	4.0	5.3	5.3	4.0	4.9		4.0	4.9	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	767	1330	575	31	602	250	235	1053		235	1074	820
v/s Ratio Prot	c0.21	0.18		0.01	c0.11		0.13	0.20		c0.14	c0.27	0.13
v/s Ratio Perm			0.04			0.01						0.18
v/c Ratio	0.94	0.49	0.11	0.52	0.63	0.04	0.95	0.65		1.06	0.88	0.58
Uniform Delay, d1	40.1	25.1	22.2	51.1	40.5	37.5	45.2	31.8		45.5	34.8	17.5
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	18.6	0.3	0.1	13.7	2.0	0.1	45.4	1.5		74.0	8.3	1.1
Delay (s)	58.6	25.4	22.2	64.9	42.5	37.6	90.7	33.3		119.6	43.1	18.5
Level of Service	E	C	C	E	D	D	F	C		F	D	B
Approach Delay (s)		40.5			42.6			47.2			46.1	
Approach LOS		D			D			D			D	

Intersection Summary

HCM 2000 Control Delay	44.1	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.88		
Actuated Cycle Length (s)	105.1	Sum of lost time (s)	18.7
Intersection Capacity Utilization	78.7%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
40: First St/Springtown Blvd & I-580 WB Ramps

BART to Livermore Extension Project
2025 DMU + INP + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations			TT			T	TT	T			TT	T
Traffic Volume (vph)	0	0	261	0	0	0	387	1502	0	0	422	207
Future Volume (vph)	0	0	261	0	0	0	387	1502	0	0	422	207
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)			4.0				4.0	4.0			5.0	5.0
Lane Util. Factor			0.88				0.97	1.00			0.95	1.00
Frt			0.85				1.00	1.00			1.00	0.85
Flt Protected			1.00				0.95	1.00			1.00	1.00
Satd. Flow (prot)			2787				3433	1863			3539	1583
Flt Permitted			1.00				0.95	1.00			1.00	1.00
Satd. Flow (perm)			2787				3433	1863			3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	284	0	0	0	421	1633	0	0	459	225
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	39
Lane Group Flow (vph)	0	0	284	0	0	0	421	1633	0	0	459	186
Turn Type			Over			Free	Prot	NA			NA	Perm
Protected Phases			5				5	2			6	
Permitted Phases						Free						6
Actuated Green, G (s)			18.0				18.0	110.0			84.0	84.0
Effective Green, g (s)			17.5				17.5	110.0			83.5	83.5
Actuated g/C Ratio			0.16				0.16	1.00			0.76	0.76
Clearance Time (s)			3.5				3.5	4.0			4.5	4.5
Vehicle Extension (s)			2.0				2.0	0.2			4.0	4.0
Lane Grp Cap (vph)			443				546	1863			2686	1201
v/s Ratio Prot			0.10				0.12	c0.88			0.13	
v/s Ratio Perm												0.12
v/c Ratio			0.64				0.77	0.88			0.17	0.15
Uniform Delay, d1			43.3				44.3	0.0			3.7	3.6
Progression Factor			1.00				0.93	1.00			1.00	1.00
Incremental Delay, d2			2.4				2.6	2.7			0.0	0.1
Delay (s)			45.7				43.7	2.7			3.7	3.7
Level of Service			D				D	A			A	A
Approach Delay (s)		45.7			0.0			11.1			3.7	
Approach LOS		D			A			B			A	

Intersection Summary		
HCM 2000 Control Delay	12.7	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.95	B
Actuated Cycle Length (s)	110.0	Sum of lost time (s)
Intersection Capacity Utilization	82.4%	9.0
Analysis Period (min)	15	ICU Level of Service
		E

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
41: First St & I-580 EB Ramps



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕	↗↘					↕↕	↗	↘	↕↕	
Traffic Volume (vph)	552	5	785	0	0	0	0	1364	459	84	887	0
Future Volume (vph)	552	5	785	0	0	0	0	1364	459	84	887	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0					5.0	5.0	4.0	5.0	
Lane Util. Factor		1.00	0.88					0.95	1.00	1.00	0.95	
Frt		1.00	0.85					1.00	0.85	1.00	1.00	
Flt Protected		0.95	1.00					1.00	1.00	0.95	1.00	
Satd. Flow (prot)		1775	2787					3539	1583	1770	3539	
Flt Permitted		0.95	1.00					1.00	1.00	0.95	1.00	
Satd. Flow (perm)		1775	2787					3539	1583	1770	3539	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	600	5	853	0	0	0	0	1483	499	91	964	0
RTOR Reduction (vph)	0	0	193	0	0	0	0	0	235	0	0	0
Lane Group Flow (vph)	0	605	660	0	0	0	0	1483	264	91	964	0
Turn Type	Perm	NA	Perm					NA	Perm	Prot	NA	
Protected Phases		4						2		1	6	
Permitted Phases	4		4						2			
Actuated Green, G (s)		35.9	35.9					54.2	54.2	8.9	66.1	
Effective Green, g (s)		35.4	35.4					53.7	53.7	7.9	65.6	
Actuated g/C Ratio		0.32	0.32					0.49	0.49	0.07	0.60	
Clearance Time (s)		3.5	3.5					4.5	4.5	3.0	4.5	
Vehicle Extension (s)		2.5	2.5					4.0	4.0	2.0	4.0	
Lane Grp Cap (vph)		571	896					1727	772	127	2110	
v/s Ratio Prot								c0.42		c0.05	0.27	
v/s Ratio Perm		0.34	0.24						0.17			
v/c Ratio		1.06	0.74					0.86	0.34	0.72	0.46	
Uniform Delay, d1		37.3	33.2					24.8	17.3	50.0	12.3	
Progression Factor		1.00	1.00					1.00	1.00	1.04	1.20	
Incremental Delay, d2		54.4	3.0					5.8	1.2	14.7	0.7	
Delay (s)		91.7	36.1					30.6	18.5	66.7	15.5	
Level of Service		F	D					C	B	E	B	
Approach Delay (s)		59.2			0.0			27.6			19.9	
Approach LOS		E			A			C			B	

Intersection Summary

HCM 2000 Control Delay	36.0	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.92		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	13.0
Intersection Capacity Utilization	84.0%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
42: 1st St & Mines Rd

BART to Livermore Extension Project
2025 DMU + INP + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	68	239	59	423	285	377	74	1478	899	390	939	52
Future Volume (vph)	68	239	59	423	285	377	74	1478	899	390	939	52
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	0.97	1.00	1.00	1.00	0.91	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	1863	1583	3433	1863	1583	1770	5085	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	1863	1583	3433	1863	1583	1770	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	74	260	64	460	310	410	80	1607	977	424	1021	57
RTOR Reduction (vph)	0	0	54	0	0	33	0	0	163	0	0	28
Lane Group Flow (vph)	74	260	10	460	310	377	80	1607	814	424	1021	29
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8	1	5	2		1	NA	6
Permitted Phases			4			8			2			6
Actuated Green, G (s)	5.6	16.8	16.8	14.0	25.2	38.2	7.7	51.8	51.8	13.0	57.1	57.1
Effective Green, g (s)	5.6	16.8	16.8	14.0	25.2	38.2	7.7	51.8	51.8	13.0	57.1	57.1
Actuated g/C Ratio	0.05	0.15	0.15	0.13	0.23	0.34	0.07	0.46	0.46	0.12	0.51	0.51
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	88	280	238	430	420	598	122	2360	734	399	2601	809
v/s Ratio Prot	0.04	c0.14		c0.13	0.17	0.07	0.05	0.32		c0.12	0.20	
v/s Ratio Perm			0.01			0.16			c0.51			0.02
v/c Ratio	0.84	0.93	0.04	1.07	0.74	0.63	0.66	0.68	1.11	1.06	0.39	0.04
Uniform Delay, d1	52.6	46.8	40.5	48.8	40.1	30.8	50.7	23.4	29.9	49.3	16.7	13.6
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	48.1	34.9	0.1	63.3	6.7	2.2	12.0	0.8	67.3	62.6	0.1	0.0
Delay (s)	100.7	81.7	40.6	112.1	46.8	33.0	62.7	24.2	97.2	111.9	16.8	13.6
Level of Service	F	F	D	F	D	C	E	C	F	F	B	B
Approach Delay (s)		78.6			67.4			52.2			43.5	
Approach LOS		E			E			D			D	



















Intersection Summary

HCM 2000 Control Delay	54.9	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	1.06		
Actuated Cycle Length (s)	111.6	Sum of lost time (s)	16.0
Intersection Capacity Utilization	89.4%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group




















HCM Unsignalized Intersection Capacity Analysis
43: Vasco Rd & I-580 WB Ramps

BART to Livermore Extension Project
2025 DMU + INP + Garage AM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	0	0	88	0	1835	0	0	447	0
Future Volume (Veh/h)	0	0	0	0	0	88	0	1835	0	0	447	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	0	0	0	96	0	1995	0	0	486	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage (veh)												
Upstream signal (ft)											487	
pX, platoon unblocked												
vC, conflicting volume	1580	2481	486	2481	2481	998	486			1995		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1580	2481	486	2481	2481	998	486			1995		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	100	100	60	100			100		
cM capacity (veh/h)	44	29	527	15	29	242	1073			284		
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	SB 1	SB 2					
Volume Total	0	96	998	998	0	486	0					
Volume Left	0	0	0	0	0	0	0					
Volume Right	0	96	0	0	0	0	0					
cSH	1700	242	1700	1700	1700	1700	1700					
Volume to Capacity	0.00	0.40	0.59	0.59	0.00	0.29	0.00					
Queue Length 95th (ft)	0	45	0	0	0	0	0					
Control Delay (s)	0.0	29.3	0.0	0.0	0.0	0.0	0.0					
Lane LOS	A	D										
Approach Delay (s)	0.0	29.3	0.0			0.0						
Approach LOS	A	D										
Intersection Summary												
Average Delay			1.1									
Intersection Capacity Utilization			62.8%	ICU Level of Service	B							
Analysis Period (min)			15									

HCM Unsignalized Intersection Capacity Analysis
 44: Vasco Rd & I-580 EB Ramps

BART to Livermore Extension Project
 2025 DMU + INP + Garage AM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	0	0	0	0	2100	0	64	579	0
Future Volume (Veh/h)	0	0	0	0	0	0	0	2100	0	64	579	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	0	0	0	0	0	2283	0	70	629	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1910	3052	629	3052	3052	1142	629			2283		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1910	3052	629	3052	3052	1142	629			2283		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	100	100	100	100			68		
cM capacity (veh/h)	31	8	425	4	8	194	949			219		
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2						
Volume Total	0	0	1522	761	70	629						
Volume Left	0	0	0	0	70	0						
Volume Right	0	0	0	0	0	0						
cSH	1700	1700	1700	1700	219	1700						
Volume to Capacity	0.00	0.00	0.90	0.45	0.32	0.37						
Queue Length 95th (ft)	0	0	0	0	33	0						
Control Delay (s)	0.0	0.0	0.0	0.0	29.0	0.0						
Lane LOS	A	A			D							
Approach Delay (s)	0.0	0.0	0.0		2.9							
Approach LOS	A	A										
Intersection Summary												
Average Delay			0.7									
Intersection Capacity Utilization			61.4%	ICU Level of Service	B							
Analysis Period (min)			15									

HCM Signalized Intersection Capacity Analysis
45: Vasco Rd & East Ave

BART to Livermore Extension Project
2025 DMU + INP + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	473	27	94	138	359	235	102	341	12	13	350	368
Future Volume (vph)	473	27	94	138	359	235	102	341	12	13	350	368
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	0.95		0.97	1.00	1.00
Frt	1.00	0.88		1.00	0.94		1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	3126		1770	3329		1770	3521		3433	1863	1583
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1770	3126		1770	3329		1770	3521		3433	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	514	29	102	150	390	255	111	371	13	14	380	400
RTOR Reduction (vph)	0	64	0	0	138	0	0	3	0	0	0	300
Lane Group Flow (vph)	514	67	0	150	507	0	111	381	0	14	380	100
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												6
Actuated Green, G (s)	24.0	30.5		9.5	16.0		6.0	26.0		0.8	20.8	20.8
Effective Green, g (s)	24.0	30.5		9.5	16.0		6.0	26.0		0.8	20.8	20.8
Actuated g/C Ratio	0.29	0.37		0.11	0.19		0.07	0.31		0.01	0.25	0.25
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	513	1151		203	643		128	1105		33	468	397
v/s Ratio Prot	c0.29	0.02		0.08	c0.15		c0.06	0.11		0.00	c0.20	
v/s Ratio Perm												0.06
v/c Ratio	1.00	0.06		0.74	0.79		0.87	0.35		0.42	0.81	0.25
Uniform Delay, d1	29.4	16.9		35.5	31.8		38.0	21.8		40.8	29.2	24.8
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	40.2	0.0		13.1	6.4		41.9	0.2		8.6	10.3	0.3
Delay (s)	69.6	16.9		48.6	38.2		79.9	22.0		49.3	39.5	25.1
Level of Service	E	B		D	D		E	C		D	D	C
Approach Delay (s)		58.9			40.1			35.0			32.4	
Approach LOS		E			D			D			C	

Intersection Summary

HCM 2000 Control Delay	41.4	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.88		
Actuated Cycle Length (s)	82.8	Sum of lost time (s)	16.0
Intersection Capacity Utilization	81.1%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Unsignalized Intersection Capacity Analysis
 46: I-580 WB Ramps & Northfront Rd/Northfront Road



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	630	36	198	186	5	130
Future Volume (Veh/h)	630	36	198	186	5	130
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	685	39	215	202	5	141
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage (veh)						
Upstream signal (ft)	1007					
pX, platoon unblocked						
vC, conflicting volume			685	1336		704
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			685	1336		704
tC, single (s)			4.1	6.4		6.2
tC, 2 stage (s)						
tF (s)			2.2	3.5		3.3
p0 queue free %			76	96		68
cM capacity (veh/h)			908	129		437
Direction, Lane #	EB 1	WB 1	NB 1	NB 2		
Volume Total	724	417	5	141		
Volume Left	0	215	5	0		
Volume Right	39	0	0	141		
cSH	1700	908	129	437		
Volume to Capacity	0.43	0.24	0.04	0.32		
Queue Length 95th (ft)	0	23	3	34		
Control Delay (s)	0.0	6.6	34.0	17.1		
Lane LOS	A		D	C		
Approach Delay (s)	0.0	6.6	17.7			
Approach LOS	C					
Intersection Summary						
Average Delay	4.1					
Intersection Capacity Utilization	69.4%		ICU Level of Service			C
Analysis Period (min)	15					

Intersection	
Intersection Delay, s/veh	14
Intersection LOS	B

Movement	EBU	EBL	EBT	WBU	WBT	WBR	SBU	SBL	SBR
Lane Configurations		↘	↕↕		↕	↘		↘↘	↘
Traffic Vol, veh/h	0	299	253	0	84	267	0	190	7
Future Vol, veh/h	0	299	253	0	84	267	0	190	7
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	325	275	0	91	290	0	207	8
Number of Lanes	0	1	2	0	1	1	0	2	1

Approach	EB	WB	SB
Opposing Approach	WB	EB	
Opposing Lanes	2	3	0
Conflicting Approach Left	SB		WB
Conflicting Lanes Left	3	0	2
Conflicting Approach Right		SB	EB
Conflicting Lanes Right	0	3	3
HCM Control Delay	15.1	13.4	11.9
HCM LOS	C	B	B

Lane	EBLn1	EBLn2	EBLn3	WBLn1	WBLn2	SBLn1	SBLn2	SBLn3
Vol Left, %	100%	0%	0%	0%	0%	100%	100%	0%
Vol Thru, %	0%	100%	100%	100%	0%	0%	0%	0%
Vol Right, %	0%	0%	0%	0%	100%	0%	0%	100%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	299	127	127	84	267	95	95	7
LT Vol	299	0	0	0	0	95	95	0
Through Vol	0	127	127	84	0	0	0	0
RT Vol	0	0	0	0	267	0	0	7
Lane Flow Rate	325	138	138	91	290	103	103	8
Geometry Grp	8	8	8	8	8	7	7	7
Degree of Util (X)	0.612	0.24	0.173	0.169	0.481	0.212	0.212	0.009
Departure Headway (Hd)	6.781	6.276	4.523	6.675	5.967	7.394	7.394	4.428
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cap	533	571	789	536	601	484	484	803
Service Time	4.532	4.027	2.273	4.435	3.727	5.154	5.154	2.186
HCM Lane V/C Ratio	0.61	0.242	0.175	0.17	0.483	0.213	0.213	0.01
HCM Control Delay	19.7	11	8.2	10.8	14.2	12.1	12.1	7.2
HCM Lane LOS	C	B	A	B	B	B	B	A
HCM 95th-tile Q	4.1	0.9	0.6	0.6	2.6	0.8	0.8	0

HCM Signalized Intersection Capacity Analysis
48: Greenville Rd & Northfront Road/Altamont Pass Road

BART to Livermore Extension Project
2025 DMU + INP + Garage AM



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↗	↖	↑	↘	↗
Traffic Volume (vph)	609	146	1	51	345	1038
Future Volume (vph)	609	146	1	51	345	1038
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	1863	1583	1770	1863	1770	1583
Flt Permitted	1.00	1.00	0.10	1.00	0.95	1.00
Satd. Flow (perm)	1863	1583	191	1863	1770	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	662	159	1	55	375	1128
RTOR Reduction (vph)	0	65	0	0	0	28
Lane Group Flow (vph)	662	94	1	55	375	1100
Turn Type	NA	Perm	Perm	NA	Prot	Perm
Protected Phases	4			8	2	
Permitted Phases		4	8			2
Actuated Green, G (s)	39.0	39.0	39.0	39.0	73.0	73.0
Effective Green, g (s)	39.0	39.0	39.0	39.0	73.0	73.0
Actuated g/C Ratio	0.32	0.32	0.32	0.32	0.61	0.61
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	605	514	62	605	1076	962
v/s Ratio Prot	c0.36			0.03	0.21	
v/s Ratio Perm		0.06	0.01			c0.69
v/c Ratio	1.09	0.18	0.02	0.09	0.35	1.14
Uniform Delay, d1	40.5	29.1	27.5	28.2	11.7	23.5
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	65.0	0.2	0.1	0.1	0.2	77.0
Delay (s)	105.5	29.2	27.6	28.2	11.9	100.5
Level of Service	F	C	C	C	B	F
Approach Delay (s)	90.7			28.2	78.4	
Approach LOS	F			C	E	

Intersection Summary

HCM 2000 Control Delay	81.4	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.13		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	103.0%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
49: Greenville Rd & Southfront Rd



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	417	116	251	1021	67	80
Future Volume (vph)	417	116	251	1021	67	80
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.2	5.2	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.88	0.97	0.95	0.95	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	3433	2787	3433	3539	3539	1583
Flt Permitted	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (perm)	3433	2787	3433	3539	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	453	126	273	1110	73	87
RTOR Reduction (vph)	0	108	0	0	0	58
Lane Group Flow (vph)	453	18	273	1110	73	29
Turn Type	Prot	Perm	Prot	NA	NA	Perm
Protected Phases	8		1	6	2	
Permitted Phases		8				2
Actuated Green, G (s)	5.5	5.5	5.0	18.9	9.9	9.9
Effective Green, g (s)	4.9	4.9	5.0	20.6	11.6	11.6
Actuated g/C Ratio	0.14	0.14	0.14	0.59	0.33	0.33
Clearance Time (s)	4.6	4.6	4.0	5.7	5.7	5.7
Vehicle Extension (s)	5.0	5.0	6.0	2.5	2.5	2.5
Lane Grp Cap (vph)	484	393	494	2100	1183	529
v/s Ratio Prot	c0.13		0.08	c0.31	0.02	
v/s Ratio Perm		0.01				0.02
v/c Ratio	0.94	0.05	0.55	0.53	0.06	0.05
Uniform Delay, d1	14.7	12.9	13.8	4.2	7.9	7.8
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	26.4	0.1	2.9	0.2	0.0	0.0
Delay (s)	41.1	13.0	16.7	4.4	7.9	7.9
Level of Service	D	B	B	A	A	A
Approach Delay (s)	35.0			6.8	7.9	
Approach LOS	D			A	A	

Intersection Summary

HCM 2000 Control Delay	14.6	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.72		
Actuated Cycle Length (s)	34.7	Sum of lost time (s)	13.2
Intersection Capacity Utilization	47.8%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
50: Greenville Rd & Patterson Pass Rd

BART to Livermore Extension Project
2025 DMU + INP + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	36	525	58	5	13	7	69	414	322	428	206	45
Future Volume (vph)	36	525	58	5	13	7	69	414	322	428	206	45
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.99		1.00	0.95		1.00	0.93		1.00	0.97	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1835		1770	1761		1770	1741		1770	1813	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	1835		1770	1761		1770	1741		1770	1813	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	39	571	63	5	14	8	75	450	350	465	224	49
RTOR Reduction (vph)	0	7	0	0	6	0	0	47	0	0	13	0
Lane Group Flow (vph)	39	627	0	5	16	0	75	753	0	465	260	0
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												
Actuated Green, G (s)	0.7	16.1		0.7	16.1		2.4	17.8		4.0	19.4	
Effective Green, g (s)	0.7	16.1		0.7	16.1		2.4	17.8		4.0	19.4	
Actuated g/C Ratio	0.01	0.29		0.01	0.29		0.04	0.33		0.07	0.36	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	22	541		22	519		77	567		129	644	
v/s Ratio Prot	c0.02	c0.34		0.00	0.01		0.04	c0.43		c0.26	0.14	
v/s Ratio Perm												
v/c Ratio	1.77	1.16		0.23	0.03		0.97	1.33		3.60	0.40	
Uniform Delay, d1	26.9	19.2		26.7	13.7		26.1	18.4		25.3	13.2	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	482.9	90.6		5.2	0.0		93.1	159.4		1191.1	1.9	
Delay (s)	509.8	109.9		31.9	13.7		119.2	177.8		1216.4	15.1	
Level of Service	F	F		C	B		F	F		F	B	
Approach Delay (s)		133.1			17.1			172.8			772.0	
Approach LOS		F			B			F			F	

Intersection Summary

HCM 2000 Control Delay	350.6	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.49		
Actuated Cycle Length (s)	54.6	Sum of lost time (s)	16.0
Intersection Capacity Utilization	106.3%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
1: Dougherty Rd & Amador Valley Rd

BART to Livermore Extension Project
2025 Express Bus + Garage AM



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	85	497	381	713	1771	137
Future Volume (vph)	85	497	381	713	1771	137
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5	5.7	5.7	
Lane Util. Factor	1.00	1.00	0.97	0.91	0.91	
Frt	1.00	0.85	1.00	1.00	0.99	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1770	1583	3433	5085	5030	
Flt Permitted	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	1770	1583	3433	5085	5030	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	92	540	414	775	1925	149
RTOR Reduction (vph)	0	193	0	0	9	0
Lane Group Flow (vph)	92	347	414	775	2065	0
Turn Type	Perm	Perm	Prot	NA	NA	
Protected Phases			5	2	6	
Permitted Phases	4	4				
Actuated Green, G (s)	21.9	21.9	12.1	56.2	39.6	
Effective Green, g (s)	21.9	21.9	12.1	56.2	39.6	
Actuated g/C Ratio	0.25	0.25	0.14	0.64	0.45	
Clearance Time (s)	4.5	4.5	4.5	5.7	5.7	
Vehicle Extension (s)	1.8	1.8	2.0	4.0	4.0	
Lane Grp Cap (vph)	438	392	470	3236	2255	
v/s Ratio Prot			c0.12	0.15	c0.41	
v/s Ratio Perm	0.05	c0.22				
v/c Ratio	0.21	0.89	0.88	0.24	0.92	
Uniform Delay, d1	26.3	32.0	37.4	6.9	22.8	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.1	20.2	16.9	0.1	6.5	
Delay (s)	26.4	52.2	54.3	6.9	29.3	
Level of Service	C	D	D	A	C	
Approach Delay (s)	48.4			23.4	29.3	
Approach LOS	D			C	C	

Intersection Summary

HCM 2000 Control Delay	30.6	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.90		
Actuated Cycle Length (s)	88.3	Sum of lost time (s)	14.7
Intersection Capacity Utilization	76.5%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
2: Dougherty Rd & Dublin Blvd

BART to Livermore Extension Project
2025 Express Bus + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↑↑↑	↖↗	↖↗↘	↑↑↑	↖	↖↗↘	↑↑↑	↖↗	↖↗	↑↑↑	↖↗
Traffic Volume (vph)	40	357	420	273	602	366	604	989	115	665	1747	73
Future Volume (vph)	40	357	420	273	602	366	604	989	115	665	1747	73
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	6.0	5.0	5.0	5.5	5.0	5.0	5.5	5.0	5.0	5.5	
Lane Util. Factor	0.97	0.91	0.88	0.94	0.91	1.00	0.94	0.91	0.88	0.97	0.86	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	3433	5085	2787	4990	5085	1583	4990	5085	2787	3433	6369	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	3433	5085	2787	4990	5085	1583	4990	5085	2787	3433	6369	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	43	388	457	297	654	398	657	1075	125	723	1899	79
RTOR Reduction (vph)	0	0	41	0	0	103	0	0	74	0	4	0
Lane Group Flow (vph)	43	388	416	297	654	295	657	1075	51	723	1974	0
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	
Protected Phases	5	2	3	1	6	7	3	8	1	7	4	
Permitted Phases			2			6			8			
Actuated Green, G (s)	11.8	22.3	39.3	15.0	26.0	52.2	17.0	32.9	47.9	26.2	42.1	
Effective Green, g (s)	11.8	22.3	39.3	15.0	26.0	52.2	17.0	32.9	47.9	26.2	42.1	
Actuated g/C Ratio	0.10	0.19	0.33	0.13	0.22	0.44	0.14	0.28	0.41	0.22	0.36	
Clearance Time (s)	5.0	6.0	5.0	5.0	5.5	5.0	5.0	5.5	5.0	5.0	5.5	
Vehicle Extension (s)	2.0	4.5	2.0	2.0	4.5	2.0	2.0	4.5	2.0	2.0	4.5	
Lane Grp Cap (vph)	343	961	929	634	1121	700	719	1418	1132	762	2274	
v/s Ratio Prot	0.01	0.08	0.06	c0.06	c0.13	0.09	0.13	0.21	0.01	c0.21	c0.31	
v/s Ratio Perm			0.08			0.09			0.01			
v/c Ratio	0.13	0.40	0.45	0.47	0.58	0.42	0.91	0.76	0.04	0.95	0.87	
Uniform Delay, d1	48.3	42.0	30.8	47.8	41.1	22.5	49.7	38.9	21.2	45.2	35.3	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.1	0.5	0.1	0.2	1.1	0.1	15.8	2.7	0.0	20.6	4.1	
Delay (s)	48.4	42.4	30.9	48.0	42.2	22.7	65.5	41.5	21.2	65.8	39.4	
Level of Service	D	D	C	D	D	C	E	D	C	E	D	
Approach Delay (s)		36.8			37.7			48.7			46.4	
Approach LOS		D			D			D			D	

Intersection Summary

HCM 2000 Control Delay	44.1	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.81		
Actuated Cycle Length (s)	117.9	Sum of lost time (s)	21.5
Intersection Capacity Utilization	81.5%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
3: Dougherty Rd & I-580 WB Ramps

BART to Livermore Extension Project
2025 Express Bus + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↔↔		↔↔		↑↑↑			↑↑↑	↔
Traffic Volume (vph)	0	0	0	393	0	637	0	1291	0	0	1664	0
Future Volume (vph)	0	0	0	393	0	637	0	1291	0	0	1664	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0		4.0		4.0			4.0	
Lane Util. Factor				0.97		0.88		0.91			0.86	
Frt				1.00		0.85		1.00			1.00	
Flt Protected				0.95		1.00		1.00			1.00	
Satd. Flow (prot)				3433		2787		5085			4806	
Flt Permitted				0.95		1.00		1.00			1.00	
Satd. Flow (perm)				3433		2787		5085			4806	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	427	0	692	0	1403	0	0	1809	0
RTOR Reduction (vph)	0	0	0	0	0	38	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	427	0	654	0	1403	0	0	1809	0
Turn Type				Prot		Prot		NA			NA	Perm
Protected Phases				4		4		2			6	
Permitted Phases												6
Actuated Green, G (s)				17.3		17.3		31.9			31.9	
Effective Green, g (s)				18.7		18.7		33.3			33.3	
Actuated g/C Ratio				0.31		0.31		0.55			0.55	
Clearance Time (s)				5.4		5.4		5.4			5.4	
Vehicle Extension (s)				3.0		3.0		3.0			3.0	
Lane Grp Cap (vph)				1069		868		2822			2667	
v/s Ratio Prot				0.12		c0.23		0.28			c0.38	
v/s Ratio Perm												
v/c Ratio				0.40		0.75		0.50			0.68	
Uniform Delay, d1				16.2		18.6		8.2			9.5	
Progression Factor				1.00		1.00		0.68			1.00	
Incremental Delay, d2				0.2		3.7		0.6			1.4	
Delay (s)				16.5		22.3		6.2			10.9	
Level of Service				B		C		A			B	
Approach Delay (s)		0.0			20.1			6.2			10.9	
Approach LOS		A			C			A			B	

Intersection Summary		
HCM 2000 Control Delay	11.8	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.71	B
Actuated Cycle Length (s)	60.0	Sum of lost time (s)
Intersection Capacity Utilization	53.9%	8.0
Analysis Period (min)	15	ICU Level of Service
		A

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

4: Hopyard Rd/Dougherty Rd & I-580 EB Ramps

BART to Livermore Extension Project
2025 Express Bus + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔↔		↔↔					↑↑↑	↔		↑↑↑	↔
Traffic Volume (vph)	755	0	1450	0	0	0	0	768	0	0	1529	0
Future Volume (vph)	755	0	1450	0	0	0	0	768	0	0	1529	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0					4.0			4.0	
Lane Util. Factor	0.97		0.88					0.91			0.86	
Frt	1.00		0.85					1.00			1.00	
Flt Protected	0.95		1.00					1.00			1.00	
Satd. Flow (prot)	3433		2787					5085			4806	
Flt Permitted	0.95		1.00					1.00			1.00	
Satd. Flow (perm)	3433		2787					5085			4806	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	821	0	1576	0	0	0	0	835	0	0	1662	0
RTOR Reduction (vph)	0	0	22	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	821	0	1554	0	0	0	0	835	0	0	1662	0
Turn Type	Prot		Prot					NA	Free		NA	Perm
Protected Phases	4		4					2			6	
Permitted Phases									Free			6
Actuated Green, G (s)	29.2		29.2					20.0			20.0	
Effective Green, g (s)	30.6		30.6					21.4			21.4	
Actuated g/C Ratio	0.51		0.51					0.36			0.36	
Clearance Time (s)	5.4		5.4					5.4			5.4	
Vehicle Extension (s)	3.0		3.0					3.0			3.0	
Lane Grp Cap (vph)	1750		1421					1813			1714	
v/s Ratio Prot	0.24		c0.56					0.16			c0.35	
v/s Ratio Perm												
v/c Ratio	0.47		1.09					0.46			0.97	
Uniform Delay, d1	9.5		14.7					14.9			19.0	
Progression Factor	1.00		1.00					1.00			0.75	
Incremental Delay, d2	0.2		53.8					0.8			13.3	
Delay (s)	9.7		68.5					15.7			27.5	
Level of Service	A		E					B			C	
Approach Delay (s)		48.4			0.0			15.7			27.5	
Approach LOS		D			A			B			C	

Intersection Summary

HCM 2000 Control Delay	35.7	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	1.04		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	86.9%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
5: Hopyard Rd & Owens Rd

BART to Livermore Extension Project
2025 Express Bus + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↔↗		↖	↗	↗	↖	↑↑↑	↗	↖↗	↑↑↗	
Traffic Volume (vph)	199	98	52	117	132	199	139	681	145	849	1626	553
Future Volume (vph)	199	98	52	117	132	199	139	681	145	849	1626	553
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	2.7	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	0.91	0.91		1.00	0.95	0.95	1.00	0.91	1.00	0.97	0.91	
Frt	1.00	0.97		1.00	0.95	0.85	1.00	1.00	0.85	1.00	0.96	
Flt Protected	0.95	0.98		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1610	3219		1770	1685	1504	1770	5085	1583	3433	4892	
Flt Permitted	0.95	0.98		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1610	3219		1770	1685	1504	1770	5085	1583	3433	4892	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	216	107	57	127	143	216	151	740	158	923	1767	601
RTOR Reduction (vph)	0	26	0	0	18	49	0	0	117	0	68	0
Lane Group Flow (vph)	119	235	0	127	192	100	151	740	41	923	2300	0
Turn Type	Split	NA		Split	NA	pm+ov	Prot	NA	Perm	Prot	NA	
Protected Phases	8	8		4	4	1	5	2		1	6	
Permitted Phases						4			2			
Actuated Green, G (s)	6.5	6.5		9.7	9.7	41.8	8.0	21.4	21.4	32.1	45.5	
Effective Green, g (s)	7.8	7.8		11.0	11.0	44.4	8.0	23.1	23.1	32.1	47.2	
Actuated g/C Ratio	0.09	0.09		0.12	0.12	0.49	0.09	0.26	0.26	0.36	0.52	
Clearance Time (s)	5.3	5.3		5.3	5.3	4.0	4.0	5.7	5.7	4.0	5.7	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	139	278		216	205	787	157	1305	406	1224	2565	
v/s Ratio Prot	c0.07	0.07		0.07	c0.11	0.05	0.09	0.15		c0.27	c0.47	
v/s Ratio Perm						0.02			0.03			
v/c Ratio	0.86	0.84		0.59	0.93	0.13	0.96	0.57	0.10	0.75	0.90	
Uniform Delay, d1	40.5	40.5		37.4	39.1	12.3	40.8	29.1	25.5	25.5	19.2	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	37.2	20.2		4.0	44.4	0.1	60.1	0.6	0.1	2.7	4.6	
Delay (s)	77.7	60.7		41.4	83.5	12.4	100.9	29.7	25.6	28.2	23.8	
Level of Service	E	E		D	F	B	F	C	C	C	C	
Approach Delay (s)		66.0			50.7			39.3			25.0	
Approach LOS		E			D			D			C	

Intersection Summary

HCM 2000 Control Delay	33.3	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.91		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	82.6%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

6: Hopyard Rd & Stoneridge Dr

BART to Livermore Extension Project
2025 Express Bus + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↖	↑↑↑	↗	↖↖	↑↑↑	↗	↖↖↖	↑↑	↗	↖↖	↑↑↑	↗
Traffic Volume (vph)	146	731	438	84	1013	117	648	727	87	280	973	233
Future Volume (vph)	146	731	438	84	1013	117	648	727	87	280	973	233
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.91	1.00	0.97	0.91	1.00	0.94	0.95	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5085	1583	3433	5085	1583	4990	3539	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5085	1583	3433	5085	1583	4990	3539	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	159	795	476	91	1101	127	704	790	95	304	1058	253
RTOR Reduction (vph)	0	0	222	0	0	92	0	0	68	0	0	121
Lane Group Flow (vph)	159	795	254	91	1101	35	704	790	27	304	1058	132
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8			2			6
Actuated Green, G (s)	4.0	17.6	17.6	3.2	16.8	16.8	8.0	17.0	17.0	7.0	16.0	16.0
Effective Green, g (s)	4.0	17.6	17.6	3.2	16.8	16.8	8.0	17.0	17.0	7.0	16.0	16.0
Actuated g/C Ratio	0.07	0.29	0.29	0.05	0.28	0.28	0.13	0.28	0.28	0.12	0.26	0.26
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	225	1471	458	180	1405	437	656	989	442	395	1338	416
v/s Ratio Prot	c0.05	0.16		0.03	c0.22		c0.14	c0.22		0.09	0.21	
v/s Ratio Perm			0.16			0.02			0.02			0.08
v/c Ratio	0.71	0.54	0.56	0.51	0.78	0.08	1.07	0.80	0.06	0.77	0.79	0.32
Uniform Delay, d1	27.8	18.2	18.3	28.0	20.3	16.3	26.4	20.3	16.0	26.1	20.8	18.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	9.7	0.4	1.5	2.2	2.9	0.1	56.4	4.6	0.1	8.8	3.3	0.4
Delay (s)	37.5	18.6	19.7	30.3	23.3	16.4	82.8	24.9	16.1	34.9	24.1	18.5
Level of Service	D	B	B	C	C	B	F	C	B	C	C	B
Approach Delay (s)		21.1			23.1			50.0			25.3	
Approach LOS		C			C			D			C	

Intersection Summary

HCM 2000 Control Delay	30.4	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.85		
Actuated Cycle Length (s)	60.8	Sum of lost time (s)	16.0
Intersection Capacity Utilization	68.2%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

7: Hopyard Rd & Las Positas Blvd

BART to Livermore Extension Project
2025 Express Bus + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↕	↗	↖↗	↕	↗	↖↗	↕↖↗	↗	↖↗	↕↖↗	↗
Traffic Volume (vph)	149	462	373	350	448	56	411	1131	363	111	1012	90
Future Volume (vph)	149	462	373	350	448	56	411	1131	363	111	1012	90
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.95	1.00	0.97	0.95	1.00	0.97	0.91	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	3433	3539	1583	3433	5085	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	3433	3539	1583	3433	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	162	502	405	380	487	61	447	1229	395	121	1100	98
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	72
Lane Group Flow (vph)	162	502	405	380	487	61	447	1229	395	121	1100	26
Turn Type	Prot	NA	Free	Prot	NA	Free	Prot	NA	Free	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			Free			Free			Free			6
Actuated Green, G (s)	4.7	14.6	64.5	8.0	17.9	64.5	9.0	22.7	64.5	3.2	16.9	16.9
Effective Green, g (s)	4.7	14.6	64.5	8.0	17.9	64.5	9.0	22.7	64.5	3.2	16.9	16.9
Actuated g/C Ratio	0.07	0.23	1.00	0.12	0.28	1.00	0.14	0.35	1.00	0.05	0.26	0.26
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	250	801	1583	425	982	1583	479	1789	1583	170	1332	414
v/s Ratio Prot	0.05	c0.14		c0.11	0.14		c0.13	0.24		0.04	c0.22	
v/s Ratio Perm			c0.26			0.04			0.25			0.02
v/c Ratio	0.65	0.63	0.26	0.89	0.50	0.04	0.93	0.69	0.25	0.71	0.83	0.06
Uniform Delay, d1	29.1	22.5	0.0	27.8	19.5	0.0	27.5	17.9	0.0	30.2	22.4	17.9
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	5.7	1.5	0.4	20.6	0.4	0.0	25.3	1.1	0.4	13.2	4.3	0.1
Delay (s)	34.8	24.0	0.4	48.4	19.9	0.0	52.8	19.0	0.4	43.3	26.7	17.9
Level of Service	C	C	A	D	B	A	D	B	A	D	C	B
Approach Delay (s)		16.7			30.3			22.7			27.6	
Approach LOS		B			C			C			C	

































Intersection Summary

HCM 2000 Control Delay	24.0	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.78		
Actuated Cycle Length (s)	64.5	Sum of lost time (s)	16.0
Intersection Capacity Utilization	67.4%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
8: Willow Rd & Owens Rd

BART to Livermore Extension Project
2025 Express Bus + Garage AM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 	  		 	  			 		 	 	
Traffic Volume (vph)	129	391	196	108	322	101	87	99	0	144	109	105
Future Volume (vph)	129	391	196	108	322	101	87	99	0	144	109	105
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	5.3	4.0		5.3	4.0	4.0
Lane Util. Factor	0.97	0.91		0.97	0.91	1.00	1.00	0.95		1.00	1.00	1.00
Frt	1.00	0.95		1.00	1.00	0.85	1.00	1.00		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	4831		3433	5085	1583	1770	3539		1770	1863	1583
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.68	1.00		0.68	1.00	1.00
Satd. Flow (perm)	3433	4831		3433	5085	1583	1269	3539		1274	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	140	425	213	117	350	110	95	108	0	157	118	114
RTOR Reduction (vph)	0	129	0	0	0	69	0	0	0	0	0	87
Lane Group Flow (vph)	140	509	0	117	350	41	95	108	0	157	118	27
Turn Type	Prot	NA		Prot	NA	Perm	Perm	NA	Perm	Perm	NA	Perm
Protected Phases	1	6		5	2			4				8
Permitted Phases						2	4		4	8		8
Actuated Green, G (s)	4.4	14.5		3.7	13.8	13.8	8.8	8.8		8.8	8.8	8.8
Effective Green, g (s)	4.4	16.2		3.7	15.5	15.5	8.8	10.1		8.8	10.1	10.1
Actuated g/C Ratio	0.10	0.39		0.09	0.37	0.37	0.21	0.24		0.21	0.24	0.24
Clearance Time (s)	4.0	5.7		4.0	5.7	5.7	5.3	5.3		5.3	5.3	5.3
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	359	1863		302	1876	584	265	851		266	448	380
v/s Ratio Prot	c0.04	c0.11		0.03	0.07			0.03			0.06	
v/s Ratio Perm						0.03	0.07			c0.12		0.02
v/c Ratio	0.39	0.27		0.39	0.19	0.07	0.36	0.13		0.59	0.26	0.07
Uniform Delay, d1	17.5	8.9		18.1	9.0	8.6	14.2	12.5		15.0	12.9	12.3
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	0.7	0.1		0.8	0.0	0.1	0.8	0.1		3.5	0.3	0.1
Delay (s)	18.3	8.9		18.9	9.0	8.6	15.0	12.6		18.5	13.2	12.4
Level of Service	B	A		B	A	A	B	B		B	B	B
Approach Delay (s)		10.6			11.0			13.7			15.1	
Approach LOS		B			B			B			B	

Intersection Summary		
HCM 2000 Control Delay	11.9	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.38	B
Actuated Cycle Length (s)	42.0	Sum of lost time (s)
Intersection Capacity Utilization	39.9%	12.0
Analysis Period (min)	15	ICU Level of Service
		A

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
9: Hacienda Dr & Dublin Blvd

BART to Livermore Extension Project
2025 Express Bus + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↑↑↑	↖↗	↖↗	↑↑↑		↖↗	↑↑	↖↗	↖↗	↑↑↑	↖↗
Traffic Volume (vph)	73	337	93	272	745	81	156	632	115	12	390	132
Future Volume (vph)	73	337	93	272	745	81	156	632	115	12	390	132
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	6.0	5.0	4.5	6.0		5.0	6.0	6.0	4.5	5.5	5.5
Lane Util. Factor	0.97	0.91	0.88	0.97	0.91		0.94	0.95	0.88	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5085	2787	3433	5011		4990	3539	2787	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5085	2787	3433	5011		4990	3539	2787	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	79	366	101	296	810	88	170	687	125	13	424	143
RTOR Reduction (vph)	0	0	71	0	12	0	0	0	86	0	0	117
Lane Group Flow (vph)	79	366	30	296	886	0	170	687	39	13	424	26
Turn Type	Prot	NA	pm+ov	Prot	NA		Prot	NA	Perm	Prot	NA	Perm
Protected Phases	5	2	3	1	6		3	8		7	NA	4
Permitted Phases			2						8			4
Actuated Green, G (s)	4.8	12.1	22.4	17.4	24.7		10.3	23.5	23.5	0.6	13.8	13.8
Effective Green, g (s)	4.8	12.1	22.4	17.4	24.7		10.3	23.5	23.5	0.6	13.8	13.8
Actuated g/C Ratio	0.06	0.16	0.30	0.23	0.33		0.14	0.32	0.32	0.01	0.18	0.18
Clearance Time (s)	4.5	6.0	5.0	4.5	6.0		5.0	6.0	6.0	4.5	5.5	5.5
Vehicle Extension (s)	2.0	3.5	2.0	2.0	3.5		2.0	3.5	3.5	2.0	3.5	3.5
Lane Grp Cap (vph)	220	824	1023	800	1659		688	1114	877	27	940	292
v/s Ratio Prot	0.02	c0.07	0.00	0.09	c0.18		0.03	c0.19		0.00	c0.08	
v/s Ratio Perm			0.01						0.01			0.02
v/c Ratio	0.36	0.44	0.03	0.37	0.53		0.25	0.62	0.04	0.48	0.45	0.09
Uniform Delay, d1	33.4	28.2	18.4	24.0	20.3		28.7	21.7	17.8	36.8	27.0	25.2
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.4	0.5	0.0	0.1	0.4		0.1	1.1	0.0	4.9	0.4	0.2
Delay (s)	33.8	28.7	18.4	24.1	20.6		28.8	22.8	17.8	41.7	27.4	25.4
Level of Service	C	C	B	C	C		C	C	B	D	C	C
Approach Delay (s)		27.5			21.5			23.2			27.2	
Approach LOS		C			C			C			C	

Intersection Summary

HCM 2000 Control Delay	24.0	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.59		
Actuated Cycle Length (s)	74.6	Sum of lost time (s)	21.0
Intersection Capacity Utilization	57.8%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 10: Hacienda Dr & Martinelli Blvd/Hacienda Crossings

BART to Livermore Extension Project
 2025 Express Bus + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗	↖↗	↖↗	↗		↖↗↘	↖↗↘	↖	↖↗	↖↗↘	
Traffic Volume (vph)	10	8	173	110	12	8	244	866	112	17	727	49
Future Volume (vph)	10	8	173	110	12	8	244	866	112	17	727	49
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	3.0	3.0	5.5	3.0		3.5	3.0	3.0	5.0	3.5	
Lane Util. Factor	1.00	0.91	0.91	0.97	1.00		0.94	0.91	1.00	0.97	0.86	
Frt	1.00	0.90	0.85	1.00	0.94		1.00	1.00	0.85	1.00	0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1770	1523	2882	3433	1748		4990	5085	1583	3433	6347	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1770	1523	2882	3433	1748		4990	5085	1583	3433	6347	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	11	9	188	120	13	9	265	941	122	18	790	53
RTOR Reduction (vph)	0	14	128	0	6	0	0	0	54	0	8	0
Lane Group Flow (vph)	11	14	41	120	16	0	265	941	68	18	835	0
Turn Type	Prot	NA	Perm	Prot	NA		Prot	NA	pm+ov	Prot	NA	
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases			2						8			
Actuated Green, G (s)	1.7	15.8	15.8	6.9	21.5		8.2	29.7	36.6	1.1	22.6	
Effective Green, g (s)	1.2	17.8	17.8	6.4	23.5		9.2	31.7	40.6	0.6	24.1	
Actuated g/C Ratio	0.02	0.24	0.24	0.09	0.32		0.13	0.43	0.56	0.01	0.33	
Clearance Time (s)	4.5	5.0	5.0	5.0	5.0		4.5	5.0	5.0	4.5	5.0	
Vehicle Extension (s)	3.0	4.0	4.0	2.0	4.0		3.0	4.0	2.0	3.0	4.0	
Lane Grp Cap (vph)	29	371	702	300	562		628	2208	945	28	2095	
v/s Ratio Prot	c0.01	0.01		c0.03	0.01		c0.05	c0.19	0.01	0.01	0.13	
v/s Ratio Perm			c0.01						0.03			
v/c Ratio	0.38	0.04	0.06	0.40	0.03		0.42	0.43	0.07	0.64	0.40	
Uniform Delay, d1	35.5	21.1	21.2	31.5	16.9		29.4	14.3	7.5	36.1	18.9	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	8.1	0.1	0.0	0.3	0.0		0.5	0.2	0.0	40.9	0.2	
Delay (s)	43.6	21.1	21.2	31.8	17.0		29.9	14.5	7.5	77.0	19.0	
Level of Service	D	C	C	C	B		C	B	A	E	B	
Approach Delay (s)		22.4			29.5			16.9			20.2	
Approach LOS		C			C			B			C	

Intersection Summary		
HCM 2000 Control Delay	19.2	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.34	B
Actuated Cycle Length (s)	73.0	Sum of lost time (s)
Intersection Capacity Utilization	42.6%	16.5
Analysis Period (min)	15	ICU Level of Service
		A

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 11: Hacienda Dr & I-580 WB Ramps

BART to Livermore Extension Project
 2025 Express Bus + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↔↔		↔↔		↑↑↑			↑↑↑	↔
Traffic Volume (vph)	0	0	0	332	0	453	0	1063	183	0	619	416
Future Volume (vph)	0	0	0	332	0	453	0	1063	183	0	619	416
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0		4.0		4.0			4.0	4.0
Lane Util. Factor				0.97		0.88		0.91			0.86	0.86
Frt				1.00		0.85		0.98			0.96	0.85
Flt Protected				0.95		1.00		1.00			1.00	1.00
Satd. Flow (prot)				3433		2787		4973			4625	1362
Flt Permitted				0.95		1.00		1.00			1.00	1.00
Satd. Flow (perm)				3433		2787		4973			4625	1362
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	361	0	492	0	1155	199	0	673	452
RTOR Reduction (vph)	0	0	0	0	0	95	0	35	0	0	86	86
Lane Group Flow (vph)	0	0	0	361	0	397	0	1319	0	0	813	140
Turn Type				Prot		Prot		NA			NA	Perm
Protected Phases				4		4		2			6	
Permitted Phases												6
Actuated Green, G (s)				13.5		13.5		35.2			35.2	35.2
Effective Green, g (s)				14.9		14.9		37.1			37.1	37.1
Actuated g/C Ratio				0.25		0.25		0.62			0.62	0.62
Clearance Time (s)				5.4		5.4		5.9			5.9	5.9
Vehicle Extension (s)				3.0		3.0		3.0			3.0	3.0
Lane Grp Cap (vph)				852		692		3074			2859	842
v/s Ratio Prot				0.11		c0.14		c0.27			0.18	
v/s Ratio Perm												0.10
v/c Ratio				0.42		0.57		0.43			0.28	0.17
Uniform Delay, d1				18.9		19.8		5.9			5.3	4.9
Progression Factor				1.00		1.00		0.64			1.00	1.00
Incremental Delay, d2				0.3		1.2		0.4			0.2	0.4
Delay (s)				19.3		20.9		4.2			5.6	5.3
Level of Service				B		C		A			A	A
Approach Delay (s)		0.0			20.2			4.2			5.5	
Approach LOS		A			C			A			A	

Intersection Summary			
HCM 2000 Control Delay	8.8	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.47		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	47.1%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 12: Hacienda Dr & I-580 EB Ramps

BART to Livermore Extension Project
 2025 Express Bus + Garage AM




































Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗		↖↗					↖↗↘	↖		↖↗↘	
Traffic Volume (vph)	751	0	1095	0	0	0	0	456	245	0	1058	147
Future Volume (vph)	751	0	1095	0	0	0	0	456	245	0	1058	147
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0					4.0	4.0		4.0	
Lane Util. Factor	0.97		0.88					0.86	0.86		0.91	
Frt	1.00		0.85					0.98	0.85		0.98	
Flt Protected	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (prot)	3433		2787					4704	1362		4992	
Flt Permitted	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (perm)	3433		2787					4704	1362		4992	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	816	0	1190	0	0	0	0	496	266	0	1150	160
RTOR Reduction (vph)	0	0	37	0	0	0	0	38	109	0	33	0
Lane Group Flow (vph)	816	0	1153	0	0	0	0	540	75	0	1277	0
Turn Type	Prot		Prot					NA	Perm		NA	
Protected Phases	4		4					2			6	
Permitted Phases									2			
Actuated Green, G (s)	26.1		26.1					22.6	22.6		22.6	
Effective Green, g (s)	27.5		27.5					24.5	24.5		24.5	
Actuated g/C Ratio	0.46		0.46					0.41	0.41		0.41	
Clearance Time (s)	5.4		5.4					5.9	5.9		5.9	
Vehicle Extension (s)	2.0		2.0					2.0	2.0		2.0	
Lane Grp Cap (vph)	1573		1277					1920	556		2038	
v/s Ratio Prot	0.24		c0.41					0.11			c0.26	
v/s Ratio Perm									0.06			
v/c Ratio	0.52		0.90					0.28	0.14		0.63	
Uniform Delay, d1	11.5		15.0					11.9	11.1		14.1	
Progression Factor	1.00		1.00					1.00	1.00		0.86	
Incremental Delay, d2	0.1		8.9					0.4	0.5		1.4	
Delay (s)	11.7		23.9					12.2	11.6		13.6	
Level of Service	B		C					B	B		B	
Approach Delay (s)		18.9			0.0			12.1			13.6	
Approach LOS		B			A			B			B	

Intersection Summary			
HCM 2000 Control Delay	15.9	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.77		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	68.7%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 13: Hacienda Dr & Owens Rd

BART to Livermore Extension Project
 2025 Express Bus + Garage AM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 	  		 	  		 	  		  		
Traffic Volume (vph)	153	225	29	104	277	264	26	279	105	528	1010	589
Future Volume (vph)	153	225	29	104	277	264	26	279	105	528	1010	589
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	2.3	4.0	4.0	2.3	4.0	4.0	2.7	4.0	4.0	2.7
Lane Util. Factor	0.97	0.91	1.00	0.97	0.91	1.00	0.97	0.91	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5085	1583	3433	5085	1583	3433	5085	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5085	1583	3433	5085	1583	3433	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	166	245	32	113	301	287	28	303	114	574	1098	640
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	166	245	32	113	301	287	28	303	114	574	1098	640
Turn Type	Prot	NA	Free	Prot	NA	Free	Prot	NA	Free	Prot	NA	Free
Protected Phases	1	6		5	2		7	4		3	8	
Permitted Phases			Free			Free			Free			Free
Actuated Green, G (s)	4.0	9.1	60.2	4.0	9.1	60.2	1.4	9.2	60.2	18.9	26.7	60.2
Effective Green, g (s)	4.0	10.8	60.2	4.0	10.8	60.2	1.4	10.5	60.2	18.9	28.0	60.2
Actuated g/C Ratio	0.07	0.18	1.00	0.07	0.18	1.00	0.02	0.17	1.00	0.31	0.47	1.00
Clearance Time (s)	4.0	5.7		4.0	5.7		4.0	5.3		4.0	5.3	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	228	912	1583	228	912	1583	79	886	1583	1077	2365	1583
v/s Ratio Prot	0.05	0.05		0.03	0.06		0.01	0.06		c0.17	0.22	
v/s Ratio Perm			0.02			0.18			0.07			c0.40
v/c Ratio	0.73	0.27	0.02	0.50	0.33	0.18	0.35	0.34	0.07	0.53	0.46	0.40
Uniform Delay, d1	27.6	21.3	0.0	27.1	21.5	0.0	29.0	21.8	0.0	17.0	11.0	0.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	11.0	0.2	0.0	1.7	0.2	0.3	2.7	0.2	0.1	0.5	0.1	0.8
Delay (s)	38.6	21.5	0.0	28.8	21.8	0.3	31.7	22.0	0.1	17.5	11.1	0.8
Level of Service	D	C	A	C	C	A	C	C	A	B	B	A
Approach Delay (s)		26.3			14.1			17.0			9.8	
Approach LOS		C			B			B			A	
Intersection Summary												
HCM 2000 Control Delay			13.3				HCM 2000 Level of Service			B		
HCM 2000 Volume to Capacity ratio			0.57									
Actuated Cycle Length (s)			60.2				Sum of lost time (s)			16.0		
Intersection Capacity Utilization			46.4%				ICU Level of Service			A		
Analysis Period (min)			15									

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 14: Tassajara Rd & Dublin Blvd

BART to Livermore Extension Project
 2025 Express Bus + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↑↑	↖↗	↖↗↖↗	↑↓		↖↗↖↗	↑↑↑	↖	↖↗	↑↑↑	↖↗
Traffic Volume (vph)	93	150	159	521	670	43	227	508	146	25	1237	234
Future Volume (vph)	93	150	159	521	670	43	227	508	146	25	1237	234
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	6.0	6.0	5.0	6.0		5.0	6.0	6.0	5.0	6.0	6.0
Lane Util. Factor	0.97	0.95	0.88	0.94	0.95		0.94	0.91	1.00	0.97	0.86	0.88
Frt	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	2787	4990	3507		4990	5085	1583	3433	6408	2787
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	2787	4990	3507		4990	5085	1583	3433	6408	2787
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	101	163	173	566	728	47	247	552	159	27	1345	254
RTOR Reduction (vph)	0	0	131	0	4	0	0	0	98	0	0	171
Lane Group Flow (vph)	101	163	42	566	771	0	247	552	61	27	1345	83
Turn Type	Prot	NA	Perm	Prot	NA		Prot	NA	Perm	Prot	NA	Perm
Protected Phases	5	2		1	6		3	8		7	NA	4
Permitted Phases			2						8			4
Actuated Green, G (s)	16.2	33.1	33.1	19.5	36.4		16.2	52.0	52.0	8.4	44.2	44.2
Effective Green, g (s)	16.2	33.1	33.1	19.5	36.4		16.2	52.0	52.0	8.4	44.2	44.2
Actuated g/C Ratio	0.12	0.25	0.25	0.14	0.27		0.12	0.39	0.39	0.06	0.33	0.33
Clearance Time (s)	5.0	6.0	6.0	5.0	6.0		5.0	6.0	6.0	5.0	6.0	6.0
Vehicle Extension (s)	2.0	3.0	3.0	2.0	3.0		2.0	4.0	4.0	2.0	4.0	4.0
Lane Grp Cap (vph)	411	867	683	720	945		598	1958	609	213	2098	912
v/s Ratio Prot	0.03	0.05		c0.11	c0.22		c0.05	0.11		0.01	c0.21	
v/s Ratio Perm			0.02						0.04			0.03
v/c Ratio	0.25	0.19	0.06	0.79	0.82		0.41	0.28	0.10	0.13	0.64	0.09
Uniform Delay, d1	53.9	40.3	39.1	55.7	46.2		55.0	28.6	26.5	59.8	38.6	31.5
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.1	0.1	0.0	5.2	5.5		0.2	0.1	0.1	0.1	0.8	0.1
Delay (s)	54.0	40.4	39.1	61.0	51.7		55.2	28.7	26.6	59.9	39.4	31.5
Level of Service	D	D	D	E	D		E	C	C	E	D	C
Approach Delay (s)		43.0			55.6			35.2			38.5	
Approach LOS		D			E			D			D	

Intersection Summary		
HCM 2000 Control Delay	43.5	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.70	D
Actuated Cycle Length (s)	135.0	Sum of lost time (s)
Intersection Capacity Utilization	82.8%	22.0
Analysis Period (min)	15	ICU Level of Service
		E

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 15: Tassajara Rd & I-580 WB Ramps

BART to Livermore Extension Project
 2025 Express Bus + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↔		↔		↕	↔		↕↔	↔
Traffic Volume (vph)	0	0	0	557	0	294	0	1036	469	0	939	935
Future Volume (vph)	0	0	0	557	0	294	0	1036	469	0	939	935
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0		4.0		4.0	4.0		4.0	4.0
Lane Util. Factor				0.97		0.88		0.95	1.00		0.86	0.86
Frt				1.00		0.85		1.00	0.85		0.95	0.85
Flt Protected				0.95		1.00		1.00	1.00		1.00	1.00
Satd. Flow (prot)				3433		2787		3539	1583		4566	1362
Flt Permitted				0.95		1.00		1.00	1.00		1.00	1.00
Satd. Flow (perm)				3433		2787		3539	1583		4566	1362
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	605	0	320	0	1126	510	0	1021	1016
RTOR Reduction (vph)	0	0	0	0	0	91	0	0	205	0	133	204
Lane Group Flow (vph)	0	0	0	605	0	229	0	1126	305	0	1396	304
Turn Type				Perm		Perm		NA	Perm		NA	Perm
Protected Phases								2			6	
Permitted Phases				8		8			2			6
Actuated Green, G (s)				16.1		16.1		35.9	35.9		35.9	35.9
Effective Green, g (s)				16.1		16.1		35.9	35.9		35.9	35.9
Actuated g/C Ratio				0.27		0.27		0.60	0.60		0.60	0.60
Clearance Time (s)				4.0		4.0		4.0	4.0		4.0	4.0
Vehicle Extension (s)				3.0		3.0		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)				921		747		2117	947		2731	814
v/s Ratio Prot								c0.32			0.31	
v/s Ratio Perm				c0.18		0.08			0.19			0.22
v/c Ratio				0.66		0.31		0.53	0.32		0.51	0.37
Uniform Delay, d1				19.5		17.5		7.1	6.0		7.0	6.2
Progression Factor				1.00		1.00		1.00	1.00		1.00	1.00
Incremental Delay, d2				1.7		0.2		1.0	0.9		0.7	1.3
Delay (s)				21.2		17.7		8.1	6.9		7.7	7.5
Level of Service				C		B		A	A		A	A
Approach Delay (s)		0.0			20.0			7.7			7.6	
Approach LOS		A			B			A			A	

Intersection Summary			
HCM 2000 Control Delay	10.1	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.57		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	51.2%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 16: Santa Rita Rd & I-580 EB Ramps/Pimilco Dr

BART to Livermore Extension Project
 2025 Express Bus + Garage AM

































Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	540	118	675	182	0	192	0	733	105	191	1247	0
Future Volume (vph)	540	118	675	182	0	192	0	733	105	191	1247	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0		4.0		4.0		4.0	4.0	
Lane Util. Factor	0.97	1.00	1.00	0.97		0.88		0.86		1.00	0.95	
Frt	1.00	1.00	0.85	1.00		0.85		0.98		1.00	1.00	
Flt Protected	0.95	1.00	1.00	0.95		1.00		1.00		0.95	1.00	
Satd. Flow (prot)	3433	1863	1583	3433		2787		6288		1770	3539	
Flt Permitted	0.95	1.00	1.00	0.95		1.00		1.00		0.95	1.00	
Satd. Flow (perm)	3433	1863	1583	3433		2787		6288		1770	3539	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	587	128	734	198	0	209	0	797	114	208	1355	0
RTOR Reduction (vph)	0	0	0	0	0	71	0	43	0	0	0	0
Lane Group Flow (vph)	587	128	734	198	0	138	0	868	0	208	1355	0
Turn Type	Perm	NA	Free	Prot		pm+ov		NA		Prot	NA	Perm
Protected Phases		4		3		1		2		1	6	
Permitted Phases	4		Free			3						6
Actuated Green, G (s)	14.8	14.8	60.0	4.7		13.3		15.9		8.6	28.5	
Effective Green, g (s)	14.8	14.8	60.0	4.7		13.3		15.9		8.6	28.5	
Actuated g/C Ratio	0.25	0.25	1.00	0.08		0.22		0.27		0.14	0.48	
Clearance Time (s)	4.0	4.0		4.0		4.0		4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0		3.0		3.0		3.0	3.0	
Lane Grp Cap (vph)	846	459	1583	268		617		1666		253	1681	
v/s Ratio Prot		0.07		0.06		0.03		0.14		0.12	c0.38	
v/s Ratio Perm	c0.17		c0.46			0.02						
v/c Ratio	0.69	0.28	0.46	0.74		0.22		0.52		0.82	0.81	
Uniform Delay, d1	20.5	18.3	0.0	27.0		19.1		18.8		25.0	13.4	
Progression Factor	1.00	1.00	1.00	1.00		1.00		1.00		1.00	1.00	
Incremental Delay, d2	2.5	0.3	1.0	10.2		0.2		1.2		18.9	4.2	
Delay (s)	23.0	18.6	1.0	37.2		19.3		20.0		43.9	17.6	
Level of Service	C	B	A	D		B		B		D	B	
Approach Delay (s)		11.5			28.0			20.0			21.1	
Approach LOS		B			C			B			C	

Intersection Summary		
HCM 2000 Control Delay	18.3	HCM 2000 Level of Service B
HCM 2000 Volume to Capacity ratio	0.85	
Actuated Cycle Length (s)	60.0	Sum of lost time (s) 16.0
Intersection Capacity Utilization	56.5%	ICU Level of Service B
Analysis Period (min)	15	

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 17: Santa Rita Rd & Valley Ave

BART to Livermore Extension Project
 2025 Express Bus + Garage AM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 	 			 		 	 		 	 	
Traffic Volume (vph)	186	223	78	180	330	829	92	476	72	572	917	154
Future Volume (vph)	186	223	78	180	330	829	92	476	72	572	917	154
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.97	0.95		0.97	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.98		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	3433	3470		3433	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	3433	3470		3433	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	202	242	85	196	359	901	100	517	78	622	997	167
RTOR Reduction (vph)	0	0	70	0	0	0	0	17	0	0	0	100
Lane Group Flow (vph)	202	242	15	196	359	901	100	578	0	622	997	67
Turn Type	Prot	NA	Perm	Prot	NA	Free	Prot	NA		Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1		6
Permitted Phases			4			Free						6
Actuated Green, G (s)	7.7	11.5	11.5	8.1	11.9	64.8	3.1	16.1		13.1	26.1	26.1
Effective Green, g (s)	7.7	11.5	11.5	8.1	11.9	64.8	3.1	16.1		13.1	26.1	26.1
Actuated g/C Ratio	0.12	0.18	0.18	0.12	0.18	1.00	0.05	0.25		0.20	0.40	0.40
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	407	628	280	221	649	1583	164	862		694	1425	637
v/s Ratio Prot	0.06	0.07		c0.11	0.10		0.03	0.17		c0.18	c0.28	
v/s Ratio Perm			0.01			c0.57						0.04
v/c Ratio	0.50	0.39	0.05	0.89	0.55	0.57	0.61	0.67		0.90	0.70	0.11
Uniform Delay, d1	26.7	23.5	22.1	27.9	24.0	0.0	30.3	22.0		25.2	16.1	12.1
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	1.0	0.4	0.1	31.8	1.0	1.5	6.3	2.1		14.2	1.5	0.1
Delay (s)	27.7	23.9	22.2	59.7	25.1	1.5	36.5	24.0		39.4	17.6	12.1
Level of Service	C	C	C	E	C	A	D	C		D	B	B
Approach Delay (s)		25.1			15.1			25.8			24.7	
Approach LOS		C			B			C			C	
Intersection Summary												
HCM 2000 Control Delay			21.8			HCM 2000 Level of Service				C		
HCM 2000 Volume to Capacity ratio			0.84									
Actuated Cycle Length (s)			64.8			Sum of lost time (s)				16.0		
Intersection Capacity Utilization			61.2%			ICU Level of Service				B		
Analysis Period (min)			15									

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
18: Bernal Ave/Valley Ave & Stanley Blvd

BART to Livermore Extension Project
2025 Express Bus + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	204	202	52	251	895	954	173	476	106	139	344	116
Future Volume (vph)	204	202	52	251	895	954	173	476	106	139	344	116
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.95	1.00	0.97	0.91	0.91	1.00	0.95	1.00	0.97	0.95	0.95
Frt	1.00	1.00	0.85	1.00	0.96	0.85	1.00	1.00	0.85	1.00	0.96	0.96
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	3433	3238	1441	1770	3539	1583	3433	3405	3405
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	3433	3238	1441	1770	3539	1583	3433	3405	3405
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	222	220	57	273	973	1037	188	517	115	151	374	126
RTOR Reduction (vph)	0	0	28	0	46	28	0	0	91	0	38	0
Lane Group Flow (vph)	222	220	29	273	1342	594	188	517	24	151	462	0
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	NA
Protected Phases	7	4	5	3	8	1	5	2		1	6	
Permitted Phases			4			8			2			
Actuated Green, G (s)	6.0	32.1	43.7	11.0	37.1	46.9	11.6	18.2	18.2	9.8	16.4	
Effective Green, g (s)	6.0	32.1	43.7	11.0	37.1	46.9	11.6	18.2	18.2	9.8	16.4	
Actuated g/C Ratio	0.07	0.37	0.50	0.13	0.43	0.54	0.13	0.21	0.21	0.11	0.19	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	236	1304	866	433	1379	842	235	739	330	386	641	
v/s Ratio Prot	c0.06	0.06	0.00	0.08	c0.41	0.08	c0.11	c0.15		0.04	0.14	
v/s Ratio Perm			0.01			0.33			0.02			
v/c Ratio	0.94	0.17	0.03	0.63	0.97	0.71	0.80	0.70	0.07	0.39	0.72	
Uniform Delay, d1	40.4	18.5	11.0	36.1	24.5	15.0	36.6	31.9	27.7	35.9	33.2	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	42.3	0.1	0.0	3.0	18.0	2.7	17.5	2.9	0.1	0.7	4.0	
Delay (s)	82.7	18.6	11.0	39.1	42.5	17.7	54.1	34.8	27.8	36.5	37.2	
Level of Service	F	B	B	D	D	B	D	C	C	D	D	
Approach Delay (s)		46.2			35.3			38.2			37.0	
Approach LOS		D			D			D			D	








































Intersection Summary

HCM 2000 Control Delay	37.4	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.89		
Actuated Cycle Length (s)	87.1	Sum of lost time (s)	16.0
Intersection Capacity Utilization	76.9%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
19: Fallon Rd & Dublin Blvd

BART to Livermore Extension Project
2025 Express Bus + Garage AM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 	  	 	  	  		 	  	 	 	  	
Traffic Volume (vph)	45	53	83	279	1111	343	743	236	27	55	660	326
Future Volume (vph)	45	53	83	279	1111	343	743	236	27	55	660	326
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.3	5.3	5.3	4.0	4.0	4.0	5.3	4.9	4.9	5.3	4.9	4.9
Lane Util. Factor	0.97	0.91	0.88	0.94	0.91	1.00	0.97	0.91	0.88	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3090	4577	2508	4491	4577	1425	3090	4577	2508	3090	4577	1425
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3090	4577	2508	4491	4577	1425	3090	4577	2508	3090	4577	1425
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	49	58	90	303	1208	373	808	257	29	60	717	354
RTOR Reduction (vph)	0	0	59	0	0	274	0	0	15	0	0	149
Lane Group Flow (vph)	49	58	31	303	1208	99	808	257	14	60	717	205
Turn Type	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	5	2	3	1	6		3	8		7	NA	4
Permitted Phases			2			6			8			4
Actuated Green, G (s)	3.1	9.3	38.7	23.3	29.5	29.5	29.4	54.0	54.0	4.5	29.1	29.1
Effective Green, g (s)	3.1	9.3	38.7	23.3	29.5	29.5	29.4	54.0	54.0	4.5	29.1	29.1
Actuated g/C Ratio	0.03	0.08	0.35	0.21	0.27	0.27	0.27	0.49	0.49	0.04	0.26	0.26
Clearance Time (s)	5.3	5.3	5.3	4.0	4.0	4.0	5.3	4.9	4.9	5.3	4.9	4.9
Vehicle Extension (s)	2.0	4.0	2.0	2.0	2.0	2.0	2.0	4.0	4.0	2.0	4.0	4.0
Lane Grp Cap (vph)	86	384	877	946	1220	380	821	2234	1224	125	1204	374
v/s Ratio Prot	0.02	0.01	0.01	c0.07	c0.26		c0.26	0.06		0.02	c0.16	
v/s Ratio Perm			0.00			0.07			0.01			0.14
v/c Ratio	0.57	0.15	0.04	0.32	0.99	0.26	0.98	0.12	0.01	0.48	0.60	0.55
Uniform Delay, d1	53.1	47.0	23.7	36.9	40.4	32.0	40.4	15.3	14.6	51.9	35.6	35.1
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	5.1	0.3	0.0	0.1	23.3	0.1	27.2	0.0	0.0	1.1	0.9	2.1
Delay (s)	58.2	47.2	23.7	37.0	63.7	32.1	67.6	15.4	14.6	53.0	36.5	37.2
Level of Service	E	D	C	D	E	C	E	B	B	D	D	D
Approach Delay (s)		39.2			53.2			53.9			37.6	
Approach LOS		D			D			D			D	
Intersection Summary												
HCM 2000 Control Delay			48.6				HCM 2000 Level of Service			D		
HCM 2000 Volume to Capacity ratio			0.85									
Actuated Cycle Length (s)			110.6				Sum of lost time (s)		19.5			
Intersection Capacity Utilization			81.3%				ICU Level of Service		D			
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis
 20: El Charro Rd/Fallon Rd & I-580 WB Ramps

BART to Livermore Extension Project
 2025 Express Bus + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↙	↖	↗		↖	↗		↕	↘
Traffic Volume (vph)	0	0	0	166	0	609	0	554	478	0	521	399
Future Volume (vph)	0	0	0	166	0	609	0	554	478	0	521	399
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0	4.0	4.0		4.0	4.0		4.0	4.0
Lane Util. Factor				0.95	0.95	0.88		0.95	0.95		0.95	1.00
Frt				1.00	1.00	0.85		0.99	0.85		1.00	0.85
Flt Protected				0.95	0.95	1.00		1.00	1.00		1.00	1.00
Satd. Flow (prot)				1681	1681	2787		1749	1504		3539	1583
Flt Permitted				0.95	0.95	1.00		1.00	1.00		1.00	1.00
Satd. Flow (perm)				1681	1681	2787		1749	1504		3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	180	0	662	0	602	520	0	566	434
RTOR Reduction (vph)	0	0	0	0	0	401	0	4	151	0	0	140
Lane Group Flow (vph)	0	0	0	92	88	261	0	650	317	0	566	294
Turn Type				Perm	NA	Perm		NA	Perm		NA	Perm
Protected Phases					8			2			6	
Permitted Phases				8		8			2			6
Actuated Green, G (s)				11.8	11.8	11.8		40.7	40.7		40.7	40.7
Effective Green, g (s)				11.3	11.3	11.3		40.7	40.7		40.7	40.7
Actuated g/C Ratio				0.19	0.19	0.19		0.68	0.68		0.68	0.68
Clearance Time (s)				3.5	3.5	3.5		4.0	4.0		4.0	4.0
Vehicle Extension (s)				2.0	2.0	2.0		2.0	2.0		2.0	2.0
Lane Grp Cap (vph)				316	316	524		1186	1020		2400	1073
v/s Ratio Prot								c0.37			0.16	
v/s Ratio Perm				0.05	0.05	c0.09			0.21			0.19
v/c Ratio				0.29	0.28	0.50		0.55	0.31		0.24	0.27
Uniform Delay, d1				20.9	20.9	21.8		4.9	3.9		3.7	3.8
Progression Factor				1.00	1.00	1.00		0.72	0.19		1.00	1.00
Incremental Delay, d2				0.2	0.2	0.3		1.8	0.8		0.2	0.6
Delay (s)				21.1	21.0	22.1		5.3	1.5		3.9	4.4
Level of Service				C	C	C		A	A		A	A
Approach Delay (s)		0.0			21.9			3.7			4.2	
Approach LOS		A			C			A			A	

Intersection Summary			
HCM 2000 Control Delay	9.0	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.54		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	66.8%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

21: El Charro Rd & I-580 EB Ramps

BART to Livermore Extension Project
2025 Express Bus + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔↔		↔↔					↕↔	↔		↕↔	↔
Traffic Volume (vph)	245	0	400	0	0	0	0	771	141	0	369	0
Future Volume (vph)	245	0	400	0	0	0	0	771	141	0	369	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0					4.0	4.0		4.0	
Lane Util. Factor	0.97		0.88					0.91	0.91		0.91	
Frt	1.00		0.85					1.00	0.85		1.00	
Flt Protected	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (prot)	3433		2787					3380	1441		3390	
Flt Permitted	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (perm)	3433		2787					3380	1441		3390	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	266	0	435	0	0	0	0	838	153	0	401	0
RTOR Reduction (vph)	0	0	370	0	0	0	0	2	38	0	0	0
Lane Group Flow (vph)	266	0	65	0	0	0	0	854	97	0	401	0
Turn Type	Prot		Perm					NA	Perm		NA	Perm
Protected Phases	4							2			6	
Permitted Phases			4						2			6
Actuated Green, G (s)	9.0		9.0					43.0	43.0		43.0	
Effective Green, g (s)	9.0		9.0					43.0	43.0		43.0	
Actuated g/C Ratio	0.15		0.15					0.72	0.72		0.72	
Clearance Time (s)	4.0		4.0					4.0	4.0		4.0	
Vehicle Extension (s)	2.0		2.0					3.0	3.0		3.0	
Lane Grp Cap (vph)	514		418					2422	1032		2429	
v/s Ratio Prot	c0.08							c0.25			0.12	
v/s Ratio Perm			0.02						0.07			
v/c Ratio	0.52		0.16					0.35	0.09		0.17	
Uniform Delay, d1	23.5		22.2					3.2	2.6		2.7	
Progression Factor	1.00		1.00					1.00	1.00		0.75	
Incremental Delay, d2	0.4		0.1					0.4	0.2		0.1	
Delay (s)	23.9		22.3					3.6	2.8		2.2	
Level of Service	C		C					A	A		A	
Approach Delay (s)		22.9			0.0			3.5			2.2	
Approach LOS		C			A			A			A	

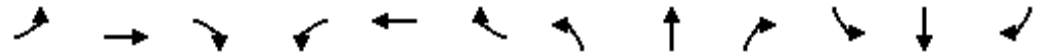
Intersection Summary

HCM 2000 Control Delay	9.7	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.38		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	36.5%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 22: El Charro Rd & Stoneridge Dr/Jack London Blvd

BART to Livermore Extension Project
 2025 Express Bus + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔↔↔	↑↑	↗	↖	↑↑	↗↖	↖	↑↑		↗↖↖	↑	↗↖
Traffic Volume (vph)	145	99	8	16	594	634	7	97	2	208	90	171
Future Volume (vph)	145	99	8	16	594	634	7	97	2	208	90	171
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	0.94	0.95	1.00	1.00	0.95	0.88	1.00	0.95		0.94	1.00	0.88
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	4491	3185	1425	1593	3185	2508	1593	3176		4491	1676	2508
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	4491	3185	1425	1593	3185	2508	1593	3176		4491	1676	2508
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	158	108	9	17	646	689	8	105	2	226	98	186
RTOR Reduction (vph)	0	0	5	0	0	391	0	2	0	0	0	130
Lane Group Flow (vph)	158	108	4	17	646	298	8	105	0	226	98	56
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Prot	NA		Prot	NA	Perm
Protected Phases	7	4		3	8	1	5	2		1	6	
Permitted Phases			4			8						6
Actuated Green, G (s)	10.9	29.0	29.0	0.8	18.9	28.9	0.8	11.1		10.0	20.3	20.3
Effective Green, g (s)	10.9	29.0	29.0	0.8	18.9	28.9	0.8	11.1		10.0	20.3	20.3
Actuated g/C Ratio	0.16	0.43	0.43	0.01	0.28	0.43	0.01	0.17		0.15	0.30	0.30
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	731	1380	617	19	899	1083	19	526		671	508	761
v/s Ratio Prot	c0.04	0.03		0.01	c0.20	0.04	0.01	0.03		c0.05	c0.06	
v/s Ratio Perm			0.00			0.08						0.02
v/c Ratio	0.22	0.08	0.01	0.89	0.72	0.27	0.42	0.20		0.34	0.19	0.07
Uniform Delay, d1	24.3	11.1	10.8	33.0	21.6	12.2	32.8	24.1		25.5	17.2	16.6
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	0.1	0.0	0.0	155.2	2.8	0.1	14.4	0.2		0.3	0.2	0.0
Delay (s)	24.4	11.1	10.8	188.2	24.4	12.4	47.2	24.3		25.8	17.4	16.6
Level of Service	C	B	B	F	C	B	D	C		C	B	B
Approach Delay (s)		18.8			20.3			25.9			20.8	
Approach LOS		B			C			C			C	

Intersection Summary

HCM 2000 Control Delay	20.5	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.43		
Actuated Cycle Length (s)	66.9	Sum of lost time (s)	16.0
Intersection Capacity Utilization	42.6%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
24: Airway Blvd/Driveway & N Canyons Pkwy

BART to Livermore Extension Project
2025 Express Bus + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑	↑	↑↑	↑	↑		↑	↑↑		↑	
Traffic Volume (vph)	0	53	81	686	461	0	1180	0	889	0	0	0
Future Volume (vph)	0	53	81	686	461	0	1180	0	889	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0	4.0	4.0			4.4	4.0			
Lane Util. Factor		0.95	1.00	0.97	1.00			1.00	0.88			
Frt		1.00	0.85	1.00	1.00			1.00	0.85			
Flt Protected		1.00	1.00	0.95	1.00			0.95	1.00			
Satd. Flow (prot)		3539	1583	3433	1863			1770	2787			
Flt Permitted		1.00	1.00	0.95	1.00			0.95	1.00			
Satd. Flow (perm)		3539	1583	3433	1863			1770	2787			
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	58	88	746	501	0	1283	0	966	0	0	0
RTOR Reduction (vph)	0	0	80	0	0	0	0	0	56	0	0	0
Lane Group Flow (vph)	0	58	8	746	501	0	0	1283	910	0	0	0
Turn Type		NA	Perm	Prot	NA	Perm	Split	NA	pm+ov			
Protected Phases		2		1	6		8	8	1	4	4	
Permitted Phases			2			6			8			
Actuated Green, G (s)		10.2	10.2	36.8	53.0			76.8	113.6			
Effective Green, g (s)		12.2	12.2	38.8	55.0			76.6	117.6			
Actuated g/C Ratio		0.09	0.09	0.28	0.39			0.55	0.84			
Clearance Time (s)		6.0	6.0	6.0	6.0			4.2	6.0			
Vehicle Extension (s)		3.0	3.0	3.0	3.0			3.0	3.0			
Lane Grp Cap (vph)		308	137	951	731			968	2420			
v/s Ratio Prot		0.02		c0.22	c0.27			c0.73	0.10			
v/s Ratio Perm			0.00						0.22			
v/c Ratio		0.19	0.06	0.78	0.69			1.33	0.38			
Uniform Delay, d1		59.3	58.6	46.7	35.3			31.7	2.6			
Progression Factor		1.00	1.00	1.00	1.00			1.00	1.00			
Incremental Delay, d2		1.4	0.8	4.3	5.2			153.7	0.1			
Delay (s)		60.7	59.4	51.0	40.5			185.4	2.7			
Level of Service		E	E	D	D			F	A			
Approach Delay (s)		59.9			46.8			106.9			0.0	
Approach LOS		E			D			F			A	

Intersection Summary

HCM 2000 Control Delay	84.4	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.14		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	16.4
Intersection Capacity Utilization	98.6%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 25: Airway Blvd & I-580 WB Ramps

BART to Livermore Extension Project
 2025 Express Bus + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↙	↖	↗		↕	↘		↕	↘
Traffic Volume (vph)	0	0	0	63	43	852	0	1301	343	0	280	553
Future Volume (vph)	0	0	0	63	43	852	0	1301	343	0	280	553
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0	4.0	4.0		4.0	4.0		4.0	
Lane Util. Factor				0.95	0.95	0.88		0.95	1.00		0.91	
Frt				1.00	1.00	0.85		1.00	0.85		0.90	
Flt Protected				0.95	0.98	1.00		1.00	1.00		1.00	
Satd. Flow (prot)				1681	1734	2787		3539	1583		4579	
Flt Permitted				0.95	0.98	1.00		1.00	1.00		1.00	
Satd. Flow (perm)				1681	1734	2787		3539	1583		4579	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	68	47	926	0	1414	373	0	304	601
RTOR Reduction (vph)	0	0	0	0	0	31	0	0	165	0	266	0
Lane Group Flow (vph)	0	0	0	36	79	895	0	1414	208	0	639	0
Turn Type				Split	NA	Perm		NA	Perm		NA	
Protected Phases				8	8			2			6	
Permitted Phases						8			2			
Actuated Green, G (s)				36.2	36.2	36.2		54.5	54.5		54.5	
Effective Green, g (s)				36.2	36.2	36.2		55.8	55.8		55.8	
Actuated g/C Ratio				0.36	0.36	0.36		0.56	0.56		0.56	
Clearance Time (s)				4.0	4.0	4.0		5.3	5.3		5.3	
Vehicle Extension (s)				2.0	2.0	2.0		4.0	4.0		4.0	
Lane Grp Cap (vph)				608	627	1008		1974	883		2555	
v/s Ratio Prot				0.02	0.05			c0.40			0.14	
v/s Ratio Perm						c0.32			0.13			
v/c Ratio				0.06	0.13	0.89		0.72	0.24		0.25	
Uniform Delay, d1				20.8	21.3	30.0		16.3	11.2		11.4	
Progression Factor				1.00	1.00	1.00		1.00	1.00		1.00	
Incremental Delay, d2				0.0	0.0	9.4		2.3	0.6		0.2	
Delay (s)				20.8	21.4	39.4		18.5	11.9		11.6	
Level of Service				C	C	D		B	B		B	
Approach Delay (s)		0.0			37.4			17.1			11.6	
Approach LOS		A			D			B			B	

Intersection Summary		
HCM 2000 Control Delay	21.4	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.78	C
Actuated Cycle Length (s)	100.0	Sum of lost time (s)
Intersection Capacity Utilization	72.4%	8.0
Analysis Period (min)	15	ICU Level of Service
		C

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 26: Airway Blvd & I-580 EB Ramps/Kitty Hawk Rd

BART to Livermore Extension Project
 2025 Express Bus + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↑	↖	↖	↑	↖	↖	↑↕		↖	↑↕	
Traffic Volume (vph)	644	192	162	22	34	101	26	507	158	82	116	151
Future Volume (vph)	644	192	162	22	34	101	26	507	158	82	116	151
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.4	4.4	4.4	4.0	4.0		4.0	4.0	
Lane Util. Factor	0.97	1.00	1.00	1.00	1.00	1.00	1.00	0.95		1.00	0.95	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.96		1.00	0.92	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	3433	1863	1583	1770	1863	1583	1770	3413		1770	3239	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	3433	1863	1583	1770	1863	1583	1770	3413		1770	3239	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	700	209	176	24	37	110	28	551	172	89	126	164
RTOR Reduction (vph)	0	0	135	0	0	87	0	34	0	0	86	0
Lane Group Flow (vph)	700	209	41	24	37	23	28	689	0	89	204	0
Turn Type	Split	NA	Perm	Split	NA	pm+ov	Prot	NA		Prot	NA	
Protected Phases	7	7		8	8	1	5	2		1	6	
Permitted Phases			7			8						
Actuated Green, G (s)	20.9	20.9	20.9	8.4	8.4	19.7	2.5	32.1		11.3	41.4	
Effective Green, g (s)	20.9	20.9	20.9	8.0	8.0	18.9	2.0	33.4		11.3	42.7	
Actuated g/C Ratio	0.23	0.23	0.23	0.09	0.09	0.21	0.02	0.37		0.13	0.47	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	3.5	5.3		4.0	5.3	
Vehicle Extension (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	3.5		2.0	4.0	
Lane Grp Cap (vph)	797	432	367	157	165	409	39	1266		222	1536	
v/s Ratio Prot	c0.20	0.11		0.01	c0.02	0.01	0.02	c0.20		c0.05	0.06	
v/s Ratio Perm			0.03			0.01						
v/c Ratio	0.88	0.48	0.11	0.15	0.22	0.06	0.72	0.54		0.40	0.13	
Uniform Delay, d1	33.3	29.9	27.2	37.9	38.1	28.4	43.7	22.3		36.2	13.3	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	10.5	0.3	0.0	0.2	0.3	0.0	40.9	1.7		0.4	0.2	
Delay (s)	43.8	30.2	27.3	38.0	38.4	28.4	84.6	24.0		36.7	13.4	
Level of Service	D	C	C	D	D	C	F	C		D	B	
Approach Delay (s)		38.5			31.9			26.2			18.9	
Approach LOS		D			C			C			B	

Intersection Summary

HCM 2000 Control Delay	31.1	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.59		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	16.8
Intersection Capacity Utilization	58.6%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 27: Collier Canyon Rd & N Canyons Pkwy/Portola Ave

BART to Livermore Extension Project
 2025 Express Bus + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	190	219	104	229	828	59	49	5	114	64	14	128
Future Volume (vph)	190	219	104	229	828	59	49	5	114	64	14	128
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	5.2	5.2
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.86		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	1770	1594		1770	1863	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	1770	1594		1770	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	207	238	113	249	900	64	53	5	124	70	15	139
RTOR Reduction (vph)	0	0	81	0	0	40	0	100	0	0	0	105
Lane Group Flow (vph)	207	238	32	249	900	24	53	29	0	70	15	34
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA		Prot	NA	Perm
Protected Phases	1	6		5	2		3	8		7		4
Permitted Phases			6			2						4
Actuated Green, G (s)	5.2	17.4	17.4	11.4	23.6	23.6	2.2	11.8		6.6	16.6	16.6
Effective Green, g (s)	5.2	18.7	18.7	11.4	24.9	24.9	2.2	12.8		6.6	16.0	16.0
Actuated g/C Ratio	0.08	0.29	0.29	0.17	0.38	0.38	0.03	0.20		0.10	0.24	0.24
Clearance Time (s)	4.0	5.3	5.3	4.0	5.3	5.3	4.0	5.0		4.0	4.6	4.6
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	272	1010	451	308	1345	601	59	311		178	455	386
v/s Ratio Prot	0.06	0.07		c0.14	c0.25		c0.03	0.02		c0.04	0.01	
v/s Ratio Perm			0.02			0.02						c0.02
v/c Ratio	0.76	0.24	0.07	0.81	0.67	0.04	0.90	0.09		0.39	0.03	0.09
Uniform Delay, d1	29.5	17.9	17.1	26.0	16.9	12.8	31.5	21.6		27.6	18.9	19.1
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	11.8	0.1	0.1	14.4	1.3	0.0	80.5	0.1		1.4	0.0	0.1
Delay (s)	41.4	18.0	17.1	40.4	18.2	12.8	112.0	21.7		29.0	18.9	19.2
Level of Service	D	B	B	D	B	B	F	C		C	B	B
Approach Delay (s)		26.5			22.4			48.0			22.3	
Approach LOS		C			C			D			C	

Intersection Summary

HCM 2000 Control Delay	25.6	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.57		
Actuated Cycle Length (s)	65.5	Sum of lost time (s)	17.2
Intersection Capacity Utilization	49.5%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
28: Isabel Ave/Campus Hill Dr & Portola Ave

BART to Livermore Extension Project
2025 Express Bus + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↘	↑↑	↗↗	↘↘↘	↑↑		↘↘	↑↑	↗	↘	↑↑	↗
Traffic Volume (vph)	1	191	279	612	593	140	501	300	78	40	155	1
Future Volume (vph)	1	191	279	612	593	140	501	300	78	40	155	1
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	5.8	5.8
Lane Util. Factor	1.00	0.95	0.88	0.94	0.95		0.97	0.95	1.00	1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	0.97		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3539	2787	4990	3438		3433	3539	1583	1770	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	3539	2787	4990	3438		3433	3539	1583	1770	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	1	208	303	665	645	152	545	326	85	43	168	1
RTOR Reduction (vph)	0	0	236	0	14	0	0	0	56	0	0	1
Lane Group Flow (vph)	1	208	67	665	783	0	545	326	29	43	168	0
Turn Type	Prot	NA	Perm	Prot	NA		Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4						2			6
Actuated Green, G (s)	1.5	18.3	18.3	17.1	33.9		21.1	29.3	29.3	5.3	13.9	13.9
Effective Green, g (s)	1.5	19.6	19.6	17.1	35.2		21.1	30.6	30.6	5.3	13.0	13.0
Actuated g/C Ratio	0.02	0.22	0.22	0.19	0.40		0.24	0.35	0.35	0.06	0.15	0.15
Clearance Time (s)	4.0	5.3	5.3	4.0	5.3		4.0	5.3	5.3	4.0	4.9	4.9
Vehicle Extension (s)	2.0	3.0	3.0	2.0	3.0		2.0	3.0	3.0	2.0	3.0	3.0
Lane Grp Cap (vph)	29	782	616	963	1365		817	1222	546	105	519	232
v/s Ratio Prot	0.00	0.06		c0.13	c0.23		c0.16	c0.09		0.02	0.05	
v/s Ratio Perm			0.02						0.02			0.00
v/c Ratio	0.03	0.27	0.11	0.69	0.57		0.67	0.27	0.05	0.41	0.32	0.00
Uniform Delay, d1	42.8	28.5	27.5	33.3	20.8		30.6	20.9	19.3	40.1	33.9	32.3
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.2	0.2	0.1	1.7	0.6		1.6	0.1	0.0	0.9	0.4	0.0
Delay (s)	43.0	28.7	27.6	35.0	21.4		32.2	21.0	19.4	41.1	34.2	32.3
Level of Service	D	C	C	D	C		C	C	B	D	C	C
Approach Delay (s)		28.1			27.6			27.2			35.6	
Approach LOS		C			C			C			D	

Intersection Summary

HCM 2000 Control Delay	28.1	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.61		
Actuated Cycle Length (s)	88.6	Sum of lost time (s)	17.8
Intersection Capacity Utilization	67.5%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 29: Isabel Ave & I-580 WB Ramps

BART to Livermore Extension Project
 2025 Express Bus + Garage AM

























Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↖↗		↖		↕	↖↗		↕	↖
Traffic Volume (vph)	0	0	0	652	0	416	0	494	0	0	502	581
Future Volume (vph)	0	0	0	652	0	416	0	494	0	0	502	581
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0		4.0		5.6			5.6	5.6
Lane Util. Factor				0.97		1.00		0.95			0.95	1.00
Frt				1.00		0.85		1.00			1.00	0.85
Flt Protected				0.95		1.00		1.00			1.00	1.00
Satd. Flow (prot)				3433		1583		3539			3539	1583
Flt Permitted				0.95		1.00		1.00			1.00	1.00
Satd. Flow (perm)				3433		1583		3539			3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	709	0	452	0	537	0	0	546	632
RTOR Reduction (vph)	0	0	0	0	0	162	0	0	0	0	0	303
Lane Group Flow (vph)	0	0	0	709	0	290	0	537	0	0	546	329
Turn Type				Prot		Prot		NA	Free		NA	Prot
Protected Phases				8		8		2			6	6
Permitted Phases									Free			
Actuated Green, G (s)				14.4		14.4		26.8			26.8	26.8
Effective Green, g (s)				14.4		14.4		26.0			26.0	26.0
Actuated g/C Ratio				0.29		0.29		0.52			0.52	0.52
Clearance Time (s)				4.0		4.0		4.8			4.8	4.8
Vehicle Extension (s)				2.0		2.0		4.0			4.0	4.0
Lane Grp Cap (vph)				988		455		1840			1840	823
v/s Ratio Prot				c0.21		0.18		0.15			0.15	c0.21
v/s Ratio Perm												
v/c Ratio				0.72		0.64		0.29			0.30	0.40
Uniform Delay, d1				16.0		15.5		6.8			6.8	7.3
Progression Factor				1.00		1.00		0.81			1.00	1.00
Incremental Delay, d2				2.1		2.1		0.4			0.1	0.4
Delay (s)				18.1		17.7		5.9			6.9	7.7
Level of Service				B		B		A			A	A
Approach Delay (s)		0.0			17.9			5.9			7.3	
Approach LOS		A			B			A			A	

Intersection Summary		
HCM 2000 Control Delay	11.3	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.51	B
Actuated Cycle Length (s)	50.0	Sum of lost time (s)
Intersection Capacity Utilization	47.4%	9.6
Analysis Period (min)	15	ICU Level of Service
		A

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
30: Isabel Ave & I-580 EB Ramps

BART to Livermore Extension Project
2025 Express Bus + Garage AM

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations	 		 					 			 		
Traffic Volume (vph)	205	0	461	0	0	0	0	721	517	0	932	265	
Future Volume (vph)	205	0	461	0	0	0	0	721	517	0	932	265	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)	4.0		4.0					4.0	4.0		4.0	4.0	
Lane Util. Factor	0.97		0.88					0.95	1.00		0.95	1.00	
Frt	1.00		0.85					1.00	0.85		1.00	0.85	
Flt Protected	0.95		1.00					1.00	1.00		1.00	1.00	
Satd. Flow (prot)	3433		2787					3539	1583		3539	1583	
Flt Permitted	0.95		1.00					1.00	1.00		1.00	1.00	
Satd. Flow (perm)	3433		2787					3539	1583		3539	1583	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	
Adj. Flow (vph)	223	0	501	0	0	0	0	784	562	0	1013	288	
RTOR Reduction (vph)	0	0	181	0	0	0	0	0	0	0	0	0	
Lane Group Flow (vph)	223	0	320	0	0	0	0	784	562	0	1013	288	
Turn Type	Prot		Perm					NA	Free		NA	Free	
Protected Phases	4							2			6		
Permitted Phases			4						Free			Free	
Actuated Green, G (s)	9.2		9.2					31.8	50.0		31.8	50.0	
Effective Green, g (s)	9.2		9.2					32.8	50.0		32.8	50.0	
Actuated g/C Ratio	0.18		0.18					0.66	1.00		0.66	1.00	
Clearance Time (s)	4.0		4.0					5.0			5.0		
Vehicle Extension (s)	2.0		2.0					4.0			4.0		
Lane Grp Cap (vph)	631		512					2321	1583		2321	1583	
v/s Ratio Prot	0.06							0.22			c0.29		
v/s Ratio Perm			c0.11						0.35			0.18	
v/c Ratio	0.35		0.62					0.34	0.36		0.44	0.18	
Uniform Delay, d1	17.8		18.8					3.8	0.0		4.1	0.0	
Progression Factor	1.00		1.00					1.00	1.00		0.41	1.00	
Incremental Delay, d2	0.1		1.7					0.1	0.6		0.5	0.2	
Delay (s)	17.9		20.5					3.9	0.6		2.2	0.2	
Level of Service	B		C					A	A		A	A	
Approach Delay (s)		19.7			0.0			2.5			1.8		
Approach LOS		B			A			A			A		
Intersection Summary													
HCM 2000 Control Delay			5.9									HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio			0.48										
Actuated Cycle Length (s)			50.0									Sum of lost time (s)	8.0
Intersection Capacity Utilization			48.6%									ICU Level of Service	A
Analysis Period (min)			15										

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 31: Isabel Ave & Airway Blvd

BART to Livermore Extension Project
 2025 Express Bus + Garage AM




































Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↑	↗	↖	↑	↗	↖	↑↑↑	↗	↖↗	↑↑↑	↗
Traffic Volume (vph)	0	57	179	135	246	110	335	1065	21	256	1282	19
Future Volume (vph)	0	57	179	135	246	110	335	1065	21	256	1282	19
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.2	5.6	5.2	5.2	5.6	4.0	4.0	4.0	4.0	4.0	5.0
Lane Util. Factor		1.00	1.00	1.00	1.00	1.00	1.00	0.91	1.00	0.97	0.91	1.00
Frt		1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1863	1583	1770	1863	1583	1770	5085	1583	3433	5085	1583
Flt Permitted		1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)		1863	1583	1770	1863	1583	1770	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	62	195	147	267	120	364	1158	23	278	1393	21
RTOR Reduction (vph)	0	0	71	0	0	75	0	0	13	0	0	14
Lane Group Flow (vph)	0	62	124	147	267	45	364	1158	10	278	1393	7
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4	5	3	8	1	5	2		1	6	
Permitted Phases			4			8			2			6
Actuated Green, G (s)		6.9	27.0	9.9	21.4	33.1	20.1	37.9	37.9	11.7	29.5	29.5
Effective Green, g (s)		6.3	25.8	9.3	20.8	31.9	21.1	38.9	38.9	12.7	30.5	29.5
Actuated g/C Ratio		0.07	0.30	0.11	0.24	0.37	0.25	0.45	0.45	0.15	0.36	0.34
Clearance Time (s)		4.6	5.0	4.6	4.6	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Extension (s)		3.0	3.0	3.0	3.0	3.0	3.0	5.0	5.0	3.0	5.0	5.0
Lane Grp Cap (vph)		137	477	192	452	589	436	2310	719	509	1811	545
v/s Ratio Prot		0.03	0.06	c0.08	c0.14	0.01	c0.21	0.23		0.08	c0.27	
v/s Ratio Perm			0.02			0.02			0.01			0.00
v/c Ratio		0.45	0.26	0.77	0.59	0.08	0.83	0.50	0.01	0.55	0.77	0.01
Uniform Delay, d1		38.0	22.7	37.1	28.6	17.3	30.6	16.5	12.8	33.8	24.4	18.5
Progression Factor		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2		2.4	0.3	16.5	2.1	0.1	12.9	0.4	0.0	1.2	2.4	0.0
Delay (s)		40.4	23.0	53.6	30.7	17.4	43.5	16.9	12.8	35.0	26.8	18.5
Level of Service		D	C	D	C	B	D	B	B	C	C	B
Approach Delay (s)		27.2			34.0			23.1			28.1	
Approach LOS		C			C			C			C	

Intersection Summary		
HCM 2000 Control Delay	26.9	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.81	C
Actuated Cycle Length (s)	85.6	Sum of lost time (s)
Intersection Capacity Utilization	68.5%	20.0
Analysis Period (min)	15	ICU Level of Service
		C

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
32: Isabel Ave & Jack London Blvd

BART to Livermore Extension Project
2025 Express Bus + Garage AM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 	 			 		 	  		 	  	
Traffic Volume (vph)	26	53	52	206	759	308	349	854	96	156	1113	279
Future Volume (vph)	26	53	52	206	759	308	349	854	96	156	1113	279
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.97	0.91	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	3433	5085	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	3433	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	28	58	57	224	825	335	379	928	104	170	1210	303
RTOR Reduction (vph)	0	0	46	0	0	74	0	0	69	0	0	121
Lane Group Flow (vph)	28	58	11	224	825	261	379	928	35	170	1210	182
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8	1	5	2		1	6	
Permitted Phases			4			8			2			6
Actuated Green, G (s)	3.7	17.7	17.7	13.8	27.8	37.5	11.1	32.2	32.2	9.7	30.8	30.8
Effective Green, g (s)	3.7	17.7	17.7	13.8	27.8	37.5	11.1	32.2	32.2	9.7	30.8	30.8
Actuated g/C Ratio	0.04	0.19	0.19	0.15	0.29	0.40	0.12	0.34	0.34	0.10	0.33	0.33
Clearance Time (s)	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	134	662	296	258	1040	716	402	1730	538	352	1655	515
v/s Ratio Prot	0.01	0.02		c0.13	c0.23	0.04	c0.11	0.18		0.05	c0.24	
v/s Ratio Perm			0.01			0.13			0.02			0.12
v/c Ratio	0.21	0.09	0.04	0.87	0.79	0.37	0.94	0.54	0.07	0.48	0.73	0.35
Uniform Delay, d1	44.0	31.8	31.5	39.5	30.8	20.1	41.4	25.2	21.1	40.1	28.2	24.3
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.8	0.1	0.0	25.1	4.2	0.3	30.5	0.3	0.1	1.0	1.7	0.4
Delay (s)	44.8	31.8	31.5	64.6	35.0	20.5	72.0	25.5	21.1	41.1	29.9	24.7
Level of Service	D	C	C	E	C	C	E	C	C	D	C	C
Approach Delay (s)		34.2			36.3			37.7			30.1	
Approach LOS		C			D			D			C	

Intersection Summary		
HCM 2000 Control Delay	34.4	HCM 2000 Level of Service C
HCM 2000 Volume to Capacity ratio	0.83	
Actuated Cycle Length (s)	94.6	Sum of lost time (s) 21.2
Intersection Capacity Utilization	65.7%	ICU Level of Service C
Analysis Period (min)	15	

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
33: Isabel Ave Connector & Stanley Blvd



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑	↑	↑↓	↑↑	↑↓	↑↓
Traffic Volume (vph)	337	159	317	1982	384	207
Future Volume (vph)	337	159	317	1982	384	207
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	3.8	4.0	4.0	4.0	2.5
Lane Util. Factor	0.95	1.00	0.97	0.95	0.97	0.88
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	3539	1583	3433	3539	3433	2787
Flt Permitted	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (perm)	3539	1583	3433	3539	3433	2787
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	366	173	345	2154	417	225
RTOR Reduction (vph)	0	8	0	0	0	145
Lane Group Flow (vph)	366	165	345	2154	417	80
Turn Type	NA	pm+ov	Prot	NA	Prot	pm+ov
Protected Phases	2	8	1	6	8	1
Permitted Phases		2				8
Actuated Green, G (s)	38.7	52.5	11.2	53.9	13.8	25.0
Effective Green, g (s)	40.4	55.9	11.2	55.6	15.3	28.0
Actuated g/C Ratio	0.51	0.71	0.14	0.70	0.19	0.35
Clearance Time (s)	5.7	5.5	4.0	5.7	5.5	4.0
Vehicle Extension (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Grp Cap (vph)	1812	1121	487	2493	665	989
v/s Ratio Prot	0.10	0.03	0.10	c0.61	c0.12	0.01
v/s Ratio Perm		0.08				0.02
v/c Ratio	0.20	0.15	0.71	0.86	0.63	0.08
Uniform Delay, d1	10.5	3.7	32.3	8.8	29.2	16.9
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.0	0.0	3.8	3.3	1.3	0.0
Delay (s)	10.5	3.8	36.1	12.1	30.5	16.9
Level of Service	B	A	D	B	C	B
Approach Delay (s)	8.3			15.4	25.8	
Approach LOS	A			B	C	

Intersection Summary

HCM 2000 Control Delay	16.2	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.86		
Actuated Cycle Length (s)	78.9	Sum of lost time (s)	12.0
Intersection Capacity Utilization	72.4%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 34: Murrieta Blvd/Driveway & Portola Ave

BART to Livermore Extension Project
 2025 Express Bus + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗		↖	↗		↖	↗	↗		↗	
Traffic Volume (vph)	0	385	93	267	1212	1	188	6	148	1	3	0
Future Volume (vph)	0	385	93	267	1212	1	188	6	148	1	3	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.8		4.0	5.8		5.2	5.2	5.2		4.0	
Lane Util. Factor		0.95		1.00	0.95		0.95	0.95	1.00		1.00	
Frt		0.97		1.00	1.00		1.00	1.00	0.85		1.00	
Flt Protected		1.00		0.95	1.00		0.95	0.96	1.00		0.99	
Satd. Flow (prot)		3436		1770	3539		1681	1691	1583		1840	
Flt Permitted		1.00		0.95	1.00		0.95	0.96	1.00		0.99	
Satd. Flow (perm)		3436		1770	3539		1681	1691	1583		1840	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	418	101	290	1317	1	204	7	161	1	3	0
RTOR Reduction (vph)	0	27	0	0	0	0	0	0	138	0	0	0
Lane Group Flow (vph)	0	492	0	290	1318	0	106	105	23	0	4	0
Turn Type	Prot	NA		Prot	NA		Split	NA	Perm		Split	NA
Protected Phases	5	2		1	6		8	8		4	4	
Permitted Phases									8			
Actuated Green, G (s)		12.5		14.5	31.0		8.1	8.1	8.1		0.6	
Effective Green, g (s)		11.6		14.5	30.1		7.5	7.5	7.5		0.6	
Actuated g/C Ratio		0.22		0.27	0.57		0.14	0.14	0.14		0.01	
Clearance Time (s)		4.9		4.0	4.9		4.6	4.6	4.6		4.0	
Vehicle Extension (s)		2.0		2.0	2.0		2.0	2.0	2.0		2.0	
Lane Grp Cap (vph)		749		482	2002		236	238	223		20	
v/s Ratio Prot		0.14		0.16	c0.37		c0.06	0.06			c0.00	
v/s Ratio Perm									0.01			
v/c Ratio		0.66		0.60	0.66		0.45	0.44	0.10		0.20	
Uniform Delay, d1		19.0		16.8	8.0		21.0	20.9	19.9		26.1	
Progression Factor		1.00		1.00	1.00		1.00	1.00	1.00		1.00	
Incremental Delay, d2		1.6		1.5	0.6		0.5	0.5	0.1		1.8	
Delay (s)		20.6		18.3	8.6		21.5	21.4	20.0		27.9	
Level of Service		C		B	A		C	C	B		C	
Approach Delay (s)		20.6			10.3			20.8			27.9	
Approach LOS		C			B			C			C	

Intersection Summary

HCM 2000 Control Delay	14.1	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.68		
Actuated Cycle Length (s)	53.2	Sum of lost time (s)	19.0
Intersection Capacity Utilization	61.4%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
35: Murrieta Blvd & Jack London Blvd

BART to Livermore Extension Project
2025 Express Bus + Garage AM
































Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	76	258	623	206	245	167
Future Volume (vph)	76	258	623	206	245	167
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00	1.00	0.95	0.91	
Frt	1.00	0.85	1.00	1.00	0.94	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1770	1583	1770	3539	4775	
Flt Permitted	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	1770	1583	1770	3539	4775	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	83	280	677	224	266	182
RTOR Reduction (vph)	0	238	0	0	152	0
Lane Group Flow (vph)	83	42	677	224	296	0
Turn Type	Prot	Perm	Prot	NA	NA	
Protected Phases	4		5	2	6	
Permitted Phases		4				
Actuated Green, G (s)	8.5	8.5	27.3	40.8	9.5	
Effective Green, g (s)	8.5	8.5	27.3	40.8	9.5	
Actuated g/C Ratio	0.15	0.15	0.48	0.71	0.17	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	262	234	843	2519	791	
v/s Ratio Prot	c0.05		c0.38	0.06	c0.06	
v/s Ratio Perm		0.03				
v/c Ratio	0.32	0.18	0.80	0.09	0.37	
Uniform Delay, d1	21.8	21.3	12.7	2.5	21.3	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.7	0.4	5.6	0.0	0.3	
Delay (s)	22.5	21.7	18.3	2.6	21.6	
Level of Service	C	C	B	A	C	
Approach Delay (s)	21.9			14.4	21.6	
Approach LOS	C			B	C	

Intersection Summary

HCM 2000 Control Delay	17.8	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.62		
Actuated Cycle Length (s)	57.3	Sum of lost time (s)	12.0
Intersection Capacity Utilization	57.2%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 36: Murrieta Blvd & Stanley Blvd



















												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 	 			 		 	 			 	
Traffic Volume (vph)	210	435	222	17	819	113	431	334	8	153	224	448
Future Volume (vph)	210	435	222	17	819	113	431	334	8	153	224	448
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.9	4.9	4.0	4.9	4.9	4.9	4.9		4.9	4.9	4.0
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.97	0.95		1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	3433	3526		1770	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	3433	3526		1770	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	228	473	241	18	890	123	468	363	9	166	243	487
RTOR Reduction (vph)	0	0	154	0	0	66	0	2	0	0	0	116
Lane Group Flow (vph)	228	473	87	18	890	57	468	370	0	166	243	371
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Prot	NA		Prot	NA	Perm
Protected Phases	7	4		3	8	1	5	2		1	6	
Permitted Phases			4			8						6
Actuated Green, G (s)	5.0	25.4	25.4	0.8	21.2	30.6	10.0	16.6		9.4	16.0	16.0
Effective Green, g (s)	5.0	24.5	24.5	0.8	20.3	28.8	9.1	15.7		8.5	15.1	16.0
Actuated g/C Ratio	0.07	0.36	0.36	0.01	0.30	0.42	0.13	0.23		0.12	0.22	0.23
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	251	1271	568	20	1053	782	458	811		220	783	371
v/s Ratio Prot	c0.07	0.13		0.01	c0.25	0.01	c0.14	0.10		0.09	0.07	
v/s Ratio Perm			0.05			0.03						c0.23
v/c Ratio	0.91	0.37	0.15	0.90	0.85	0.07	1.02	0.46		0.75	0.31	1.00
Uniform Delay, d1	31.4	16.2	14.8	33.7	22.5	11.7	29.6	22.6		28.8	22.2	26.1
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	33.1	0.2	0.1	153.9	6.4	0.0	47.7	0.4		13.7	0.2	47.0
Delay (s)	64.5	16.3	14.9	187.6	28.8	11.8	77.3	23.0		42.5	22.4	73.1
Level of Service	E	B	B	F	C	B	E	C		D	C	E
Approach Delay (s)		27.6			29.6			53.2			53.7	
Approach LOS		C			C			D			D	

Intersection Summary		
HCM 2000 Control Delay	40.3	HCM 2000 Level of Service D
HCM 2000 Volume to Capacity ratio	0.95	
Actuated Cycle Length (s)	68.2	Sum of lost time (s) 18.7
Intersection Capacity Utilization	74.2%	ICU Level of Service D
Analysis Period (min)	15	

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 37: Livermore Ave & I-580 WB Ramps

BART to Livermore Extension Project
 2025 Express Bus + Garage AM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	344	88	28	444	79	0	0	151	0
Future Volume (vph)	0	0	0	344	88	28	444	79	0	0	151	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)					4.0		4.0	4.0			4.0	
Lane Util. Factor					0.95		0.97	1.00			0.95	
Frt					0.99		1.00	1.00			1.00	
Flt Protected					0.96		0.95	1.00			1.00	
Satd. Flow (prot)					1690		3433	1863			3539	
Flt Permitted					0.96		0.95	1.00			1.00	
Satd. Flow (perm)					1690		3433	1863			3539	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	374	96	30	483	86	0	0	164	0
RTOR Reduction (vph)	0	0	0	0	5	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	0	495	0	483	86	0	0	164	0
Turn Type				Split	NA		Prot	NA			NA	
Protected Phases				8	8		5	2			6	
Permitted Phases												
Actuated Green, G (s)					21.1		12.0	29.2			13.7	
Effective Green, g (s)					21.1		11.5	30.9			15.4	
Actuated g/C Ratio					0.35		0.19	0.51			0.26	
Clearance Time (s)					4.0		3.5	5.7			5.7	
Vehicle Extension (s)					2.0		2.0	2.5			2.5	
Lane Grp Cap (vph)					594		657	959			908	
v/s Ratio Prot					c0.29		c0.14	0.05			c0.05	
v/s Ratio Perm												
v/c Ratio					0.83		0.74	0.09			0.18	
Uniform Delay, d1					17.8		22.8	7.4			17.4	
Progression Factor					1.00		0.73	0.26			1.00	
Incremental Delay, d2					9.4		3.4	0.2			0.4	
Delay (s)					27.2		20.0	2.1			17.8	
Level of Service					C		B	A			B	
Approach Delay (s)		0.0			27.2			17.3			17.8	
Approach LOS		A			C			B			B	
Intersection Summary												
HCM 2000 Control Delay			21.4		HCM 2000 Level of Service						C	
HCM 2000 Volume to Capacity ratio			0.60									
Actuated Cycle Length (s)			60.0		Sum of lost time (s)						12.0	
Intersection Capacity Utilization			46.8%		ICU Level of Service						A	
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis
 38: Livermore Ave & I-580 EB Ramps

BART to Livermore Extension Project
 2025 Express Bus + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕	↗					↕		↘	↕	
Traffic Volume (vph)	15	1	594	0	0	0	0	506	200	17	482	0
Future Volume (vph)	15	1	594	0	0	0	0	506	200	17	482	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0					4.0		4.0	4.0	
Lane Util. Factor		0.95	0.95					0.95		1.00	0.95	
Frt		0.86	0.85					0.96		1.00	1.00	
Flt Protected		1.00	1.00					1.00		0.95	1.00	
Satd. Flow (prot)		1514	1504					3389		1770	3539	
Flt Permitted		1.00	1.00					1.00		0.95	1.00	
Satd. Flow (perm)		1514	1504					3389		1770	3539	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	16	1	646	0	0	0	0	550	217	18	524	0
RTOR Reduction (vph)	0	224	224	0	0	0	0	52	0	0	0	0
Lane Group Flow (vph)	0	110	105	0	0	0	0	715	0	18	524	0
Turn Type	Prot	NA	Perm					NA		Prot	NA	
Protected Phases	7	4						2		1	6	
Permitted Phases			4									
Actuated Green, G (s)		15.9	15.9					30.8		1.3	35.1	
Effective Green, g (s)		15.9	15.9					31.8		0.3	36.1	
Actuated g/C Ratio		0.27	0.27					0.53		0.00	0.60	
Clearance Time (s)		4.0	4.0					5.0		3.0	5.0	
Vehicle Extension (s)		2.0	2.0					2.5		2.0	2.5	
Lane Grp Cap (vph)		401	398					1796		8	2129	
v/s Ratio Prot								c0.21		c0.01	0.15	
v/s Ratio Perm		0.07	0.07									
v/c Ratio		0.27	0.26					0.40		2.25	0.25	
Uniform Delay, d1		17.5	17.4					8.4		29.9	5.6	
Progression Factor		1.00	1.00					1.00		1.10	0.23	
Incremental Delay, d2		0.1	0.1					0.7		803.6	0.2	
Delay (s)		17.6	17.6					9.1		836.3	1.5	
Level of Service		B	B					A		F	A	
Approach Delay (s)		17.6			0.0			9.1			29.2	
Approach LOS		B			A			A			C	

Intersection Summary

HCM 2000 Control Delay	17.5	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.37		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	46.8%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
39: Livermore Ave & Portola Ave

BART to Livermore Extension Project
2025 Express Bus + Garage AM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	213	263	100	30	730	61	340	432	86	98	547	346
Future Volume (vph)	213	263	100	30	730	61	340	432	86	98	547	346
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	5.8		4.0	5.8	4.9
Lane Util. Factor	0.97	0.95		1.00	0.95		1.00	0.95		1.00	0.95	1.00
Frt	1.00	0.96		1.00	0.99		1.00	0.98		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3393		1770	3498		1770	3452		1770	3539	1583
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3393		1770	3498		1770	3452		1770	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	232	286	109	33	793	66	370	470	93	107	595	376
RTOR Reduction (vph)	0	33	0	0	6	0	0	15	0	0	0	95
Lane Group Flow (vph)	232	362	0	33	853	0	370	548	0	107	595	281
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	pm+ov
Protected Phases	3	8		7	4		1	6		5	2	3
Permitted Phases												2
Actuated Green, G (s)	9.9	36.7		3.4	30.2		23.2	36.0		10.8	23.6	33.5
Effective Green, g (s)	9.9	38.0		3.4	31.5		23.2	35.1		10.8	22.7	31.7
Actuated g/C Ratio	0.09	0.36		0.03	0.30		0.22	0.33		0.10	0.22	0.30
Clearance Time (s)	4.0	5.3		4.0	5.3		4.0	4.9		4.0	4.9	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	323	1226		57	1048		390	1152		181	764	477
v/s Ratio Prot	c0.07	0.11		0.02	c0.24		c0.21	0.16		0.06	c0.17	0.05
v/s Ratio Perm												0.13
v/c Ratio	0.72	0.30		0.58	0.81		0.95	0.48		0.59	0.78	0.59
Uniform Delay, d1	46.2	24.0		50.1	34.1		40.4	27.7		45.0	38.8	31.2
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	7.4	0.1		13.5	4.9		32.2	0.3		5.1	5.0	1.9
Delay (s)	53.7	24.1		63.6	39.0		72.6	28.0		50.1	43.9	33.0
Level of Service	D	C		E	D		E	C		D	D	C
Approach Delay (s)		35.1			39.9			45.7			40.7	
Approach LOS		D			D			D			D	

Intersection Summary

HCM 2000 Control Delay	40.8	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.84		
Actuated Cycle Length (s)	105.1	Sum of lost time (s)	18.7
Intersection Capacity Utilization	77.0%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
40: First St/Springtown Blvd & I-580 WB Ramps

BART to Livermore Extension Project
2025 Express Bus + Garage AM





















Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations			TT			T	TT	T			TT	T
Traffic Volume (vph)	0	0	443	0	0	0	341	375	0	0	875	625
Future Volume (vph)	0	0	443	0	0	0	341	375	0	0	875	625
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)			4.0				4.0	4.0			5.0	5.0
Lane Util. Factor			0.88				0.97	1.00			0.95	1.00
Frt			0.85				1.00	1.00			1.00	0.85
Flt Protected			1.00				0.95	1.00			1.00	1.00
Satd. Flow (prot)			2787				3433	1863			3539	1583
Flt Permitted			1.00				0.95	1.00			1.00	1.00
Satd. Flow (perm)			2787				3433	1863			3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	482	0	0	0	371	408	0	0	951	679
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	62
Lane Group Flow (vph)	0	0	482	0	0	0	371	408	0	0	951	617
Turn Type			Over			Free	Prot	NA			NA	Perm
Protected Phases			5				5	2			6	
Permitted Phases						Free						6
Actuated Green, G (s)			21.7				21.7	100.0			70.3	70.3
Effective Green, g (s)			21.2				21.2	100.0			69.8	69.8
Actuated g/C Ratio			0.21				0.21	1.00			0.70	0.70
Clearance Time (s)			3.5				3.5	4.0			4.5	4.5
Vehicle Extension (s)			2.0				2.0	0.2			4.0	4.0
Lane Grp Cap (vph)			590				727	1863			2470	1104
v/s Ratio Prot			c0.17				0.11	0.22			0.27	
v/s Ratio Perm												c0.39
v/c Ratio			0.82				0.51	0.22			0.39	0.56
Uniform Delay, d1			37.6				34.8	0.0			6.2	7.5
Progression Factor			1.00				1.03	1.00			1.00	1.00
Incremental Delay, d2			8.2				0.2	0.3			0.1	0.8
Delay (s)			45.7				36.2	0.3			6.4	8.2
Level of Service			D				D	A			A	A
Approach Delay (s)		45.7			0.0			17.4			7.2	
Approach LOS		D			A			B			A	

Intersection Summary		
HCM 2000 Control Delay	16.3	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.62	B
Actuated Cycle Length (s)	100.0	Sum of lost time (s)
Intersection Capacity Utilization	55.9%	9.0
Analysis Period (min)	15	ICU Level of Service
		B

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
41: First St & I-580 EB Ramps

BART to Livermore Extension Project
2025 Express Bus + Garage AM

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations													
Traffic Volume (vph)	96	1	360	0	0	0	0	627	312	65	1224	0	
Future Volume (vph)	96	1	360	0	0	0	0	627	312	65	1224	0	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)		4.0	4.0					5.0	5.0	4.0	5.0		
Lane Util. Factor		1.00	0.88					0.95	1.00	1.00	0.95		
Frt		1.00	0.85					1.00	0.85	1.00	1.00		
Flt Protected		0.95	1.00					1.00	1.00	0.95	1.00		
Satd. Flow (prot)		1775	2787					3539	1583	1770	3539		
Flt Permitted		0.95	1.00					1.00	1.00	0.95	1.00		
Satd. Flow (perm)		1775	2787					3539	1583	1770	3539		
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	
Adj. Flow (vph)	104	1	391	0	0	0	0	682	339	71	1330	0	
RTOR Reduction (vph)	0	0	108	0	0	0	0	0	169	0	0	0	
Lane Group Flow (vph)	0	105	283	0	0	0	0	682	170	71	1330	0	
Turn Type	Perm	NA	Perm					NA	Perm	Prot	NA		
Protected Phases		4						2		1	6		
Permitted Phases	4		4						2				
Actuated Green, G (s)		9.3	9.3					25.6	25.6	4.1	32.7		
Effective Green, g (s)		8.8	8.8					25.1	25.1	3.1	32.2		
Actuated g/C Ratio		0.18	0.18					0.50	0.50	0.06	0.64		
Clearance Time (s)		3.5	3.5					4.5	4.5	3.0	4.5		
Vehicle Extension (s)		2.5	2.5					4.0	4.0	2.0	4.0		
Lane Grp Cap (vph)		312	490					1776	794	109	2279		
v/s Ratio Prot								0.19		0.04	c0.38		
v/s Ratio Perm		0.06	c0.10						0.11				
v/c Ratio		0.34	0.58					0.38	0.21	0.65	0.58		
Uniform Delay, d1		18.0	18.9					7.7	6.9	22.9	5.1		
Progression Factor		1.00	1.00					1.00	1.00	1.00	1.05		
Incremental Delay, d2		0.5	1.4					0.6	0.6	9.2	1.0		
Delay (s)		18.5	20.3					8.3	7.6	32.1	6.3		
Level of Service		B	C					A	A	C	A		
Approach Delay (s)		19.9			0.0			8.1			7.6		
Approach LOS		B			A			A			A		
Intersection Summary													
HCM 2000 Control Delay			9.9									HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio			0.65										
Actuated Cycle Length (s)			50.0									Sum of lost time (s)	13.0
Intersection Capacity Utilization			53.9%									ICU Level of Service	A
Analysis Period (min)			15										

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
42: 1st St & Mines Rd

BART to Livermore Extension Project
2025 Express Bus + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↗	↘		↗↘	↑	↗	↗	↑↑↑		↗↘	↑↑↑	
Traffic Volume (vph)	33	70	42	539	108	332	18	834	304	214	1244	20
Future Volume (vph)	33	70	42	539	108	332	18	834	304	214	1244	20
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		0.97	1.00	1.00	1.00	0.91		0.97	0.91	
Frt	1.00	0.94		1.00	1.00	0.85	1.00	0.96		1.00	1.00	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1757		3433	1863	1583	1770	4882		3433	5073	
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	1757		3433	1863	1583	1770	4882		3433	5073	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	36	76	46	586	117	361	20	907	330	233	1352	22
RTOR Reduction (vph)	0	35	0	0	0	77	0	86	0	0	2	0
Lane Group Flow (vph)	36	87	0	586	117	284	20	1151	0	233	1372	0
Turn Type	Prot	NA		Prot	NA	pm+ov	Prot	NA		Prot	NA	
Protected Phases	7	4		3	8	1	5	2		1	6	
Permitted Phases						8						
Actuated Green, G (s)	1.8	8.5		12.2	18.9	25.0	0.7	22.7		6.1	28.1	
Effective Green, g (s)	1.8	8.5		12.2	18.9	25.0	0.7	22.7		6.1	28.1	
Actuated g/C Ratio	0.03	0.13		0.19	0.29	0.38	0.01	0.35		0.09	0.43	
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	48	228		639	537	700	18	1691		319	2176	
v/s Ratio Prot	0.02	0.05		c0.17	0.06	c0.04	0.01	0.24		c0.07	c0.27	
v/s Ratio Perm						0.14						
v/c Ratio	0.75	0.38		0.92	0.22	0.41	1.11	0.68		0.73	0.63	
Uniform Delay, d1	31.6	26.1		26.2	17.7	14.8	32.4	18.3		28.9	14.6	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	48.1	1.1		18.0	0.2	0.4	250.0	1.1		8.3	0.6	
Delay (s)	79.7	27.2		44.1	17.9	15.2	282.4	19.4		37.2	15.2	
Level of Service	E	C		D	B	B	F	B		D	B	
Approach Delay (s)		39.1			31.4			23.6			18.4	
Approach LOS		D			C			C			B	




















Intersection Summary

HCM 2000 Control Delay	24.2	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.74		
Actuated Cycle Length (s)	65.5	Sum of lost time (s)	16.0
Intersection Capacity Utilization	61.1%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Unsignalized Intersection Capacity Analysis
43: Vasco Rd & I-580 WB Ramps

BART to Livermore Extension Project
2025 Express Bus + Garage AM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations								 				
Traffic Volume (veh/h)	0	0	0	0	0	169	0	828	0	0	1541	0
Future Volume (Veh/h)	0	0	0	0	0	169	0	828	0	0	1541	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	0	0	0	184	0	900	0	0	1675	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage (veh)												
Upstream signal (ft)											487	
pX, platoon unblocked												
vC, conflicting volume	2309	2575	1675	2575	2575	450	1675			900		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	2309	2575	1675	2575	2575	450	1675			900		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	100	100	67	100			100		
cM capacity (veh/h)	14	25	84	13	25	556	379			751		
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	SB 1	SB 2					
Volume Total	0	184	450	450	0	1675	0					
Volume Left	0	0	0	0	0	0	0					
Volume Right	0	184	0	0	0	0	0					
cSH	1700	556	1700	1700	1700	1700	1700					
Volume to Capacity	0.00	0.33	0.26	0.26	0.00	0.99	0.00					
Queue Length 95th (ft)	0	36	0	0	0	0	0					
Control Delay (s)	0.0	14.6	0.0	0.0	0.0	0.0	0.0					
Lane LOS	A	B										
Approach Delay (s)	0.0	14.6	0.0			0.0						
Approach LOS	A	B										
Intersection Summary												
Average Delay			1.0									
Intersection Capacity Utilization			84.4%		ICU Level of Service					E		
Analysis Period (min)			15									

HCM Unsignalized Intersection Capacity Analysis
 44: Vasco Rd & I-580 EB Ramps

BART to Livermore Extension Project
 2025 Express Bus + Garage AM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	0	0	0	0	1162	0	73	1764	0
Future Volume (Veh/h)	0	0	0	0	0	0	0	1162	0	73	1764	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	0	0	0	0	0	1263	0	79	1917	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	2706	3338	1917	3338	3338	632	1917			1263		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	2706	3338	1917	3338	3338	632	1917			1263		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	100	100	100	100			86		
cM capacity (veh/h)	9	7	57	3	7	423	305			546		
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2						
Volume Total	0	0	842	421	79	1917						
Volume Left	0	0	0	0	79	0						
Volume Right	0	0	0	0	0	0						
cSH	1700	1700	1700	1700	546	1700						
Volume to Capacity	0.00	0.00	0.50	0.25	0.14	1.13						
Queue Length 95th (ft)	0	0	0	0	13	0						
Control Delay (s)	0.0	0.0	0.0	0.0	12.7	0.0						
Lane LOS	A	A			B							
Approach Delay (s)	0.0	0.0	0.0		0.5							
Approach LOS	A	A										
Intersection Summary												
Average Delay			0.3									
Intersection Capacity Utilization			96.2%		ICU Level of Service					F		
Analysis Period (min)			15									

HCM Signalized Intersection Capacity Analysis
45: Vasco Rd & East Ave

BART to Livermore Extension Project
2025 Express Bus + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	277	324	50	7	17	14	62	250	182	234	286	278
Future Volume (vph)	277	324	50	7	17	14	62	250	182	234	286	278
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	0.95		0.97	1.00	1.00
Frt	1.00	0.98		1.00	0.93		1.00	0.94		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	3469		1770	3298		1770	3316		3433	1863	1583
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1770	3469		1770	3298		1770	3316		3433	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	301	352	54	8	18	15	67	272	198	254	311	302
RTOR Reduction (vph)	0	21	0	0	14	0	0	145	0	0	0	203
Lane Group Flow (vph)	301	385	0	8	19	0	67	325	0	254	311	99
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												6
Actuated Green, G (s)	12.2	14.3		0.6	2.7		2.2	13.2		5.2	16.2	16.2
Effective Green, g (s)	12.2	14.3		0.6	2.7		2.2	13.2		5.2	16.2	16.2
Actuated g/C Ratio	0.25	0.29		0.01	0.05		0.04	0.27		0.11	0.33	0.33
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	438	1006		21	180		78	887		362	612	520
v/s Ratio Prot	c0.17	c0.11		0.00	0.01		0.04	0.10		c0.07	c0.17	
v/s Ratio Perm												0.06
v/c Ratio	0.69	0.38		0.38	0.10		0.86	0.37		0.70	0.51	0.19
Uniform Delay, d1	16.8	14.0		24.2	22.2		23.4	14.7		21.3	13.3	11.9
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	4.4	0.2		11.2	0.3		56.5	0.3		6.0	0.7	0.2
Delay (s)	21.3	14.2		35.3	22.4		79.9	14.9		27.3	14.0	12.0
Level of Service	C	B		D	C		E	B		C	B	B
Approach Delay (s)		17.2			24.9			23.0			17.2	
Approach LOS		B			C			C			B	

Intersection Summary

HCM 2000 Control Delay	18.8	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.64		
Actuated Cycle Length (s)	49.3	Sum of lost time (s)	16.0
Intersection Capacity Utilization	51.4%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Unsignalized Intersection Capacity Analysis
 46: I-580 WB Ramps & Northfront Rd/Northfront Road

BART to Livermore Extension Project
 2025 Express Bus + Garage AM



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↻			↻	↻	↻
Traffic Volume (veh/h)	115	205	1332	126	62	543
Future Volume (Veh/h)	115	205	1332	126	62	543
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	125	223	1448	137	67	590
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None		None			
Median storage (veh)						
Upstream signal (ft)	1007					
pX, platoon unblocked					0.51	
vC, conflicting volume			125		3270	236
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			125		4965	236
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			1		0	26
cM capacity (veh/h)			1462		0	802
Direction, Lane #	EB 1	WB 1	NB 1	NB 2		
Volume Total	348	1585	67	590		
Volume Left	0	1448	67	0		
Volume Right	223	0	0	590		
cSH	1700	1462	0	802		
Volume to Capacity	0.20	0.99	Err	0.74		
Queue Length 95th (ft)	0	562	Err	166		
Control Delay (s)	0.0	38.6	Err	20.9		
Lane LOS	E		F	C		
Approach Delay (s)	0.0	38.6	1038.4			
Approach LOS	F					
Intersection Summary						
Average Delay	287.0					
Intersection Capacity Utilization	112.5%		ICU Level of Service		H	
Analysis Period (min)	15					

Intersection	
Intersection Delay, s/veh	10
Intersection LOS	A

Movement	EBU	EBL	EBT	WBU	WBT	WBR	SBU	SBL	SBR
Lane Configurations		↘	↗↗		↗	↘		↘↘	↘
Traffic Vol, veh/h	0	43	26	0	166	105	0	303	83
Future Vol, veh/h	0	43	26	0	166	105	0	303	83
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	47	28	0	180	114	0	329	90
Number of Lanes	0	1	2	0	1	1	0	2	1

Approach	EB	WB	SB
Opposing Approach	WB	EB	
Opposing Lanes	2	3	0
Conflicting Approach Left	SB		WB
Conflicting Lanes Left	3	0	2
Conflicting Approach Right		SB	EB
Conflicting Lanes Right	0	3	3
HCM Control Delay	9.5	10.2	9.9
HCM LOS	A	B	A

Lane	EBLn1	EBLn2	EBLn3	WBLn1	WBLn2	SBLn1	SBLn2	SBLn3
Vol Left, %	100%	0%	0%	0%	0%	100%	100%	0%
Vol Thru, %	0%	100%	100%	100%	0%	0%	0%	0%
Vol Right, %	0%	0%	0%	0%	100%	0%	0%	100%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	43	13	13	166	105	152	152	83
LT Vol	43	0	0	0	0	152	152	0
Through Vol	0	13	13	166	0	0	0	0
RT Vol	0	0	0	0	105	0	0	83
Lane Flow Rate	47	14	14	180	114	165	165	90
Geometry Grp	8	8	8	8	8	7	7	7
Degree of Util (X)	0.089	0.025	0.018	0.292	0.162	0.272	0.272	0.076
Departure Headway (Hd)	6.866	6.361	4.607	5.817	5.112	5.951	5.951	3.015
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cap	525	566	782	612	694	599	599	1164
Service Time	4.566	4.061	2.307	3.603	2.897	3.732	3.732	0.796
HCM Lane V/C Ratio	0.09	0.025	0.018	0.294	0.164	0.275	0.275	0.077
HCM Control Delay	10.2	9.2	7.4	11	8.9	11	11	6.1
HCM Lane LOS	B	A	A	B	A	B	B	A
HCM 95th-tile Q	0.3	0.1	0.1	1.2	0.6	1.1	1.1	0.2

HCM Signalized Intersection Capacity Analysis
 48: Greenville Rd & Northfront Road/Altamont Pass Road

BART to Livermore Extension Project
 2025 Express Bus + Garage AM



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↑	↑	↑	↑	↑
Traffic Volume (vph)	4	652	270	859	614	62
Future Volume (vph)	4	652	270	859	614	62
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	1863	1583	1770	1863	1770	1583
Flt Permitted	1.00	1.00	0.76	1.00	0.95	1.00
Satd. Flow (perm)	1863	1583	1407	1863	1770	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	4	709	293	934	667	67
RTOR Reduction (vph)	0	343	0	0	0	29
Lane Group Flow (vph)	4	366	293	934	667	38
Turn Type	NA	Perm	Perm	NA	Prot	Perm
Protected Phases	4			8	2	
Permitted Phases		4	8			2
Actuated Green, G (s)	46.0	46.0	46.0	46.0	35.0	35.0
Effective Green, g (s)	46.0	46.0	46.0	46.0	35.0	35.0
Actuated g/C Ratio	0.52	0.52	0.52	0.52	0.39	0.39
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	962	818	727	962	696	622
v/s Ratio Prot	0.00			c0.50	c0.38	
v/s Ratio Perm		0.23	0.21			0.02
v/c Ratio	0.00	0.45	0.40	0.97	0.96	0.06
Uniform Delay, d1	10.4	13.5	13.1	20.9	26.3	16.8
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.0	0.4	0.4	22.1	24.0	0.0
Delay (s)	10.4	13.9	13.5	43.0	50.3	16.8
Level of Service	B	B	B	D	D	B
Approach Delay (s)	13.9			35.9	47.2	
Approach LOS	B			D	D	

Intersection Summary

HCM 2000 Control Delay	33.2	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.96		
Actuated Cycle Length (s)	89.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	85.9%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
49: Greenville Rd & Southfront Rd

BART to Livermore Extension Project
2025 Express Bus + Garage AM



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	116	226	137	554	744	126
Future Volume (vph)	116	226	137	554	744	126
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.2	5.2	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.88	0.97	0.95	0.95	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	3433	2787	3433	3539	3539	1583
Flt Permitted	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (perm)	3433	2787	3433	3539	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	126	246	149	602	809	137
RTOR Reduction (vph)	0	215	0	0	0	72
Lane Group Flow (vph)	126	31	149	602	809	65
Turn Type	Prot	Perm	Prot	NA	NA	Perm
Protected Phases	8		1	6	2	
Permitted Phases		8				2
Actuated Green, G (s)	5.7	5.7	3.1	24.5	17.4	17.4
Effective Green, g (s)	5.1	5.1	3.1	26.2	19.1	19.1
Actuated g/C Ratio	0.13	0.13	0.08	0.65	0.47	0.47
Clearance Time (s)	4.6	4.6	4.0	5.7	5.7	5.7
Vehicle Extension (s)	5.0	5.0	6.0	2.5	2.5	2.5
Lane Grp Cap (vph)	432	350	262	2289	1669	746
v/s Ratio Prot	c0.04		c0.04	0.17	c0.23	
v/s Ratio Perm		0.01				0.04
v/c Ratio	0.29	0.09	0.57	0.26	0.48	0.09
Uniform Delay, d1	16.1	15.6	18.1	3.0	7.3	5.9
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.8	0.2	5.8	0.0	0.2	0.0
Delay (s)	16.8	15.9	23.8	3.1	7.5	5.9
Level of Service	B	B	C	A	A	A
Approach Delay (s)	16.2			7.2	7.3	
Approach LOS	B			A	A	

Intersection Summary

HCM 2000 Control Delay	8.8	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.46		
Actuated Cycle Length (s)	40.5	Sum of lost time (s)	13.2
Intersection Capacity Utilization	38.8%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
50: Greenville Rd & Patterson Pass Rd

BART to Livermore Extension Project
2025 Express Bus + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↗	↘		↗	↘		↗	↘		↗	↘	
Traffic Volume (vph)	30	3	27	228	405	592	9	145	1	9	337	52
Future Volume (vph)	30	3	27	228	405	592	9	145	1	9	337	52
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.86		1.00	0.91		1.00	1.00		1.00	0.98	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1610		1770	1697		1770	1861		1770	1825	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	1610		1770	1697		1770	1861		1770	1825	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	33	3	29	248	440	643	10	158	1	10	366	57
RTOR Reduction (vph)	0	21	0	0	41	0	0	0	0	0	5	0
Lane Group Flow (vph)	33	11	0	248	1042	0	10	159	0	10	418	0
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												
Actuated Green, G (s)	2.3	30.4		41.1	69.2		0.7	27.1		0.7	27.1	
Effective Green, g (s)	2.3	30.4		41.1	69.2		0.7	27.1		0.7	27.1	
Actuated g/C Ratio	0.02	0.26		0.36	0.60		0.01	0.24		0.01	0.24	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	35	424		630	1018		10	437		10	428	
v/s Ratio Prot	c0.02	0.01		0.14	c0.61		c0.01	0.09		0.01	c0.23	
v/s Ratio Perm												
v/c Ratio	0.94	0.03		0.39	1.02		1.00	0.36		1.00	0.98	
Uniform Delay, d1	56.4	31.5		27.8	23.0		57.3	36.9		57.3	43.8	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	128.2	0.0		0.4	34.3		284.6	2.3		284.6	38.3	
Delay (s)	184.6	31.5		28.2	57.3		341.9	39.2		341.9	82.1	
Level of Service	F	C		C	E		F	D		F	F	
Approach Delay (s)		109.2			51.9			57.1			88.1	
Approach LOS		F			D			E			F	

Intersection Summary

HCM 2000 Control Delay	62.0	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.01		
Actuated Cycle Length (s)	115.3	Sum of lost time (s)	16.0
Intersection Capacity Utilization	85.2%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
1: Dougherty Rd & Amador Valley Rd

BART to Livermore Extension Project
2025 Express Bus + Garage PM



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	330	455	609	1956	1081	207
Future Volume (vph)	330	455	609	1956	1081	207
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5	5.7	5.7	
Lane Util. Factor	1.00	1.00	0.97	0.91	0.91	
Frt	1.00	0.85	1.00	1.00	0.98	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1770	1583	3433	5085	4963	
Flt Permitted	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	1770	1583	3433	5085	4963	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	359	495	662	2126	1175	225
RTOR Reduction (vph)	0	290	0	0	28	0
Lane Group Flow (vph)	359	205	662	2126	1372	0
Turn Type	Perm	Perm	Prot	NA	NA	
Protected Phases			5	2	6	
Permitted Phases	4	4				
Actuated Green, G (s)	22.0	22.0	19.5	58.8	34.8	
Effective Green, g (s)	22.0	22.0	19.5	58.8	34.8	
Actuated g/C Ratio	0.24	0.24	0.21	0.65	0.38	
Clearance Time (s)	4.5	4.5	4.5	5.7	5.7	
Vehicle Extension (s)	1.8	1.8	2.0	4.0	4.0	
Lane Grp Cap (vph)	427	382	735	3285	1897	
v/s Ratio Prot			c0.19	0.42	c0.28	
v/s Ratio Perm	c0.20	0.13				
v/c Ratio	0.84	0.54	0.90	0.65	0.72	
Uniform Delay, d1	32.8	30.1	34.8	9.8	24.0	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	13.4	0.7	13.9	0.5	1.5	
Delay (s)	46.2	30.8	48.7	10.3	25.5	
Level of Service	D	C	D	B	C	
Approach Delay (s)	37.3			19.4	25.5	
Approach LOS	D			B	C	

























Intersection Summary

HCM 2000 Control Delay	24.1	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.80		
Actuated Cycle Length (s)	91.0	Sum of lost time (s)	14.7
Intersection Capacity Utilization	73.4%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
2: Dougherty Rd & Dublin Blvd

BART to Livermore Extension Project
2025 Express Bus + Garage PM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	83	1027	935	546	810	675	835	1870	305	619	1258	35
Future Volume (vph)	83	1027	935	546	810	675	835	1870	305	619	1258	35
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	6.0	5.0	5.0	5.5	5.0	5.0	5.5	5.0	5.0	5.5	
Lane Util. Factor	0.97	0.91	0.88	0.94	0.91	1.00	0.94	0.91	0.88	0.97	0.86	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	3433	5085	2787	4990	5085	1583	4990	5085	2787	3433	6382	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	3433	5085	2787	4990	5085	1583	4990	5085	2787	3433	6382	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	90	1116	1016	593	880	734	908	2033	332	673	1367	38
RTOR Reduction (vph)	0	0	34	0	0	54	0	0	33	0	3	0
Lane Group Flow (vph)	90	1116	982	593	880	680	908	2033	299	673	1402	0
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	
Protected Phases	5	2	3	1	6	7	3	8	1	7	4	
Permitted Phases			2			6			8			
Actuated Green, G (s)	15.0	35.1	57.5	18.5	39.1	56.1	22.4	46.5	65.0	17.0	41.1	
Effective Green, g (s)	15.0	35.1	57.5	18.5	39.1	56.1	22.4	46.5	65.0	17.0	41.1	
Actuated g/C Ratio	0.11	0.25	0.41	0.13	0.28	0.40	0.16	0.34	0.47	0.12	0.30	
Clearance Time (s)	5.0	6.0	5.0	5.0	5.5	5.0	5.0	5.5	5.0	5.0	5.5	
Vehicle Extension (s)	2.0	4.5	2.0	2.0	4.5	2.0	2.0	4.5	2.0	2.0	4.5	
Lane Grp Cap (vph)	371	1287	1156	666	1434	640	806	1706	1307	421	1892	
v/s Ratio Prot	0.03	0.22	0.14	c0.12	0.17	c0.13	c0.18	c0.40	0.03	c0.20	0.22	
v/s Ratio Perm			0.22			0.30			0.08			
v/c Ratio	0.24	0.87	0.85	0.89	0.61	1.06	1.13	1.19	0.23	1.60	0.74	
Uniform Delay, d1	56.6	49.5	36.6	59.1	43.2	41.2	58.1	46.0	21.9	60.8	44.0	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.1	6.8	5.8	13.8	1.0	53.6	72.6	92.4	0.0	280.3	1.8	
Delay (s)	56.7	56.3	42.4	72.8	44.2	94.8	130.7	138.4	21.9	341.1	45.8	
Level of Service	E	E	D	E	D	F	F	F	C	F	D	
Approach Delay (s)		50.0			68.7			124.5			141.4	
Approach LOS		D			E			F			F	

Intersection Summary

HCM 2000 Control Delay	98.6	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.20		
Actuated Cycle Length (s)	138.6	Sum of lost time (s)	21.5
Intersection Capacity Utilization	104.0%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
3: Dougherty Rd & I-580 WB Ramps

BART to Livermore Extension Project
2025 Express Bus + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↔↔		↔↔		↑↑↑			↑↑↑	↔
Traffic Volume (vph)	0	0	0	314	0	680	0	2358	0	0	1660	0
Future Volume (vph)	0	0	0	314	0	680	0	2358	0	0	1660	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0		4.0		4.0			4.0	
Lane Util. Factor				0.97		0.88		0.91			0.86	
Frt				1.00		0.85		1.00			1.00	
Flt Protected				0.95		1.00		1.00			1.00	
Satd. Flow (prot)				3433		2787		5085			4806	
Flt Permitted				0.95		1.00		1.00			1.00	
Satd. Flow (perm)				3433		2787		5085			4806	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	341	0	739	0	2563	0	0	1804	0
RTOR Reduction (vph)	0	0	0	0	0	15	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	341	0	724	0	2563	0	0	1804	0
Turn Type				Prot		Prot		NA			NA	Perm
Protected Phases				4		4		2			6	
Permitted Phases												6
Actuated Green, G (s)				35.5		35.5		73.7			73.7	
Effective Green, g (s)				36.9		36.9		75.1			75.1	
Actuated g/C Ratio				0.31		0.31		0.63			0.63	
Clearance Time (s)				5.4		5.4		5.4			5.4	
Vehicle Extension (s)				3.0		3.0		3.0			3.0	
Lane Grp Cap (vph)				1055		857		3182			3007	
v/s Ratio Prot				0.10		c0.26		c0.50			0.38	
v/s Ratio Perm												
v/c Ratio				0.32		0.84		0.81			0.60	
Uniform Delay, d1				31.9		38.9		16.9			13.4	
Progression Factor				1.00		1.00		1.03			1.00	
Incremental Delay, d2				0.2		7.7		0.8			0.9	
Delay (s)				32.1		46.5		18.2			14.3	
Level of Service				C		D		B			B	
Approach Delay (s)		0.0			42.0			18.2			14.3	
Approach LOS		A			D			B			B	

Intersection Summary			
HCM 2000 Control Delay	21.6	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.82		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	76.0%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 4: Hopyard Rd/Dougherty Rd & I-580 EB Ramps

BART to Livermore Extension Project
 2025 Express Bus + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗		↖↗					↑↑↑	↖		↑↑↑	↖
Traffic Volume (vph)	1111	0	812	0	0	0	0	2460	0	0	1147	0
Future Volume (vph)	1111	0	812	0	0	0	0	2460	0	0	1147	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0					4.0			4.0	
Lane Util. Factor	0.97		0.88					0.91			0.86	
Frt	1.00		0.85					1.00			1.00	
Flt Protected	0.95		1.00					1.00			1.00	
Satd. Flow (prot)	3433		2787					5085			4806	
Flt Permitted	0.95		1.00					1.00			1.00	
Satd. Flow (perm)	3433		2787					5085			4806	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	1208	0	883	0	0	0	0	2674	0	0	1247	0
RTOR Reduction (vph)	0	0	60	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	1208	0	823	0	0	0	0	2674	0	0	1247	0
Turn Type	Prot		Prot					NA	Free		NA	Perm
Protected Phases	4		4					2			6	
Permitted Phases									Free			6
Actuated Green, G (s)	43.6		43.6					65.6			65.6	
Effective Green, g (s)	45.0		45.0					67.0			67.0	
Actuated g/C Ratio	0.38		0.38					0.56			0.56	
Clearance Time (s)	5.4		5.4					5.4			5.4	
Vehicle Extension (s)	3.0		3.0					3.0			3.0	
Lane Grp Cap (vph)	1287		1045					2839			2683	
v/s Ratio Prot	c0.35		0.30					c0.53			0.26	
v/s Ratio Perm												
v/c Ratio	0.94		0.79					0.94			0.46	
Uniform Delay, d1	36.2		33.3					24.7			15.8	
Progression Factor	1.00		1.00					0.50			0.72	
Incremental Delay, d2	12.9		4.0					7.3			0.5	
Delay (s)	49.1		37.3					19.6			11.9	
Level of Service	D		D					B			B	
Approach Delay (s)		44.1			0.0			19.6			11.9	
Approach LOS		D			A			B			B	

Intersection Summary		
HCM 2000 Control Delay	26.5	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.94	C
Actuated Cycle Length (s)	120.0	Sum of lost time (s)
Intersection Capacity Utilization	85.9%	8.0
Analysis Period (min)	15	ICU Level of Service
		E

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

5: Hopyard Rd & Owens Rd

BART to Livermore Extension Project
2025 Express Bus + Garage PM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	362	234	312	536	283	278	283	906	253	306	1467	233
Future Volume (vph)	362	234	312	536	283	278	283	906	253	306	1467	233
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	2.7	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	0.91	0.91		1.00	0.95	0.95	1.00	0.91	1.00	0.97	0.91	
Frt	1.00	0.93		1.00	0.96	0.85	1.00	1.00	0.85	1.00	0.98	
Flt Protected	0.95	0.99		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1610	3130		1770	1708	1504	1770	5085	1583	3433	4981	
Flt Permitted	0.95	0.99		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1610	3130		1770	1708	1504	1770	5085	1583	3433	4981	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	393	254	339	583	308	302	308	985	275	333	1595	253
RTOR Reduction (vph)	0	118	0	0	9	41	0	0	193	0	18	0
Lane Group Flow (vph)	216	652	0	583	393	167	308	985	82	333	1830	0
Turn Type	Split	NA		Split	NA	pm+ov	Prot	NA	Perm	Prot	NA	
Protected Phases	8	8		4	4	1	5	2		1	6	
Permitted Phases						4			2			
Actuated Green, G (s)	15.7	15.7		27.7	27.7	50.1	15.0	33.9	33.9	22.4	41.3	
Effective Green, g (s)	17.0	17.0		29.0	29.0	52.7	15.0	35.6	35.6	22.4	43.0	
Actuated g/C Ratio	0.14	0.14		0.24	0.24	0.44	0.12	0.30	0.30	0.19	0.36	
Clearance Time (s)	5.3	5.3		5.3	5.3	4.0	4.0	5.7	5.7	4.0	5.7	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	228	443		427	412	694	221	1508	469	640	1784	
v/s Ratio Prot	0.13	c0.21		c0.33	0.23	0.05	c0.17	0.19		0.10	c0.37	
v/s Ratio Perm						0.06			0.05			
v/c Ratio	0.95	1.47		1.37	0.95	0.24	1.39	0.65	0.17	0.52	1.03	
Uniform Delay, d1	51.1	51.5		45.5	44.8	21.1	52.5	36.8	31.3	44.0	38.5	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.04	0.90	
Incremental Delay, d2	44.6	223.9		178.9	32.4	0.2	202.4	2.2	0.8	0.6	26.1	
Delay (s)	95.6	275.4		224.4	77.2	21.3	254.9	39.0	32.1	46.5	60.6	
Level of Service	F	F		F	E	C	F	D	C	D	E	
Approach Delay (s)		236.0			139.4			80.2			58.5	
Approach LOS		F			F			F			E	
Intersection Summary												
HCM 2000 Control Delay			110.0			HCM 2000 Level of Service				F		
HCM 2000 Volume to Capacity ratio			1.24									
Actuated Cycle Length (s)			120.0			Sum of lost time (s)				16.0		
Intersection Capacity Utilization			110.2%			ICU Level of Service				H		
Analysis Period (min)			15									
c	Critical Lane Group											

HCM Signalized Intersection Capacity Analysis
6: Hopyard Rd & Stoneridge Dr

BART to Livermore Extension Project
2025 Express Bus + Garage PM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	278	1376	712	118	1312	192	589	835	99	291	873	193
Future Volume (vph)	278	1376	712	118	1312	192	589	835	99	291	873	193
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.91	1.00	0.97	0.91	1.00	0.94	0.95	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5085	1583	3433	5085	1583	4990	3539	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5085	1583	3433	5085	1583	4990	3539	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	302	1496	774	128	1426	209	640	908	108	316	949	210
RTOR Reduction (vph)	0	0	174	0	0	139	0	0	77	0	0	120
Lane Group Flow (vph)	302	1496	600	128	1426	70	640	908	31	316	949	90
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8			2			6
Actuated Green, G (s)	9.0	35.0	35.0	4.0	30.0	30.0	13.0	25.6	25.6	9.0	21.6	21.6
Effective Green, g (s)	9.0	35.0	35.0	4.0	30.0	30.0	13.0	25.6	25.6	9.0	21.6	21.6
Actuated g/C Ratio	0.10	0.39	0.39	0.04	0.33	0.33	0.15	0.29	0.29	0.10	0.24	0.24
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	344	1986	618	153	1702	530	723	1011	452	344	1225	381
v/s Ratio Prot	c0.09	0.29		0.04	0.28		c0.13	c0.26		0.09	0.19	
v/s Ratio Perm			c0.38			0.04			0.02			0.06
v/c Ratio	0.88	0.75	0.97	0.84	0.84	0.13	0.89	0.90	0.07	0.92	0.77	0.24
Uniform Delay, d1	39.8	23.6	26.8	42.5	27.6	20.7	37.6	30.7	23.3	39.9	31.7	27.4
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	21.4	1.7	28.8	30.9	3.8	0.1	12.5	10.5	0.1	28.5	3.1	0.3
Delay (s)	61.2	25.2	55.6	73.4	31.3	20.9	50.1	41.3	23.4	68.4	34.9	27.7
Level of Service	E	C	E	E	C	C	D	D	C	E	C	C
Approach Delay (s)		38.6			33.1			43.5			41.0	
Approach LOS		D			C			D			D	

Intersection Summary




































HCM 2000 Control Delay	38.9	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.97		
Actuated Cycle Length (s)	89.6	Sum of lost time (s)	16.0
Intersection Capacity Utilization	78.0%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

7: Hopyard Rd & Las Positas Blvd

BART to Livermore Extension Project
2025 Express Bus + Garage PM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 	 		 	 		 	  		 	   	
Traffic Volume (vph)	99	247	422	538	407	50	343	935	242	72	1387	73
Future Volume (vph)	99	247	422	538	407	50	343	935	242	72	1387	73
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.95	1.00	0.97	0.95	1.00	0.97	0.91	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	3433	3539	1583	3433	5085	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	3433	3539	1583	3433	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	108	268	459	585	442	54	373	1016	263	78	1508	79
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	52
Lane Group Flow (vph)	108	268	459	585	442	54	373	1016	263	78	1508	27
Turn Type	Prot	NA	Free	Prot	NA	Free	Prot	NA	Free	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			Free			Free			Free			6
Actuated Green, G (s)	4.0	11.8	76.7	14.0	21.8	76.7	9.0	30.9	76.7	4.0	25.9	25.9
Effective Green, g (s)	4.0	11.8	76.7	14.0	21.8	76.7	9.0	30.9	76.7	4.0	25.9	25.9
Actuated g/C Ratio	0.05	0.15	1.00	0.18	0.28	1.00	0.12	0.40	1.00	0.05	0.34	0.34
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	179	544	1583	626	1005	1583	402	2048	1583	179	1717	534
v/s Ratio Prot	0.03	0.08		c0.17	c0.12		c0.11	0.20		0.02	c0.30	
v/s Ratio Perm			0.29			0.03			0.17			0.02
v/c Ratio	0.60	0.49	0.29	0.93	0.44	0.03	0.93	0.50	0.17	0.44	0.88	0.05
Uniform Delay, d1	35.6	29.7	0.0	30.9	22.5	0.0	33.5	17.1	0.0	35.3	23.9	17.1
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	5.6	0.7	0.5	21.2	0.3	0.0	27.3	0.2	0.2	1.7	5.4	0.0
Delay (s)	41.2	30.4	0.5	52.1	22.8	0.0	60.8	17.3	0.2	37.0	29.4	17.2
Level of Service	D	C	A	D	C	A	E	B	A	D	C	B
Approach Delay (s)		15.3			37.5			24.4			29.1	
Approach LOS		B			D			C			C	
Intersection Summary												
HCM 2000 Control Delay			27.2		HCM 2000 Level of Service			C				
HCM 2000 Volume to Capacity ratio			0.83									
Actuated Cycle Length (s)			76.7		Sum of lost time (s)			16.0				
Intersection Capacity Utilization			72.1%		ICU Level of Service			C				
Analysis Period (min)			15									

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

8: Willow Rd & Owens Rd

BART to Livermore Extension Project

2025 Express Bus + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	84	588	161	118	613	87	159	81	0	177	73	123
Future Volume (vph)	84	588	161	118	613	87	159	81	0	177	73	123
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	5.3	4.0		5.3	4.0	4.0
Lane Util. Factor	0.97	0.91		0.97	0.91	1.00	1.00	0.95		1.00	1.00	1.00
Frt	1.00	0.97		1.00	1.00	0.85	1.00	1.00		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	4921		3433	5085	1583	1770	3539		1770	1863	1583
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.71	1.00		0.70	1.00	1.00
Satd. Flow (perm)	3433	4921		3433	5085	1583	1314	3539		1298	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	91	639	175	128	666	95	173	88	0	192	79	134
RTOR Reduction (vph)	0	66	0	0	0	51	0	0	0	0	0	102
Lane Group Flow (vph)	91	748	0	128	666	44	173	88	0	192	79	32
Turn Type	Prot	NA		Prot	NA	Perm	Perm	NA	Perm	Perm	NA	Perm
Protected Phases	1	6		5	2			4			8	
Permitted Phases						2	4		4	8		8
Actuated Green, G (s)	2.5	19.3		4.3	21.1	21.1	10.5	10.5		10.5	10.5	10.5
Effective Green, g (s)	2.5	21.0		4.3	22.8	22.8	10.5	11.8		10.5	11.8	11.8
Actuated g/C Ratio	0.05	0.43		0.09	0.46	0.46	0.21	0.24		0.21	0.24	0.24
Clearance Time (s)	4.0	5.7		4.0	5.7	5.7	5.3	5.3		5.3	5.3	5.3
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	174	2104		300	2361	735	280	850		277	447	380
v/s Ratio Prot	0.03	c0.15		c0.04	0.13			0.02			0.04	
v/s Ratio Perm						0.03	0.13			c0.15		0.02
v/c Ratio	0.52	0.36		0.43	0.28	0.06	0.62	0.10		0.69	0.18	0.08
Uniform Delay, d1	22.7	9.5		21.2	8.1	7.2	17.5	14.5		17.8	14.8	14.5
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	2.8	0.1		1.0	0.1	0.0	4.0	0.1		7.3	0.2	0.1
Delay (s)	25.5	9.6		22.2	8.2	7.3	21.5	14.6		25.1	15.0	14.6
Level of Service	C	A		C	A	A	C	B		C	B	B
Approach Delay (s)		11.2			10.1			19.2			19.6	
Approach LOS		B			B			B			B	

Intersection Summary

HCM 2000 Control Delay	13.0	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.44		
Actuated Cycle Length (s)	49.1	Sum of lost time (s)	12.0
Intersection Capacity Utilization	44.8%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
9: Hacienda Dr & Dublin Blvd

BART to Livermore Extension Project
2025 Express Bus + Garage PM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	50	1020	131	230	486	34	224	582	462	42	634	165
Future Volume (vph)	50	1020	131	230	486	34	224	582	462	42	634	165
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	6.0	5.0	4.5	6.0		5.0	6.0	6.0	4.5	5.5	5.5
Lane Util. Factor	0.97	0.91	0.88	0.97	0.91		0.94	0.95	0.88	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5085	2787	3433	5035		4990	3539	2787	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5085	2787	3433	5035		4990	3539	2787	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	54	1109	142	250	528	37	243	633	502	46	689	179
RTOR Reduction (vph)	0	0	64	0	7	0	0	0	233	0	0	138
Lane Group Flow (vph)	54	1109	78	250	558	0	243	633	269	46	689	41
Turn Type	Prot	NA	pm+ov	Prot	NA		Prot	NA	Perm	Prot	NA	Perm
Protected Phases	5	2	3	1	6		3	8		7	NA	4
Permitted Phases			2						8			4
Actuated Green, G (s)	4.1	29.8	40.5	10.8	36.5		10.7	29.7	29.7	2.7	21.7	21.7
Effective Green, g (s)	4.1	29.8	40.5	10.8	36.5		10.7	29.7	29.7	2.7	21.7	21.7
Actuated g/C Ratio	0.04	0.32	0.43	0.11	0.39		0.11	0.32	0.32	0.03	0.23	0.23
Clearance Time (s)	4.5	6.0	5.0	4.5	6.0		5.0	6.0	6.0	4.5	5.5	5.5
Vehicle Extension (s)	2.0	3.5	2.0	2.0	3.5		2.0	3.5	3.5	2.0	3.5	3.5
Lane Grp Cap (vph)	149	1612	1349	394	1955		568	1118	880	98	1173	365
v/s Ratio Prot	0.02	c0.22	0.01	c0.07	0.11		0.05	c0.18		0.01	c0.14	
v/s Ratio Perm			0.02						0.10			0.03
v/c Ratio	0.36	0.69	0.06	0.63	0.29		0.43	0.57	0.31	0.47	0.59	0.11
Uniform Delay, d1	43.7	28.0	15.6	39.7	19.8		38.8	26.8	24.3	44.9	32.2	28.6
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.5	1.3	0.0	2.5	0.1		0.2	0.7	0.2	1.3	0.8	0.2
Delay (s)	44.2	29.3	15.6	42.2	19.9		39.0	27.5	24.6	46.2	33.0	28.7
Level of Service	D	C	B	D	B		D	C	C	D	C	C
Approach Delay (s)		28.5			26.7			28.5			32.8	
Approach LOS		C			C			C			C	

Intersection Summary

HCM 2000 Control Delay	29.0	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.64		
Actuated Cycle Length (s)	94.0	Sum of lost time (s)	21.0
Intersection Capacity Utilization	63.3%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
10: Hacienda Dr & Martinelli Blvd/Hacienda Crossings



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗	↖↗	↖↗	↗		↖↗↘	↖↗↘	↖	↖↗	↖↗↘	
Traffic Volume (vph)	23	50	392	290	37	21	436	1255	469	59	918	74
Future Volume (vph)	23	50	392	290	37	21	436	1255	469	59	918	74
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	3.0	3.0	5.5	3.0		3.5	3.0	3.0	5.0	3.5	
Lane Util. Factor	1.00	0.91	0.91	0.97	1.00		0.94	0.91	1.00	0.97	0.86	
Frt	1.00	0.93	0.85	1.00	0.95		1.00	1.00	0.85	1.00	0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1770	1582	2882	3433	1761		4990	5085	1583	3433	6337	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1770	1582	2882	3433	1761		4990	5085	1583	3433	6337	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	25	54	426	315	40	23	474	1364	510	64	998	80
RTOR Reduction (vph)	0	24	267	0	13	0	0	0	232	0	11	0
Lane Group Flow (vph)	25	73	116	315	50	0	474	1364	278	64	1067	0
Turn Type	Prot	NA	Perm	Prot	NA		Prot	NA	pm+ov	Prot	NA	
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases			2						8			
Actuated Green, G (s)	3.6	34.3	34.3	19.8	51.0		16.4	41.5	61.3	4.9	30.0	
Effective Green, g (s)	3.1	36.3	36.3	19.3	53.0		17.4	43.5	65.3	4.4	31.5	
Actuated g/C Ratio	0.03	0.30	0.30	0.16	0.44		0.14	0.36	0.54	0.04	0.26	
Clearance Time (s)	4.5	5.0	5.0	5.0	5.0		4.5	5.0	5.0	4.5	5.0	
Vehicle Extension (s)	3.0	4.0	4.0	2.0	4.0		3.0	4.0	2.0	3.0	4.0	
Lane Grp Cap (vph)	45	478	871	552	777		723	1843	861	125	1663	
v/s Ratio Prot	c0.01	c0.05		c0.09	0.03		0.09	c0.27	0.06	0.02	c0.17	
v/s Ratio Perm			0.04						0.12			
v/c Ratio	0.56	0.15	0.13	0.57	0.06		0.66	0.74	0.32	0.51	0.64	
Uniform Delay, d1	57.8	30.6	30.4	46.5	19.3		48.5	33.3	15.1	56.7	39.2	
Progression Factor	1.00	1.00	1.00	1.00	1.00		0.93	0.90	1.20	1.00	1.00	
Incremental Delay, d2	14.0	0.7	0.3	0.9	0.2		1.7	1.3	0.1	3.5	1.0	
Delay (s)	71.8	31.3	30.7	47.4	19.4		46.9	31.2	18.2	60.3	40.2	
Level of Service	E	C	C	D	B		D	C	B	E	D	
Approach Delay (s)		32.9			42.7			31.6			41.3	
Approach LOS		C			D			C			D	

Intersection Summary

HCM 2000 Control Delay	35.2	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.52		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	16.5
Intersection Capacity Utilization	62.6%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 11: Hacienda Dr & I-580 WB Ramps

BART to Livermore Extension Project
 2025 Express Bus + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↔↔		↔↔		↑↑↑			↑↑↑	↔
Traffic Volume (vph)	0	0	0	357	0	379	0	1517	761	0	805	756
Future Volume (vph)	0	0	0	357	0	379	0	1517	761	0	805	756
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0		4.0		4.0			4.0	4.0
Lane Util. Factor				0.97		0.88		0.91			0.86	0.86
Frt				1.00		0.85		0.95			0.95	0.85
Flt Protected				0.95		1.00		1.00			1.00	1.00
Satd. Flow (prot)				3433		2787		4831			4575	1362
Flt Permitted				0.95		1.00		1.00			1.00	1.00
Satd. Flow (perm)				3433		2787		4831			4575	1362
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	388	0	412	0	1649	827	0	875	822
RTOR Reduction (vph)	0	0	0	0	0	43	0	143	0	0	133	145
Lane Group Flow (vph)	0	0	0	388	0	369	0	2333	0	0	1153	266
Turn Type				Prot		Prot		NA			NA	Perm
Protected Phases				4		4		2			6	
Permitted Phases												6
Actuated Green, G (s)				11.8		11.8		36.9			36.9	36.9
Effective Green, g (s)				13.2		13.2		38.8			38.8	38.8
Actuated g/C Ratio				0.22		0.22		0.65			0.65	0.65
Clearance Time (s)				5.4		5.4		5.9			5.9	5.9
Vehicle Extension (s)				3.0		3.0		3.0			3.0	3.0
Lane Grp Cap (vph)				755		613		3124			2958	880
v/s Ratio Prot				0.11		c0.13		c0.48			0.25	
v/s Ratio Perm												0.20
v/c Ratio				0.51		0.60		0.75			0.39	0.30
Uniform Delay, d1				20.6		21.0		7.2			5.0	4.7
Progression Factor				1.00		1.00		1.34			0.61	3.46
Incremental Delay, d2				0.6		1.7		1.2			0.3	0.8
Delay (s)				21.2		22.7		10.8			3.4	16.9
Level of Service				C		C		B			A	B
Approach Delay (s)		0.0			22.0			10.8			6.7	
Approach LOS		A			C			B			A	

Intersection Summary		
HCM 2000 Control Delay	11.2	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.71	B
Actuated Cycle Length (s)	60.0	Sum of lost time (s)
Intersection Capacity Utilization	66.3%	8.0
Analysis Period (min)	15	ICU Level of Service
		C

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 12: Hacienda Dr & I-580 EB Ramps

BART to Livermore Extension Project
 2025 Express Bus + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔↔		↔↔					↑↑↑	↔		↑↑↑	
Traffic Volume (vph)	886	0	438	0	0	0	0	1558	827	0	745	313
Future Volume (vph)	886	0	438	0	0	0	0	1558	827	0	745	313
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0					4.0	4.0		4.0	
Lane Util. Factor	0.97		0.88					0.86	0.86		0.91	
Frt	1.00		0.85					0.98	0.85		0.96	
Flt Protected	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (prot)	3433		2787					4704	1362		4860	
Flt Permitted	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (perm)	3433		2787					4704	1362		4860	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	963	0	476	0	0	0	0	1693	899	0	810	340
RTOR Reduction (vph)	0	0	177	0	0	0	0	15	252	0	56	0
Lane Group Flow (vph)	963	0	299	0	0	0	0	1957	368	0	1094	0
Turn Type	Prot		Prot					NA	Perm		NA	
Protected Phases	4		4					2			6	
Permitted Phases									2			
Actuated Green, G (s)	39.4		39.4					69.3	69.3		69.3	
Effective Green, g (s)	40.8		40.8					71.2	71.2		71.2	
Actuated g/C Ratio	0.34		0.34					0.59	0.59		0.59	
Clearance Time (s)	5.4		5.4					5.9	5.9		5.9	
Vehicle Extension (s)	2.0		2.0					2.0	2.0		2.0	
Lane Grp Cap (vph)	1167		947					2791	808		2883	
v/s Ratio Prot	c0.28		0.11					c0.42			0.23	
v/s Ratio Perm									0.27			
v/c Ratio	0.83		0.32					0.70	0.46		0.38	
Uniform Delay, d1	36.3		29.3					17.0	13.6		12.8	
Progression Factor	1.00		1.00					1.26	5.57		0.49	
Incremental Delay, d2	4.6		0.1					1.2	1.5		0.4	
Delay (s)	41.0		29.4					22.6	77.1		6.6	
Level of Service	D		C					C	E		A	
Approach Delay (s)		37.1			0.0			35.6			6.6	
Approach LOS		D			A			D			A	

Intersection Summary		
HCM 2000 Control Delay	29.6	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.75	C
Actuated Cycle Length (s)	120.0	Sum of lost time (s)
Intersection Capacity Utilization	68.2%	8.0
Analysis Period (min)	15	ICU Level of Service
		C

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
13: Hacienda Dr & Owens Rd

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	664	750	52	121	308	743	36	962	281	450	462	257
Future Volume (vph)	664	750	52	121	308	743	36	962	281	450	462	257
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	2.3	4.0	4.0	2.3	4.0	4.0	2.7	4.0	4.0	2.7
Lane Util. Factor	0.97	0.91	1.00	0.97	0.91	1.00	0.97	0.91	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5085	1583	3433	5085	1583	3433	5085	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5085	1583	3433	5085	1583	3433	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	722	815	57	132	335	808	39	1046	305	489	502	279
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	722	815	57	132	335	808	39	1046	305	489	502	279
Turn Type	Prot	NA	Free	Prot	NA	Free	Prot	NA	Free	Prot	NA	Free
Protected Phases	1	6		5	2		7	4		3	8	
Permitted Phases			Free			Free			Free			Free
Actuated Green, G (s)	38.7	41.7	120.0	8.6	11.6	120.0	3.5	32.5	120.0	18.2	47.2	120.0
Effective Green, g (s)	38.7	43.4	120.0	8.6	13.3	120.0	3.5	33.8	120.0	18.2	48.5	120.0
Actuated g/C Ratio	0.32	0.36	1.00	0.07	0.11	1.00	0.03	0.28	1.00	0.15	0.40	1.00
Clearance Time (s)	4.0	5.7		4.0	5.7		4.0	5.3		4.0	5.3	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	1107	1839	1583	246	563	1583	100	1432	1583	520	2055	1583
v/s Ratio Prot	c0.21	0.16		0.04	0.07		0.01	c0.21		c0.14	0.10	
v/s Ratio Perm			0.04			c0.51			0.19			0.18
v/c Ratio	0.65	0.44	0.04	0.54	0.60	0.51	0.39	0.73	0.19	0.94	0.24	0.18
Uniform Delay, d1	34.9	29.1	0.0	53.8	50.8	0.0	57.2	39.0	0.0	50.4	23.6	0.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.93	0.86	1.00
Incremental Delay, d2	1.4	0.8	0.0	2.2	4.6	1.2	2.5	2.0	0.3	24.3	0.1	0.2
Delay (s)	36.3	29.9	0.0	56.0	55.4	1.2	59.7	40.9	0.3	71.0	20.3	0.2
Level of Service	D	C	A	E	E	A	E	D	A	E	C	A
Approach Delay (s)		31.7			21.1			32.5			35.4	
Approach LOS		C			C			C			D	

Intersection Summary

HCM 2000 Control Delay	30.3	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.73		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	69.7%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 14: Tassajara Rd & Dublin Blvd

BART to Livermore Extension Project
 2025 Express Bus + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↙↘	↑↑	↖↗	↙↘↗	↑↘		↙↘↗	↑↑↑	↖	↙↘	↑↑↑	↖↗
Traffic Volume (vph)	255	839	451	243	295	20	376	868	504	31	787	140
Future Volume (vph)	255	839	451	243	295	20	376	868	504	31	787	140
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	6.0	6.0	5.0	6.0		5.0	6.0	6.0	5.0	6.0	6.0
Lane Util. Factor	0.97	0.95	0.88	0.94	0.95		0.94	0.91	1.00	0.97	0.86	0.88
Frt	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	2787	4990	3505		4990	5085	1583	3433	6408	2787
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	2787	4990	3505		4990	5085	1583	3433	6408	2787
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	277	912	490	264	321	22	409	943	548	34	855	152
RTOR Reduction (vph)	0	0	271	0	3	0	0	0	249	0	0	110
Lane Group Flow (vph)	277	912	219	264	340	0	409	943	299	34	855	42
Turn Type	Prot	NA	Perm	Prot	NA		Prot	NA	Perm	Prot	NA	Perm
Protected Phases	5	2		1	6		3	8		7		4
Permitted Phases			2						8			4
Actuated Green, G (s)	17.0	43.8	43.8	16.3	43.1		16.7	45.8	45.8	8.2	37.3	37.3
Effective Green, g (s)	17.0	43.8	43.8	16.3	43.1		16.7	45.8	45.8	8.2	37.3	37.3
Actuated g/C Ratio	0.12	0.32	0.32	0.12	0.32		0.12	0.34	0.34	0.06	0.27	0.27
Clearance Time (s)	5.0	6.0	6.0	5.0	6.0		5.0	6.0	6.0	5.0	6.0	6.0
Vehicle Extension (s)	2.0	3.0	3.0	2.0	3.0		2.0	4.0	4.0	2.0	4.0	4.0
Lane Grp Cap (vph)	428	1138	896	597	1109		612	1711	532	206	1756	763
v/s Ratio Prot	c0.08	c0.26		0.05	0.10		c0.08	0.19		0.01	0.13	
v/s Ratio Perm			0.08						c0.19			0.01
v/c Ratio	0.65	0.80	0.24	0.44	0.31		0.67	0.55	0.56	0.17	0.49	0.05
Uniform Delay, d1	56.7	42.2	34.0	55.7	35.2		57.1	36.8	36.9	60.7	41.4	36.4
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	2.5	4.1	0.1	0.2	0.2		2.1	0.5	1.7	0.1	0.3	0.0
Delay (s)	59.2	46.3	34.1	55.9	35.3		59.2	37.3	38.6	60.8	41.7	36.4
Level of Service	E	D	C	E	D		E	D	D	E	D	D
Approach Delay (s)		44.9			44.3			42.4			41.5	
Approach LOS		D			D			D			D	

Intersection Summary

HCM 2000 Control Delay	43.2	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.70		
Actuated Cycle Length (s)	136.1	Sum of lost time (s)	22.0
Intersection Capacity Utilization	84.1%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 15: Tassajara Rd & I-580 WB Ramps

BART to Livermore Extension Project
 2025 Express Bus + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↖↗		↖↗		↑↑	↖		↑↑↑	↖
Traffic Volume (vph)	0	0	0	486	0	226	0	1354	644	0	1179	614
Future Volume (vph)	0	0	0	486	0	226	0	1354	644	0	1179	614
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0		4.0		4.0	4.0		4.0	4.0
Lane Util. Factor				0.97		0.88		0.95	1.00		0.86	0.86
Frt				1.00		0.85		1.00	0.85		0.98	0.85
Flt Protected				0.95		1.00		1.00	1.00		1.00	1.00
Satd. Flow (prot)				3433		2787		3539	1583		4697	1362
Flt Permitted				0.95		1.00		1.00	1.00		1.00	1.00
Satd. Flow (perm)				3433		2787		3539	1583		4697	1362
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	528	0	246	0	1472	700	0	1282	667
RTOR Reduction (vph)	0	0	0	0	0	54	0	0	258	0	35	162
Lane Group Flow (vph)	0	0	0	528	0	192	0	1472	442	0	1474	278
Turn Type				Perm		Perm		NA	Perm		NA	Perm
Protected Phases								2			6	
Permitted Phases				8		8			2			6
Actuated Green, G (s)				14.1		14.1		37.9	37.9		37.9	37.9
Effective Green, g (s)				14.1		14.1		37.9	37.9		37.9	37.9
Actuated g/C Ratio				0.23		0.23		0.63	0.63		0.63	0.63
Clearance Time (s)				4.0		4.0		4.0	4.0		4.0	4.0
Vehicle Extension (s)				3.0		3.0		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)				806		654		2235	999		2966	860
v/s Ratio Prot								c0.42			0.31	
v/s Ratio Perm				c0.15		0.07			0.28			0.20
v/c Ratio				0.66		0.29		0.66	0.44		0.50	0.32
Uniform Delay, d1				20.8		18.9		7.0	5.6		5.9	5.1
Progression Factor				1.00		1.00		1.00	1.00		1.00	1.00
Incremental Delay, d2				1.9		0.3		1.5	1.4		0.6	1.0
Delay (s)				22.7		19.1		8.5	7.1		6.5	6.1
Level of Service				C		B		A	A		A	A
Approach Delay (s)		0.0			21.5			8.0			6.4	
Approach LOS		A			C			A			A	

Intersection Summary			
HCM 2000 Control Delay	9.5	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.66		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	58.0%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 16: Santa Rita Rd & I-580 EB Ramps/Pimilco Dr

BART to Livermore Extension Project
 2025 Express Bus + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	388	90	235	143	0	315	0	1196	181	318	951	0
Future Volume (vph)	388	90	235	143	0	315	0	1196	181	318	951	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0		4.0		4.0		4.0	4.0	
Lane Util. Factor	0.97	1.00	1.00	0.97		0.88		0.86		1.00	0.95	
Frt	1.00	1.00	0.85	1.00		0.85		0.98		1.00	1.00	
Flt Protected	0.95	1.00	1.00	0.95		1.00		1.00		0.95	1.00	
Satd. Flow (prot)	3433	1863	1583	3433		2787		6281		1770	3539	
Flt Permitted	0.95	1.00	1.00	0.95		1.00		1.00		0.95	1.00	
Satd. Flow (perm)	3433	1863	1583	3433		2787		6281		1770	3539	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	422	98	255	155	0	342	0	1300	197	346	1034	0
RTOR Reduction (vph)	0	0	92	0	0	38	0	20	0	0	0	0
Lane Group Flow (vph)	422	98	163	155	0	304	0	1477	0	346	1034	0
Turn Type	Perm	NA	Perm	Prot		pm+ov		NA		Prot	NA	Perm
Protected Phases		4		3		1		2		1	6	
Permitted Phases	4		4			3						6
Actuated Green, G (s)	21.4	21.4	21.4	9.5		37.8		44.8		28.3	77.1	
Effective Green, g (s)	21.4	21.4	21.4	9.5		37.8		44.8		28.3	77.1	
Actuated g/C Ratio	0.18	0.18	0.18	0.08		0.31		0.37		0.24	0.64	
Clearance Time (s)	4.0	4.0	4.0	4.0		4.0		4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0		3.0		3.0		3.0	3.0	
Lane Grp Cap (vph)	612	332	282	271		877		2344		417	2273	
v/s Ratio Prot		0.05		c0.05		0.08		c0.24		c0.20	0.29	
v/s Ratio Perm	c0.12		0.10			0.03						
v/c Ratio	0.69	0.30	0.58	0.57		0.35		0.63		0.83	0.45	
Uniform Delay, d1	46.2	42.8	45.2	53.3		31.6		30.8		43.6	10.8	
Progression Factor	1.00	1.00	1.00	1.00		1.00		1.00		1.00	1.00	
Incremental Delay, d2	3.2	0.5	2.9	2.9		0.2		1.3		12.8	0.7	
Delay (s)	49.4	43.3	48.0	56.2		31.8		32.1		56.4	11.5	
Level of Service	D	D	D	E		C		C		E	B	
Approach Delay (s)		48.2			39.4			32.1			22.8	
Approach LOS		D			D			C			C	

Intersection Summary		
HCM 2000 Control Delay	32.9	HCM 2000 Level of Service C
HCM 2000 Volume to Capacity ratio	0.69	
Actuated Cycle Length (s)	120.0	Sum of lost time (s) 16.0
Intersection Capacity Utilization	60.1%	ICU Level of Service B
Analysis Period (min)	15	

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 17: Santa Rita Rd & Valley Ave

BART to Livermore Extension Project
 2025 Express Bus + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	351	479	113	129	310	778	152	782	136	1023	1098	242
Future Volume (vph)	351	479	113	129	310	778	152	782	136	1023	1098	242
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.97	0.95		0.97	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.98		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	3433	3460		3433	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	3433	3460		3433	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	382	521	123	140	337	846	165	850	148	1112	1193	263
RTOR Reduction (vph)	0	0	101	0	0	0	0	14	0	0	0	134
Lane Group Flow (vph)	382	521	22	140	337	846	165	984	0	1112	1193	129
Turn Type	Prot	NA	Perm	Prot	NA	Free	Prot	NA		Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1		6
Permitted Phases			4			Free						6
Actuated Green, G (s)	11.0	17.4	17.4	9.0	15.4	99.5	8.7	27.1		30.0	48.4	48.4
Effective Green, g (s)	11.0	17.4	17.4	9.0	15.4	99.5	8.7	27.1		30.0	48.4	48.4
Actuated g/C Ratio	0.11	0.17	0.17	0.09	0.15	1.00	0.09	0.27		0.30	0.49	0.49
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	379	618	276	160	547	1583	300	942		1035	1721	770
v/s Ratio Prot	c0.11	c0.15		0.08	0.10		0.05	c0.28		c0.32	0.34	
v/s Ratio Perm			0.01			c0.53						0.08
v/c Ratio	1.01	0.84	0.08	0.88	0.62	0.53	0.55	1.04		1.07	0.69	0.17
Uniform Delay, d1	44.2	39.7	34.3	44.7	39.3	0.0	43.5	36.2		34.8	19.8	14.3
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	48.2	10.2	0.1	37.4	2.1	1.3	2.2	41.7		50.2	1.2	0.1
Delay (s)	92.5	49.9	34.5	82.1	41.4	1.3	45.7	77.9		85.0	21.0	14.4
Level of Service	F	D	C	F	D	A	D	E		F	C	B
Approach Delay (s)		63.9			20.1			73.3			48.0	
Approach LOS		E			C			E			D	

Intersection Summary

HCM 2000 Control Delay	49.5	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	1.04		
Actuated Cycle Length (s)	99.5	Sum of lost time (s)	16.0
Intersection Capacity Utilization	88.9%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 18: Bernal Ave/Valley Ave & Stanley Blvd

BART to Livermore Extension Project
 2025 Express Bus + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	204	834	61	105	232	342	86	328	303	825	574	120
Future Volume (vph)	204	834	61	105	232	342	86	328	303	825	574	120
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.95	1.00	0.97	0.91	0.91	1.00	0.95	1.00	0.97	0.95	
Frt	1.00	1.00	0.85	1.00	0.94	0.85	1.00	1.00	0.85	1.00	0.97	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	3433	3539	1583	3433	3182	1441	1770	3539	1583	3433	3448	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	3433	3539	1583	3433	3182	1441	1770	3539	1583	3433	3448	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	222	907	66	114	252	372	93	357	329	897	624	130
RTOR Reduction (vph)	0	0	41	0	116	52	0	0	168	0	19	0
Lane Group Flow (vph)	222	907	25	114	311	145	93	357	161	897	735	0
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	
Protected Phases	7	4	5	3	8	1	5	2		1	6	
Permitted Phases			4			8			2			
Actuated Green, G (s)	9.4	25.1	32.5	4.0	19.7	44.8	7.4	15.8	15.8	25.1	33.5	
Effective Green, g (s)	9.4	25.1	32.5	4.0	19.7	44.8	7.4	15.8	15.8	25.1	33.5	
Actuated g/C Ratio	0.11	0.29	0.38	0.05	0.23	0.52	0.09	0.18	0.18	0.29	0.39	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	375	1032	671	159	728	817	152	650	290	1001	1343	
v/s Ratio Prot	c0.06	c0.26	0.00	0.03	0.10	0.05	0.05	0.10		c0.26	c0.21	
v/s Ratio Perm			0.01			0.05			0.10			
v/c Ratio	0.59	0.88	0.04	0.72	0.43	0.18	0.61	0.55	0.55	0.90	0.55	
Uniform Delay, d1	36.5	29.0	16.9	40.4	28.3	10.9	37.9	31.9	31.9	29.2	20.4	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	2.5	8.7	0.0	14.3	0.4	0.1	7.1	1.0	2.3	10.4	0.5	
Delay (s)	39.0	37.7	16.9	54.7	28.7	11.0	45.0	32.8	34.2	39.6	20.8	
Level of Service	D	D	B	D	C	B	D	C	C	D	C	
Approach Delay (s)		36.8			28.0			34.9			31.1	
Approach LOS		D			C			C			C	

Intersection Summary		
HCM 2000 Control Delay	32.8	HCM 2000 Level of Service C
HCM 2000 Volume to Capacity ratio	0.83	
Actuated Cycle Length (s)	86.0	Sum of lost time (s) 16.0
Intersection Capacity Utilization	75.4%	ICU Level of Service D
Analysis Period (min)	15	

























c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

19: Fallon Rd & Dublin Blvd

BART to Livermore Extension Project

2025 Express Bus + Garage PM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	221	664	428	47	18	55	192	610	175	117	576	27
Future Volume (vph)	221	664	428	47	18	55	192	610	175	117	576	27
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.3	5.3	5.3	4.0	4.0	4.0	5.3	4.9	4.9	5.3	4.9	4.9
Lane Util. Factor	0.97	0.91	0.88	0.94	0.91	1.00	0.97	0.91	0.88	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3090	4577	2508	4491	4577	1425	3090	4577	2508	3090	4577	1425
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3090	4577	2508	4491	4577	1425	3090	4577	2508	3090	4577	1425
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	240	722	465	51	20	60	209	663	190	127	626	29
RTOR Reduction (vph)	0	0	106	0	0	57	0	0	134	0	0	21
Lane Group Flow (vph)	240	722	359	51	20	3	209	663	56	127	626	8
Turn Type	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	5	2	3	1	6		3	8		7	4	
Permitted Phases			2			6			8			4
Actuated Green, G (s)	19.2	20.9	30.7	2.1	3.8	3.8	9.8	21.2	21.2	7.8	19.2	19.2
Effective Green, g (s)	19.2	20.9	30.7	2.1	3.8	3.8	9.8	21.2	21.2	7.8	19.2	19.2
Actuated g/C Ratio	0.27	0.29	0.43	0.03	0.05	0.05	0.14	0.30	0.30	0.11	0.27	0.27
Clearance Time (s)	5.3	5.3	5.3	4.0	4.0	4.0	5.3	4.9	4.9	5.3	4.9	4.9
Vehicle Extension (s)	2.0	4.0	2.0	2.0	2.0	2.0	2.0	4.0	4.0	2.0	4.0	4.0
Lane Grp Cap (vph)	829	1337	1076	131	243	75	423	1357	743	337	1229	382
v/s Ratio Prot	c0.08	c0.16	0.05	0.01	0.00		c0.07	c0.14		0.04	0.14	
v/s Ratio Perm			0.10			0.00			0.02			0.01
v/c Ratio	0.29	0.54	0.33	0.39	0.08	0.04	0.49	0.49	0.08	0.38	0.51	0.02
Uniform Delay, d1	20.7	21.3	13.6	34.1	32.2	32.1	28.6	20.7	18.1	29.6	22.2	19.2
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.1	0.6	0.1	0.7	0.1	0.1	0.3	0.4	0.1	0.3	0.5	0.0
Delay (s)	20.8	21.8	13.7	34.8	32.2	32.2	28.9	21.1	18.2	29.9	22.6	19.3
Level of Service	C	C	B	C	C	C	C	C	B	C	C	B
Approach Delay (s)		19.0			33.2			22.1			23.7	
Approach LOS		B			C			C			C	
Intersection Summary												
HCM 2000 Control Delay			21.6	HCM 2000 Level of Service				C				
HCM 2000 Volume to Capacity ratio			0.53									
Actuated Cycle Length (s)			71.5	Sum of lost time (s)				19.5				
Intersection Capacity Utilization			45.6%	ICU Level of Service				A				
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis
 20: El Charro Rd/Fallon Rd & I-580 WB Ramps

BART to Livermore Extension Project
 2025 Express Bus + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↖	↖	↖↖		↖	↖		↗↗	↗
Traffic Volume (vph)	0	0	0	267	0	444	0	660	245	0	857	376
Future Volume (vph)	0	0	0	267	0	444	0	660	245	0	857	376
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0	4.0	4.0		4.0	4.0		4.0	4.0
Lane Util. Factor				0.95	0.95	0.88		0.95	0.95		0.95	1.00
Frt				1.00	1.00	0.85		0.99	0.85		1.00	0.85
Flt Protected				0.95	0.95	1.00		1.00	1.00		1.00	1.00
Satd. Flow (prot)				1681	1681	2787		1760	1504		3539	1583
Flt Permitted				0.95	0.95	1.00		1.00	1.00		1.00	1.00
Satd. Flow (perm)				1681	1681	2787		1760	1504		3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	290	0	483	0	717	266	0	932	409
RTOR Reduction (vph)	0	0	0	0	0	375	0	2	74	0	0	127
Lane Group Flow (vph)	0	0	0	148	142	108	0	742	165	0	932	282
Turn Type				Perm	NA	Perm		NA	Perm		NA	Perm
Protected Phases					8			2			6	
Permitted Phases				8		8			2			6
Actuated Green, G (s)				11.2	11.2	11.2		41.3	41.3		41.3	41.3
Effective Green, g (s)				10.7	10.7	10.7		41.3	41.3		41.3	41.3
Actuated g/C Ratio				0.18	0.18	0.18		0.69	0.69		0.69	0.69
Clearance Time (s)				3.5	3.5	3.5		4.0	4.0		4.0	4.0
Vehicle Extension (s)				2.0	2.0	2.0		2.0	2.0		2.0	2.0
Lane Grp Cap (vph)				299	299	497		1211	1035		2436	1089
v/s Ratio Prot								c0.42			0.26	
v/s Ratio Perm				c0.09	0.08	0.04			0.11			0.18
v/c Ratio				0.49	0.47	0.22		0.61	0.16		0.38	0.26
Uniform Delay, d1				22.2	22.1	21.1		5.0	3.3		4.0	3.5
Progression Factor				1.00	1.00	1.00		0.74	0.45		1.00	1.00
Incremental Delay, d2				0.5	0.4	0.1		2.1	0.3		0.5	0.6
Delay (s)				22.7	22.6	21.2		5.9	1.8		4.4	4.1
Level of Service				C	C	C		A	A		A	A
Approach Delay (s)		0.0			21.7			4.9			4.3	
Approach LOS		A			C			A			A	

Intersection Summary			
HCM 2000 Control Delay	8.8	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.59		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	61.9%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 21: El Charro Rd & I-580 EB Ramps

BART to Livermore Extension Project
 2025 Express Bus + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗		↖↗					↕↔	↖		↕↔	↖
Traffic Volume (vph)	321	0	357	0	0	0	0	898	281	0	881	0
Future Volume (vph)	321	0	357	0	0	0	0	898	281	0	881	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0					4.0	4.0		4.0	
Lane Util. Factor	0.97		0.88					0.91	0.91		0.91	
Frt	1.00		0.85					0.99	0.85		1.00	
Flt Protected	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (prot)	3433		2787					3372	1441		3390	
Flt Permitted	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (perm)	3433		2787					3372	1441		3390	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	349	0	388	0	0	0	0	976	305	0	958	0
RTOR Reduction (vph)	0	0	193	0	0	0	0	3	82	0	0	0
Lane Group Flow (vph)	349	0	195	0	0	0	0	1010	186	0	958	0
Turn Type	Prot		Perm					NA	Perm		NA	Perm
Protected Phases	4							2			6	
Permitted Phases			4						2			6
Actuated Green, G (s)	10.4		10.4					41.6	41.6		41.6	
Effective Green, g (s)	10.4		10.4					41.6	41.6		41.6	
Actuated g/C Ratio	0.17		0.17					0.69	0.69		0.69	
Clearance Time (s)	4.0		4.0					4.0	4.0		4.0	
Vehicle Extension (s)	2.0		2.0					3.0	3.0		3.0	
Lane Grp Cap (vph)	595		483					2337	999		2350	
v/s Ratio Prot	c0.10							c0.30			0.28	
v/s Ratio Perm			0.07						0.13			
v/c Ratio	0.59		0.40					0.43	0.19		0.41	
Uniform Delay, d1	22.8		22.0					4.0	3.2		3.9	
Progression Factor	1.00		1.00					1.00	1.00		0.81	
Incremental Delay, d2	1.0		0.2					0.6	0.4		0.5	
Delay (s)	23.8		22.2					4.6	3.7		3.7	
Level of Service	C		C					A	A		A	
Approach Delay (s)		23.0			0.0			4.4			3.7	
Approach LOS		C			A			A			A	

Intersection Summary

HCM 2000 Control Delay	8.8	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.46		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	43.6%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 22: El Charro Rd & Stoneridge Dr/Jack London Blvd

BART to Livermore Extension Project
 2025 Express Bus + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔↔↔	↑↑	↔	↔	↑↑	↔↔	↔	↑↑		↔↔↔	↑	↔↔
Traffic Volume (vph)	260	565	4	3	307	462	2	33	3	746	25	136
Future Volume (vph)	260	565	4	3	307	462	2	33	3	746	25	136
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	0.94	0.95	1.00	1.00	0.95	0.88	1.00	0.95		0.94	1.00	0.88
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	4491	3185	1425	1593	3185	2508	1593	3149		4491	1676	2508
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	4491	3185	1425	1593	3185	2508	1593	3149		4491	1676	2508
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	283	614	4	3	334	502	2	36	3	811	27	148
RTOR Reduction (vph)	0	0	3	0	0	231	0	3	0	0	0	90
Lane Group Flow (vph)	283	614	1	3	334	271	2	36	0	811	27	58
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Prot	NA		Prot	NA	Perm
Protected Phases	7	4		3	8	1	5	2		1	6	
Permitted Phases			4			8						6
Actuated Green, G (s)	8.5	23.3	23.3	0.7	15.5	36.2	0.7	6.3		20.7	26.3	26.3
Effective Green, g (s)	8.5	23.3	23.3	0.7	15.5	36.2	0.7	6.3		20.7	26.3	26.3
Actuated g/C Ratio	0.13	0.35	0.35	0.01	0.23	0.54	0.01	0.09		0.31	0.39	0.39
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	569	1107	495	16	736	1355	16	296		1387	657	984
v/s Ratio Prot	0.06	c0.19		0.00	c0.10	0.06	0.00	c0.01		c0.18	0.02	
v/s Ratio Perm			0.00			0.05						0.02
v/c Ratio	0.50	0.55	0.00	0.19	0.45	0.20	0.12	0.12		0.58	0.04	0.06
Uniform Delay, d1	27.3	17.7	14.3	32.9	22.1	7.9	32.8	27.8		19.5	12.6	12.7
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	0.7	0.6	0.0	5.6	0.4	0.1	3.5	0.2		0.6	0.0	0.0
Delay (s)	27.9	18.3	14.3	38.5	22.6	8.0	36.4	28.0		20.2	12.6	12.7
Level of Service	C	B	B	D	C	A	D	C		C	B	B
Approach Delay (s)		21.3			13.9			28.4			18.8	
Approach LOS		C			B			C			B	

Intersection Summary

HCM 2000 Control Delay	18.3	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.53		
Actuated Cycle Length (s)	67.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	53.1%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
24: Airway Blvd/Driveway & N Canyons Pkwy

BART to Livermore Extension Project
2025 Express Bus + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑	↑	↑↑	↑	↑		↑	↑↑		↑	
Traffic Volume (vph)	0	535	370	812	64	0	52	0	738	0	0	0
Future Volume (vph)	0	535	370	812	64	0	52	0	738	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0	4.0	4.0			4.4	4.0			
Lane Util. Factor		0.95	1.00	0.97	1.00			1.00	0.88			
Frt		1.00	0.85	1.00	1.00			1.00	0.85			
Flt Protected		1.00	1.00	0.95	1.00			0.95	1.00			
Satd. Flow (prot)		3539	1583	3433	1863			1770	2787			
Flt Permitted		1.00	1.00	0.95	1.00			0.95	1.00			
Satd. Flow (perm)		3539	1583	3433	1863			1770	2787			
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	582	402	883	70	0	57	0	802	0	0	0
RTOR Reduction (vph)	0	0	267	0	0	0	0	0	400	0	0	0
Lane Group Flow (vph)	0	582	135	883	70	0	0	57	402	0	0	0
Turn Type		NA	Perm	Prot	NA	Perm	Split	NA	pm+ov			
Protected Phases		2		1	6		8	8	1	4	4	
Permitted Phases			2			6			8			
Actuated Green, G (s)		18.9	18.9	23.2	48.1			4.0	27.2			
Effective Green, g (s)		20.9	20.9	25.2	50.1			3.8	31.2			
Actuated g/C Ratio		0.34	0.34	0.40	0.80			0.06	0.50			
Clearance Time (s)		6.0	6.0	6.0	6.0			4.2	6.0			
Vehicle Extension (s)		3.0	3.0	3.0	3.0			3.0	3.0			
Lane Grp Cap (vph)		1187	531	1388	1498			107	1574			
v/s Ratio Prot		c0.16		c0.26	0.04			0.03	c0.10			
v/s Ratio Perm			0.09						0.04			
v/c Ratio		0.49	0.25	0.64	0.05			0.53	0.26			
Uniform Delay, d1		16.5	15.0	14.9	1.2			28.4	8.9			
Progression Factor		1.00	1.00	1.00	1.00			1.00	1.00			
Incremental Delay, d2		0.3	0.3	1.0	0.0			5.0	0.1			
Delay (s)		16.8	15.3	15.8	1.3			33.4	9.0			
Level of Service		B	B	B	A			C	A			
Approach Delay (s)		16.2			14.8			10.6			0.0	
Approach LOS		B			B			B			A	

Intersection Summary		
HCM 2000 Control Delay	14.0	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.62	B
Actuated Cycle Length (s)	62.3	Sum of lost time (s)
Intersection Capacity Utilization	52.7%	16.4
Analysis Period (min)	15	ICU Level of Service
		A

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
25: Airway Blvd & I-580 WB Ramps

BART to Livermore Extension Project
2025 Express Bus + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↙	↖	↗		↑↑	↗		↑↑↑	
Traffic Volume (vph)	0	0	0	72	26	155	0	695	309	0	614	642
Future Volume (vph)	0	0	0	72	26	155	0	695	309	0	614	642
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0	4.0	4.0		4.0	4.0		4.0	
Lane Util. Factor				0.95	0.95	0.88		0.95	1.00		0.91	
Frt				1.00	1.00	0.85		1.00	0.85		0.92	
Flt Protected				0.95	0.97	1.00		1.00	1.00		1.00	
Satd. Flow (prot)				1681	1721	2787		3539	1583		4695	
Flt Permitted				0.95	0.97	1.00		1.00	1.00		1.00	
Satd. Flow (perm)				1681	1721	2787		3539	1583		4695	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	78	28	168	0	755	336	0	667	698
RTOR Reduction (vph)	0	0	0	0	0	152	0	0	65	0	135	0
Lane Group Flow (vph)	0	0	0	41	65	16	0	755	271	0	1230	0
Turn Type				Split	NA	Perm		NA	Perm		NA	
Protected Phases				8	8			2			6	
Permitted Phases						8			2			
Actuated Green, G (s)				7.5	7.5	7.5		63.2	63.2		63.2	
Effective Green, g (s)				7.5	7.5	7.5		64.5	64.5		64.5	
Actuated g/C Ratio				0.09	0.09	0.09		0.81	0.81		0.81	
Clearance Time (s)				4.0	4.0	4.0		5.3	5.3		5.3	
Vehicle Extension (s)				2.0	2.0	2.0		4.0	4.0		4.0	
Lane Grp Cap (vph)				157	161	261		2853	1276		3785	
v/s Ratio Prot				0.02	c0.04			0.21			c0.26	
v/s Ratio Perm						0.01			0.17			
v/c Ratio				0.26	0.40	0.06		0.26	0.21		0.32	
Uniform Delay, d1				33.7	34.1	33.0		1.9	1.8		2.0	
Progression Factor				1.00	1.00	1.00		1.00	1.00		1.00	
Incremental Delay, d2				0.3	0.6	0.0		0.2	0.4		0.2	
Delay (s)				34.0	34.7	33.1		2.1	2.2		2.3	
Level of Service				C	C	C		A	A		A	
Approach Delay (s)		0.0			33.6			2.2			2.3	
Approach LOS		A			C			A			A	

Intersection Summary

HCM 2000 Control Delay	5.4	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.33		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	36.3%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 26: Airway Blvd & I-580 EB Ramps/Kitty Hawk Rd

BART to Livermore Extension Project
 2025 Express Bus + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↑	↖	↖	↑	↖	↖	↕↔		↖	↕↔	
Traffic Volume (vph)	574	224	305	63	79	140	28	323	132	111	252	263
Future Volume (vph)	574	224	305	63	79	140	28	323	132	111	252	263
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.4	4.4	4.4	4.0	4.0		4.0	4.0	
Lane Util. Factor	0.97	1.00	1.00	1.00	1.00	1.00	1.00	0.95		1.00	0.95	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.96		1.00	0.92	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	3433	1863	1583	1770	1863	1583	1770	3386		1770	3268	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	3433	1863	1583	1770	1863	1583	1770	3386		1770	3268	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	624	243	332	68	86	152	30	351	143	121	274	286
RTOR Reduction (vph)	0	0	246	0	0	117	0	54	0	0	171	0
Lane Group Flow (vph)	624	243	86	68	86	35	30	440	0	121	389	0
Turn Type	Split	NA	Perm	Split	NA	pm+ov	Prot	NA		Prot	NA	
Protected Phases	7	7		8	8	1	5	2		1	6	
Permitted Phases			7			8						
Actuated Green, G (s)	23.2	23.2	23.2	11.2	11.2	21.4	3.8	28.1		10.2	35.0	
Effective Green, g (s)	23.2	23.2	23.2	10.8	10.8	20.6	3.3	29.4		10.2	36.3	
Actuated g/C Ratio	0.26	0.26	0.26	0.12	0.12	0.23	0.04	0.33		0.11	0.40	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	3.5	5.3		4.0	5.3	
Vehicle Extension (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	3.5		2.0	4.0	
Lane Grp Cap (vph)	884	480	408	212	223	362	64	1106		200	1318	
v/s Ratio Prot	c0.18	0.13		0.04	c0.05	0.01	0.02	c0.13		c0.07	0.12	
v/s Ratio Perm			0.05			0.01						
v/c Ratio	0.71	0.51	0.21	0.32	0.39	0.10	0.47	0.40		0.60	0.30	
Uniform Delay, d1	30.3	28.5	26.2	36.2	36.5	27.4	42.5	23.5		38.0	18.2	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	2.1	0.3	0.1	0.3	0.4	0.0	2.0	1.1		3.5	0.6	
Delay (s)	32.4	28.8	26.3	36.6	36.9	27.4	44.5	24.5		41.5	18.8	
Level of Service	C	C	C	D	D	C	D	C		D	B	
Approach Delay (s)		30.0			32.1			25.7			22.8	
Approach LOS		C			C			C			C	

Intersection Summary

HCM 2000 Control Delay	27.6	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.52		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	16.8
Intersection Capacity Utilization	61.0%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 27: Collier Canyon Rd & N Canyons Pkwy/Portola Ave

BART to Livermore Extension Project
 2025 Express Bus + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↖	↗↗	↘	↖	↗↗	↘	↖	↗		↖	↗	↘
Traffic Volume (vph)	304	710	150	83	250	24	48	7	305	130	13	97
Future Volume (vph)	304	710	150	83	250	24	48	7	305	130	13	97
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	5.2	5.2
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.85		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	1770	1590		1770	1863	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	1770	1590		1770	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	330	772	163	90	272	26	52	8	332	141	14	105
RTOR Reduction (vph)	0	0	106	0	0	18	0	236	0	0	0	75
Lane Group Flow (vph)	330	772	57	90	272	8	52	104	0	141	14	30
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA		Prot	NA	Perm
Protected Phases	1	6		5	2		3	8		7	NA	4
Permitted Phases			6			2						4
Actuated Green, G (s)	11.5	25.9	25.9	7.4	21.8	21.8	3.8	15.9		10.2	22.7	22.7
Effective Green, g (s)	11.5	27.2	27.2	7.4	23.1	23.1	3.8	16.9		10.2	22.1	22.1
Actuated g/C Ratio	0.15	0.35	0.35	0.10	0.30	0.30	0.05	0.22		0.13	0.28	0.28
Clearance Time (s)	4.0	5.3	5.3	4.0	5.3	5.3	4.0	5.0		4.0	4.6	4.6
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	508	1238	554	168	1052	470	86	345		232	529	450
v/s Ratio Prot	c0.10	c0.22		0.05	0.08		0.03	c0.07		c0.08	0.01	
v/s Ratio Perm			0.04			0.00						0.02
v/c Ratio	0.65	0.62	0.10	0.54	0.26	0.02	0.60	0.30		0.61	0.03	0.07
Uniform Delay, d1	31.2	21.0	17.0	33.5	20.8	19.3	36.2	25.5		31.9	20.0	20.3
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	2.9	1.0	0.1	3.3	0.1	0.0	11.4	0.5		4.5	0.0	0.1
Delay (s)	34.1	22.0	17.1	36.8	20.9	19.3	47.6	26.0		36.3	20.1	20.3
Level of Service	C	C	B	D	C	B	D	C		D	C	C
Approach Delay (s)		24.5			24.5			28.8			29.0	
Approach LOS		C			C			C			C	
























Intersection Summary

HCM 2000 Control Delay	25.7	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.57		
Actuated Cycle Length (s)	77.7	Sum of lost time (s)	17.2
Intersection Capacity Utilization	64.0%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
28: Isabel Ave/Campus Hill Dr & Portola Ave



















BART to Livermore Extension Project
2025 Express Bus + Garage PM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	4	643	524	228	175	101	234	342	83	126	274	2
Future Volume (vph)	4	643	524	228	175	101	234	342	83	126	274	2
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	5.8	5.8
Lane Util. Factor	1.00	0.95	0.88	0.94	0.95		0.97	0.95	1.00	1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	0.94		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3539	2787	4990	3345		3433	3539	1583	1770	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	3539	2787	4990	3345		3433	3539	1583	1770	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	4	699	570	248	190	110	254	372	90	137	298	2
RTOR Reduction (vph)	0	0	363	0	59	0	0	0	72	0	0	2
Lane Group Flow (vph)	4	699	207	248	241	0	254	372	18	137	298	0
Turn Type	Prot	NA	Perm	Prot	NA		Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4						2			6
Actuated Green, G (s)	1.5	28.5	28.5	9.2	36.2		9.2	14.8	14.8	11.1	17.1	17.1
Effective Green, g (s)	1.5	29.8	29.8	9.2	37.5		9.2	16.1	16.1	11.1	16.2	16.2
Actuated g/C Ratio	0.02	0.36	0.36	0.11	0.46		0.11	0.20	0.20	0.14	0.20	0.20
Clearance Time (s)	4.0	5.3	5.3	4.0	5.3		4.0	5.3	5.3	4.0	4.9	4.9
Vehicle Extension (s)	2.0	3.0	3.0	2.0	3.0		2.0	3.0	3.0	2.0	3.0	3.0
Lane Grp Cap (vph)	32	1282	1010	558	1526		384	693	310	239	697	311
v/s Ratio Prot	0.00	c0.20		c0.05	0.07		0.07	c0.11		c0.08	0.08	
v/s Ratio Perm			0.07						0.01			0.00
v/c Ratio	0.12	0.55	0.20	0.44	0.16		0.66	0.54	0.06	0.57	0.43	0.00
Uniform Delay, d1	39.7	20.8	18.0	34.1	13.1		35.0	29.7	26.9	33.3	28.9	26.5
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.6	0.5	0.1	0.2	0.0		3.3	0.8	0.1	2.1	0.4	0.0
Delay (s)	40.3	21.3	18.1	34.3	13.1		38.3	30.5	27.0	35.4	29.4	26.5
Level of Service	D	C	B	C	B		D	C	C	D	C	C
Approach Delay (s)		19.9			22.7			32.8			31.2	
Approach LOS		B			C			C			C	
Intersection Summary												
HCM 2000 Control Delay			25.2			HCM 2000 Level of Service			C			
HCM 2000 Volume to Capacity ratio			0.54									
Actuated Cycle Length (s)			82.2			Sum of lost time (s)			17.8			
Intersection Capacity Utilization			57.6%			ICU Level of Service			B			
Analysis Period (min)			15									

c Critical Lane Group























HCM Signalized Intersection Capacity Analysis
 29: Isabel Ave & I-580 WB Ramps

BART to Livermore Extension Project
 2025 Express Bus + Garage PM

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations													
Traffic Volume (vph)	0	0	0	680	0	275	0	364	0	0	621	402	
Future Volume (vph)	0	0	0	680	0	275	0	364	0	0	621	402	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)				4.0		4.0		5.6			5.6	5.6	
Lane Util. Factor				0.97		1.00		0.95			0.95	1.00	
Frt				1.00		0.85		1.00			1.00	0.85	
Flt Protected				0.95		1.00		1.00			1.00	1.00	
Satd. Flow (prot)				3433		1583		3539			3539	1583	
Flt Permitted				0.95		1.00		1.00			1.00	1.00	
Satd. Flow (perm)				3433		1583		3539			3539	1583	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	
Adj. Flow (vph)	0	0	0	739	0	299	0	396	0	0	675	437	
RTOR Reduction (vph)	0	0	0	0	0	214	0	0	0	0	0	229	
Lane Group Flow (vph)	0	0	0	739	0	85	0	396	0	0	675	208	
Turn Type				Prot		Prot		NA	Free		NA	Prot	
Protected Phases				8		8		2			6	6	
Permitted Phases									Free				
Actuated Green, G (s)				11.4		11.4		19.8			19.8	19.8	
Effective Green, g (s)				11.4		11.4		19.0			19.0	19.0	
Actuated g/C Ratio				0.29		0.29		0.48			0.48	0.48	
Clearance Time (s)				4.0		4.0		4.8			4.8	4.8	
Vehicle Extension (s)				2.0		2.0		4.0			4.0	4.0	
Lane Grp Cap (vph)				978		451		1681			1681	751	
v/s Ratio Prot				c0.22		0.05		0.11			c0.19	0.13	
v/s Ratio Perm													
v/c Ratio				0.76		0.19		0.24			0.40	0.28	
Uniform Delay, d1				13.0		10.8		6.2			6.8	6.3	
Progression Factor				1.00		1.00		0.98			1.00	1.00	
Incremental Delay, d2				3.0		0.1		0.3			0.2	0.3	
Delay (s)				16.0		10.9		6.4			7.0	6.6	
Level of Service				B		B		A			A	A	
Approach Delay (s)		0.0			14.5			6.4			6.9		
Approach LOS		A			B			A			A		
Intersection Summary													
HCM 2000 Control Delay			9.9	HCM 2000 Level of Service					A				
HCM 2000 Volume to Capacity ratio			0.53										
Actuated Cycle Length (s)			40.0	Sum of lost time (s)					9.6				
Intersection Capacity Utilization			44.6%	ICU Level of Service					A				
Analysis Period (min)			15										
c Critical Lane Group													

HCM Signalized Intersection Capacity Analysis
30: Isabel Ave & I-580 EB Ramps

BART to Livermore Extension Project
2025 Express Bus + Garage PM

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations	 		 					 			 		
Traffic Volume (vph)	187	0	351	0	0	0	0	692	723	0	890	637	
Future Volume (vph)	187	0	351	0	0	0	0	692	723	0	890	637	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)	4.0		4.0					4.0	4.0		4.0	4.0	
Lane Util. Factor	0.97		0.88					0.95	1.00		0.95	1.00	
Frt	1.00		0.85					1.00	0.85		1.00	0.85	
Flt Protected	0.95		1.00					1.00	1.00		1.00	1.00	
Satd. Flow (prot)	3433		2787					3539	1583		3539	1583	
Flt Permitted	0.95		1.00					1.00	1.00		1.00	1.00	
Satd. Flow (perm)	3433		2787					3539	1583		3539	1583	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	
Adj. Flow (vph)	203	0	382	0	0	0	0	752	786	0	967	692	
RTOR Reduction (vph)	0	0	211	0	0	0	0	0	0	0	0	0	
Lane Group Flow (vph)	203	0	171	0	0	0	0	752	786	0	967	692	
Turn Type	Prot		Perm					NA	Free		NA	Free	
Protected Phases	4							2			6		
Permitted Phases			4						Free			Free	
Actuated Green, G (s)	9.7		9.7					61.3	80.0		61.3	80.0	
Effective Green, g (s)	9.7		9.7					62.3	80.0		62.3	80.0	
Actuated g/C Ratio	0.12		0.12					0.78	1.00		0.78	1.00	
Clearance Time (s)	4.0		4.0					5.0			5.0		
Vehicle Extension (s)	2.0		2.0					4.0			4.0		
Lane Grp Cap (vph)	416		337					2755	1583		2755	1583	
v/s Ratio Prot	0.06							0.21			0.27		
v/s Ratio Perm			0.06						c0.50			0.44	
v/c Ratio	0.49		0.51					0.27	0.50		0.35	0.44	
Uniform Delay, d1	32.8		32.9					2.5	0.0		2.7	0.0	
Progression Factor	1.00		1.00					1.00	1.00		0.65	1.00	
Incremental Delay, d2	0.3		0.4					0.1	1.1		0.3	0.8	
Delay (s)	33.2		33.4					2.6	1.1		2.1	0.8	
Level of Service	C		C					A	A		A	A	
Approach Delay (s)		33.3			0.0			1.8			1.5		
Approach LOS		C			A			A			A		
Intersection Summary													
HCM 2000 Control Delay			6.6									HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio			0.55										
Actuated Cycle Length (s)			80.0									Sum of lost time (s)	8.0
Intersection Capacity Utilization			43.5%									ICU Level of Service	A
Analysis Period (min)			15										
c Critical Lane Group													

HCM Signalized Intersection Capacity Analysis
 31: Isabel Ave & Airway Blvd

BART to Livermore Extension Project
 2025 Express Bus + Garage PM




































Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↑	↗	↖	↑	↗	↖	↑↑↑	↗	↖↗	↑↑↑	↗
Traffic Volume (vph)	0	167	459	106	115	76	252	1188	30	305	1334	12
Future Volume (vph)	0	167	459	106	115	76	252	1188	30	305	1334	12
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.2	5.6	5.2	5.2	5.6	4.0	4.0	4.0	4.0	4.0	5.0
Lane Util. Factor		1.00	1.00	1.00	1.00	1.00	1.00	0.91	1.00	0.97	0.91	1.00
Frt		1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1863	1583	1770	1863	1583	1770	5085	1583	3433	5085	1583
Flt Permitted		1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)		1863	1583	1770	1863	1583	1770	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	182	499	115	125	83	274	1291	33	332	1450	13
RTOR Reduction (vph)	0	0	69	0	0	48	0	0	19	0	0	8
Lane Group Flow (vph)	0	182	430	115	125	35	274	1291	14	332	1450	5
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4	5	3	8	1	5	2		1	NA	6
Permitted Phases			4			8			2			6
Actuated Green, G (s)		14.2	31.2	9.0	27.8	40.4	17.0	37.3	37.3	12.6	32.9	32.9
Effective Green, g (s)		13.6	30.0	8.4	27.2	39.2	18.0	38.3	38.3	13.6	33.9	32.9
Actuated g/C Ratio		0.15	0.33	0.09	0.29	0.42	0.20	0.41	0.41	0.15	0.37	0.36
Clearance Time (s)		4.6	5.0	4.6	4.6	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Extension (s)		3.0	3.0	3.0	3.0	3.0	3.0	5.0	5.0	3.0	5.0	5.0
Lane Grp Cap (vph)		274	514	161	549	672	345	2110	656	505	1867	564
v/s Ratio Prot		0.10	c0.15	c0.06	0.07	0.01	c0.15	0.25		0.10	c0.29	
v/s Ratio Perm			0.12			0.02			0.01			0.00
v/c Ratio		0.66	0.84	0.71	0.23	0.05	0.79	0.61	0.02	0.66	0.78	0.01
Uniform Delay, d1		37.2	28.9	40.8	24.6	15.6	35.4	21.2	15.9	37.2	25.8	19.2
Progression Factor		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2		6.0	11.3	14.0	0.2	0.0	11.9	0.8	0.0	3.1	2.5	0.0
Delay (s)		43.1	40.2	54.8	24.8	15.7	47.3	21.9	16.0	40.2	28.3	19.2
Level of Service		D	D	D	C	B	D	C	B	D	C	B
Approach Delay (s)		41.0			33.1			26.2			30.4	
Approach LOS		D			C			C			C	

Intersection Summary		
HCM 2000 Control Delay	30.7	HCM 2000 Level of Service C
HCM 2000 Volume to Capacity ratio	0.81	
Actuated Cycle Length (s)	92.3	Sum of lost time (s) 20.0
Intersection Capacity Utilization	72.4%	ICU Level of Service C
Analysis Period (min)	15	

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
32: Isabel Ave & Jack London Blvd

BART to Livermore Extension Project
2025 Express Bus + Garage PM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 	 			 		 	  		 	  	
Traffic Volume (vph)	128	673	253	200	143	297	89	1110	328	444	1224	59
Future Volume (vph)	128	673	253	200	143	297	89	1110	328	444	1224	59
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.97	0.91	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	3433	5085	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	3433	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	139	732	275	217	155	323	97	1207	357	483	1330	64
RTOR Reduction (vph)	0	0	133	0	0	42	0	0	156	0	0	41
Lane Group Flow (vph)	139	732	142	217	155	281	97	1207	201	483	1330	23
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8	1	5	2		1	6	
Permitted Phases			4			8			2			6
Actuated Green, G (s)	8.3	26.9	26.9	12.7	31.3	46.0	5.2	28.5	28.5	14.7	38.0	38.0
Effective Green, g (s)	8.3	26.9	26.9	12.7	31.3	46.0	5.2	28.5	28.5	14.7	38.0	38.0
Actuated g/C Ratio	0.08	0.26	0.26	0.12	0.30	0.44	0.05	0.27	0.27	0.14	0.37	0.37
Clearance Time (s)	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	273	915	409	216	1065	780	171	1393	433	485	1857	578
v/s Ratio Prot	0.04	c0.21		c0.12	0.04	c0.05	0.03	c0.24		c0.14	0.26	
v/s Ratio Perm			0.09			0.13			0.13			0.01
v/c Ratio	0.51	0.80	0.35	1.00	0.15	0.36	0.57	0.87	0.46	1.00	0.72	0.04
Uniform Delay, d1	45.9	36.0	31.4	45.6	26.6	19.2	48.3	35.9	31.4	44.6	28.4	21.3
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.5	5.1	0.5	62.4	0.1	0.3	4.3	5.9	0.8	39.5	1.3	0.0
Delay (s)	47.4	41.1	31.9	108.1	26.6	19.5	52.6	41.9	32.2	84.2	29.7	21.3
Level of Service	D	D	C	F	C	B	D	D	C	F	C	C
Approach Delay (s)		39.7			48.8			40.4			43.4	
Approach LOS		D			D			D			D	

Intersection Summary		
HCM 2000 Control Delay	42.4	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.88	D
Actuated Cycle Length (s)	104.0	Sum of lost time (s)
Intersection Capacity Utilization	81.5%	21.2
Analysis Period (min)	15	ICU Level of Service
		D

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 33: Isabel Ave Connector & Stanley Blvd



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑	↑	↔	↑↑	↔	↔
Traffic Volume (vph)	1689	439	212	549	158	371
Future Volume (vph)	1689	439	212	549	158	371
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	3.8	4.0	4.0	4.0	2.5
Lane Util. Factor	0.95	1.00	0.97	0.95	0.97	0.88
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	3539	1583	3433	3539	3433	2787
Flt Permitted	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (perm)	3539	1583	3433	3539	3433	2787
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	1836	477	230	597	172	403
RTOR Reduction (vph)	0	2	0	0	0	7
Lane Group Flow (vph)	1836	475	230	597	172	396
Turn Type	NA	pm+ov	Prot	NA	Prot	pm+ov
Protected Phases	2	8	1	6	8	1
Permitted Phases		2				8
Actuated Green, G (s)	43.8	52.4	6.0	53.8	8.6	14.6
Effective Green, g (s)	45.5	55.8	6.0	55.5	10.1	17.6
Actuated g/C Ratio	0.62	0.76	0.08	0.75	0.14	0.24
Clearance Time (s)	5.7	5.5	4.0	5.7	5.5	4.0
Vehicle Extension (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Grp Cap (vph)	2187	1200	279	2668	471	666
v/s Ratio Prot	c0.52	0.06	c0.07	0.17	0.05	c0.06
v/s Ratio Perm		0.24				0.08
v/c Ratio	0.84	0.40	0.82	0.22	0.37	0.59
Uniform Delay, d1	11.2	3.1	33.3	2.7	28.8	24.8
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	2.9	0.1	16.9	0.0	0.2	1.0
Delay (s)	14.0	3.2	50.2	2.7	29.0	25.8
Level of Service	B	A	D	A	C	C
Approach Delay (s)	11.8			15.9	26.8	
Approach LOS	B			B	C	

Intersection Summary

HCM 2000 Control Delay	15.0	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.80		
Actuated Cycle Length (s)	73.6	Sum of lost time (s)	12.0
Intersection Capacity Utilization	69.4%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 34: Murrieta Blvd/Driveway & Portola Ave

BART to Livermore Extension Project
 2025 Express Bus + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗		↖	↗		↖	↗	↗		↗	
Traffic Volume (vph)	0	964	124	219	586	1	127	5	319	4	7	0
Future Volume (vph)	0	964	124	219	586	1	127	5	319	4	7	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.8		4.0	5.8		5.2	5.2	5.2		4.0	
Lane Util. Factor		0.95		1.00	0.95		0.95	0.95	1.00		1.00	
Frt		0.98		1.00	1.00		1.00	1.00	0.85		1.00	
Flt Protected		1.00		0.95	1.00		0.95	0.96	1.00		0.98	
Satd. Flow (prot)		3479		1770	3538		1681	1691	1583		1832	
Flt Permitted		1.00		0.95	1.00		0.95	0.96	1.00		0.98	
Satd. Flow (perm)		3479		1770	3538		1681	1691	1583		1832	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	1048	135	238	637	1	138	5	347	4	8	0
RTOR Reduction (vph)	0	10	0	0	0	0	0	0	266	0	0	0
Lane Group Flow (vph)	0	1173	0	238	638	0	72	71	81	0	12	0
Turn Type	Prot	NA		Prot	NA		Split	NA	Perm		Split	NA
Protected Phases	5	2		1	6		8	8			4	4
Permitted Phases									8			
Actuated Green, G (s)		30.2		12.2	46.4		8.8	8.8	8.8		0.6	
Effective Green, g (s)		29.3		12.2	45.5		8.2	8.2	8.2		0.6	
Actuated g/C Ratio		0.42		0.18	0.66		0.12	0.12	0.12		0.01	
Clearance Time (s)		4.9		4.0	4.9		4.6	4.6	4.6		4.0	
Vehicle Extension (s)		2.0		2.0	2.0		2.0	2.0	2.0		2.0	
Lane Grp Cap (vph)		1470		311	2322		198	200	187		15	
v/s Ratio Prot		c0.34		c0.13	0.18		0.04	0.04			c0.01	
v/s Ratio Perm									c0.05			
v/c Ratio		0.80		0.77	0.27		0.36	0.35	0.43		0.80	
Uniform Delay, d1		17.4		27.2	5.0		28.1	28.1	28.4		34.3	
Progression Factor		1.00		1.00	1.00		1.00	1.00	1.00		1.00	
Incremental Delay, d2		2.9		9.7	0.0		0.4	0.4	0.6		127.3	
Delay (s)		20.3		36.9	5.0		28.6	28.5	29.0		161.5	
Level of Service		C		D	A		C	C	C		F	
Approach Delay (s)		20.3			13.7			28.8			161.5	
Approach LOS		C			B			C			F	

Intersection Summary		
HCM 2000 Control Delay	20.3	HCM 2000 Level of Service C
HCM 2000 Volume to Capacity ratio	0.73	
Actuated Cycle Length (s)	69.3	Sum of lost time (s) 19.0
Intersection Capacity Utilization	66.2%	ICU Level of Service C
Analysis Period (min)	15	

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
35: Murrieta Blvd & Jack London Blvd

BART to Livermore Extension Project
2025 Express Bus + Garage PM



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	256	744	432	244	279	128
Future Volume (vph)	256	744	432	244	279	128
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00	1.00	0.95	0.91	
Frt	1.00	0.85	1.00	1.00	0.95	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1770	1583	1770	3539	4845	
Flt Permitted	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	1770	1583	1770	3539	4845	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	278	809	470	265	303	139
RTOR Reduction (vph)	0	494	0	0	115	0
Lane Group Flow (vph)	278	315	470	265	327	0
Turn Type	Prot	Perm	Prot	NA	NA	
Protected Phases	4		5	2	6	
Permitted Phases		4				
Actuated Green, G (s)	14.6	14.6	17.9	31.3	9.4	
Effective Green, g (s)	14.6	14.6	17.9	31.3	9.4	
Actuated g/C Ratio	0.27	0.27	0.33	0.58	0.17	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	479	428	587	2055	844	
v/s Ratio Prot	0.16		c0.27	0.07	c0.07	
v/s Ratio Perm		c0.20				
v/c Ratio	0.58	0.74	0.80	0.13	0.39	
Uniform Delay, d1	17.0	17.9	16.4	5.1	19.7	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	1.8	6.4	7.7	0.0	0.3	
Delay (s)	18.8	24.3	24.1	5.2	20.0	
Level of Service	B	C	C	A	B	
Approach Delay (s)	22.9			17.3	20.0	
Approach LOS	C			B	B	






























Intersection Summary

HCM 2000 Control Delay	20.5	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.68		
Actuated Cycle Length (s)	53.9	Sum of lost time (s)	12.0
Intersection Capacity Utilization	61.0%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 36: Murrieta Blvd & Stanley Blvd

BART to Livermore Extension Project
 2025 Express Bus + Garage PM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 	 			 		 	 			 	
Traffic Volume (vph)	274	1058	493	41	524	157	227	380	18	250	334	181
Future Volume (vph)	274	1058	493	41	524	157	227	380	18	250	334	181
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.9	4.9	4.0	4.9	4.9	4.9	4.9		4.9	4.9	4.0
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.97	0.95		1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	3433	3515		1770	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	3433	3515		1770	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	298	1150	536	45	570	171	247	413	20	272	363	197
RTOR Reduction (vph)	0	0	312	0	0	70	0	4	0	0	0	148
Lane Group Flow (vph)	298	1150	224	45	570	101	247	429	0	272	363	49
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Prot	NA		Prot	NA	Perm
Protected Phases	7	4		3	8	1	5	2		1	6	
Permitted Phases			4			8						6
Actuated Green, G (s)	10.8	28.6	28.6	2.2	20.0	34.4	9.8	14.0		14.4	18.6	18.6
Effective Green, g (s)	10.8	27.7	27.7	2.2	19.1	32.6	8.9	13.1		13.5	17.7	18.6
Actuated g/C Ratio	0.14	0.37	0.37	0.03	0.25	0.43	0.12	0.17		0.18	0.24	0.25
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	493	1303	583	51	898	789	406	612		317	832	391
v/s Ratio Prot	c0.09	c0.32		0.03	0.16	0.02	0.07	c0.12		c0.15	c0.10	
v/s Ratio Perm			0.14			0.04						0.03
v/c Ratio	0.60	0.88	0.38	0.88	0.63	0.13	0.61	0.70		0.86	0.44	0.12
Uniform Delay, d1	30.2	22.2	17.5	36.4	24.9	12.8	31.5	29.2		29.9	24.5	22.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	2.1	7.4	0.4	83.2	1.5	0.1	2.6	3.6		19.9	0.4	0.1
Delay (s)	32.3	29.6	17.9	119.6	26.4	12.9	34.1	32.8		49.8	24.9	22.1
Level of Service	C	C	B	F	C	B	C	C		D	C	C
Approach Delay (s)		26.8			28.8			33.3			32.4	
Approach LOS		C			C			C			C	

Intersection Summary		
HCM 2000 Control Delay	29.3	HCM 2000 Level of Service C
HCM 2000 Volume to Capacity ratio	0.82	
Actuated Cycle Length (s)	75.2	Sum of lost time (s) 18.7
Intersection Capacity Utilization	73.1%	ICU Level of Service D
Analysis Period (min)	15	

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 37: Livermore Ave & I-580 WB Ramps

BART to Livermore Extension Project
 2025 Express Bus + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	264	17	17	836	460	0	0	112	0
Future Volume (vph)	0	0	0	264	17	17	836	460	0	0	112	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)					4.0		4.0	4.0			4.0	
Lane Util. Factor					0.95		0.97	1.00			0.95	
Frt					0.99		1.00	1.00			1.00	
Flt Protected					0.96		0.95	1.00			1.00	
Satd. Flow (prot)					1680		3433	1863			3539	
Flt Permitted					0.96		0.95	1.00			1.00	
Satd. Flow (perm)					1680		3433	1863			3539	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	287	18	18	909	500	0	0	122	0
RTOR Reduction (vph)	0	0	0	0	4	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	0	319	0	909	500	0	0	122	0
Turn Type				Split	NA		Prot	NA			NA	
Protected Phases				8	8		5	2			6	
Permitted Phases												
Actuated Green, G (s)					13.0		18.0	32.3			10.8	
Effective Green, g (s)					13.0		17.5	34.0			12.5	
Actuated g/C Ratio					0.24		0.32	0.62			0.23	
Clearance Time (s)					4.0		3.5	5.7			5.7	
Vehicle Extension (s)					2.0		2.0	2.5			2.5	
Lane Grp Cap (vph)					397		1092	1151			804	
v/s Ratio Prot					c0.19		c0.26	c0.27			0.03	
v/s Ratio Perm												
v/c Ratio					0.80		0.83	0.43			0.15	
Uniform Delay, d1					19.8		17.4	5.5			17.0	
Progression Factor					1.00		1.00	1.00			1.00	
Incremental Delay, d2					10.6		5.3	1.2			0.4	
Delay (s)					30.4		22.7	6.7			17.4	
Level of Service					C		C	A			B	
Approach Delay (s)		0.0			30.4			17.0			17.4	
Approach LOS		A			C			B			B	

Intersection Summary			
HCM 2000 Control Delay	19.4	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.72		
Actuated Cycle Length (s)	55.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	102.9%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
38: Livermore Ave & I-580 EB Ramps

BART to Livermore Extension Project
2025 Express Bus + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔	↗					↕		↘	↕	
Traffic Volume (vph)	283	11	1243	0	0	0	0	1023	233	57	320	0
Future Volume (vph)	283	11	1243	0	0	0	0	1023	233	57	320	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0					4.0		4.0	4.0	
Lane Util. Factor		0.95	0.95					0.95		1.00	0.95	
Frt		0.90	0.85					0.97		1.00	1.00	
Flt Protected		0.98	1.00					1.00		0.95	1.00	
Satd. Flow (prot)		1566	1504					3441		1770	3539	
Flt Permitted		0.98	1.00					1.00		0.95	1.00	
Satd. Flow (perm)		1566	1504					3441		1770	3539	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	308	12	1351	0	0	0	0	1112	253	62	348	0
RTOR Reduction (vph)	0	122	323	0	0	0	0	33	0	0	0	0
Lane Group Flow (vph)	0	860	366	0	0	0	0	1332	0	62	348	0
Turn Type	Prot	NA	Perm					NA		Prot	NA	
Protected Phases	7	4						2		1	6	
Permitted Phases			4									
Actuated Green, G (s)		19.9	19.9					24.9		3.2	31.1	
Effective Green, g (s)		19.9	19.9					25.9		2.2	32.1	
Actuated g/C Ratio		0.33	0.33					0.43		0.04	0.54	
Clearance Time (s)		4.0	4.0					5.0		3.0	5.0	
Vehicle Extension (s)		2.0	2.0					2.5		2.0	2.5	
Lane Grp Cap (vph)		519	498					1485		64	1893	
v/s Ratio Prot								c0.39		c0.04	0.10	
v/s Ratio Perm		0.55	0.24									
v/c Ratio		1.66	0.74					0.90		0.97	0.18	
Uniform Delay, d1		20.1	17.7					15.8		28.9	7.2	
Progression Factor		1.00	1.00					1.00		1.00	1.00	
Incremental Delay, d2		304.5	4.8					8.9		99.9	0.2	
Delay (s)		324.5	22.5					24.7		128.7	7.4	
Level of Service		F	C					C		F	A	
Approach Delay (s)		200.0			0.0			24.7			25.8	
Approach LOS		F			A			C			C	































Intersection Summary

HCM 2000 Control Delay	109.8	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.21		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	102.9%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
39: Livermore Ave & Portola Ave

BART to Livermore Extension Project
2025 Express Bus + Garage PM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 	 		 	 		 	 		 	 	 
Traffic Volume (vph)	504	493	145	17	315	58	177	496	78	198	854	403
Future Volume (vph)	504	493	145	17	315	58	177	496	78	198	854	403
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	5.8		4.0	5.8	4.9
Lane Util. Factor	0.97	0.95		1.00	0.95		1.00	0.95		1.00	0.95	1.00
Frt	1.00	0.97		1.00	0.98		1.00	0.98		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3418		1770	3457		1770	3467		1770	3539	1583
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3418		1770	3457		1770	3467		1770	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	548	536	158	18	342	63	192	539	85	215	928	438
RTOR Reduction (vph)	0	26	0	0	16	0	0	10	0	0	0	104
Lane Group Flow (vph)	548	668	0	18	389	0	192	614	0	215	928	334
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	pm+ov
Protected Phases	3	8		7	4		1	6		5	2	3
Permitted Phases												2
Actuated Green, G (s)	19.6	33.8		1.9	16.1		12.1	30.2		13.1	31.2	50.8
Effective Green, g (s)	19.6	35.1		1.9	17.4		12.1	29.3		13.1	30.3	49.0
Actuated g/C Ratio	0.20	0.36		0.02	0.18		0.12	0.30		0.13	0.31	0.50
Clearance Time (s)	4.0	5.3		4.0	5.3		4.0	4.9		4.0	4.9	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	692	1234		34	618		220	1045		238	1103	798
v/s Ratio Prot	c0.16	0.20		0.01	c0.11		0.11	0.18		c0.12	c0.26	0.08
v/s Ratio Perm												0.13
v/c Ratio	0.79	0.54		0.53	0.63		0.87	0.59		0.90	0.84	0.42
Uniform Delay, d1	36.9	24.7		47.2	36.9		41.8	28.8		41.4	31.2	15.2
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	6.2	0.5		14.1	2.1		29.4	0.8		33.5	5.9	0.4
Delay (s)	43.0	25.1		61.3	39.0		71.2	29.7		75.0	37.2	15.5
Level of Service	D	C		E	D		E	C		E	D	B
Approach Delay (s)		33.0			40.0			39.4			36.3	
Approach LOS		C			D			D			D	

Intersection Summary		
HCM 2000 Control Delay	36.3	HCM 2000 Level of Service D
HCM 2000 Volume to Capacity ratio	0.81	
Actuated Cycle Length (s)	97.2	Sum of lost time (s) 18.7
Intersection Capacity Utilization	73.2%	ICU Level of Service D
Analysis Period (min)	15	

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
40: First St/Springtown Blvd & I-580 WB Ramps

BART to Livermore Extension Project
2025 Express Bus + Garage PM





















Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations			↗↗			↗	↗↗	↑			↖↖	↖
Traffic Volume (vph)	0	0	262	0	0	0	387	1494	0	0	421	193
Future Volume (vph)	0	0	262	0	0	0	387	1494	0	0	421	193
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)			4.0				4.0	4.0			5.0	5.0
Lane Util. Factor			0.88				0.97	1.00			0.95	1.00
Frt			0.85				1.00	1.00			1.00	0.85
Flt Protected			1.00				0.95	1.00			1.00	1.00
Satd. Flow (prot)			2787				3433	1863			3539	1583
Flt Permitted			1.00				0.95	1.00			1.00	1.00
Satd. Flow (perm)			2787				3433	1863			3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	285	0	0	0	421	1624	0	0	458	210
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	34
Lane Group Flow (vph)	0	0	285	0	0	0	421	1624	0	0	458	176
Turn Type			Over			Free	Prot	NA			NA	Perm
Protected Phases			5				5	2			6	
Permitted Phases						Free						6
Actuated Green, G (s)			34.4				34.4	80.0			37.6	37.6
Effective Green, g (s)			33.9				33.9	80.0			37.1	37.1
Actuated g/C Ratio			0.42				0.42	1.00			0.46	0.46
Clearance Time (s)			3.5				3.5	4.0			4.5	4.5
Vehicle Extension (s)			2.0				2.0	0.2			4.0	4.0
Lane Grp Cap (vph)			1180				1454	1863			1641	734
v/s Ratio Prot			0.10				0.12	c0.87			0.13	
v/s Ratio Perm												0.11
v/c Ratio			0.24				0.29	0.87			0.28	0.24
Uniform Delay, d1			14.8				15.1	0.0			13.2	12.9
Progression Factor			1.00				0.98	1.00			1.00	1.00
Incremental Delay, d2			0.0				0.0	1.8			0.1	0.2
Delay (s)			14.8				14.8	1.8			13.3	13.2
Level of Service			B				B	A			B	B
Approach Delay (s)		14.8			0.0			4.5			13.3	
Approach LOS		B			A			A			B	

Intersection Summary		
HCM 2000 Control Delay	7.4	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.98	A
Actuated Cycle Length (s)	80.0	Sum of lost time (s)
Intersection Capacity Utilization	82.0%	9.0
Analysis Period (min)	15	ICU Level of Service
		D

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
41: First St & I-580 EB Ramps

BART to Livermore Extension Project
2025 Express Bus + Garage PM

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations													
Traffic Volume (vph)	551	5	744	0	0	0	0	1353	457	85	851	0	
Future Volume (vph)	551	5	744	0	0	0	0	1353	457	85	851	0	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)		4.0	4.0					5.0	5.0	4.0	5.0		
Lane Util. Factor		1.00	0.88					0.95	1.00	1.00	0.95		
Frt		1.00	0.85					1.00	0.85	1.00	1.00		
Flt Protected		0.95	1.00					1.00	1.00	0.95	1.00		
Satd. Flow (prot)		1775	2787					3539	1583	1770	3539		
Flt Permitted		0.95	1.00					1.00	1.00	0.95	1.00		
Satd. Flow (perm)		1775	2787					3539	1583	1770	3539		
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	
Adj. Flow (vph)	599	5	809	0	0	0	0	1471	497	92	925	0	
RTOR Reduction (vph)	0	0	138	0	0	0	0	0	280	0	0	0	
Lane Group Flow (vph)	0	604	671	0	0	0	0	1471	217	92	925	0	
Turn Type	Perm	NA	Perm					NA	Perm	Prot	NA		
Protected Phases		4						2		1	6		
Permitted Phases	4		4						2				
Actuated Green, G (s)		27.5	27.5					35.5	35.5	6.0	44.5		
Effective Green, g (s)		27.0	27.0					35.0	35.0	5.0	44.0		
Actuated g/C Ratio		0.34	0.34					0.44	0.44	0.06	0.55		
Clearance Time (s)		3.5	3.5					4.5	4.5	3.0	4.5		
Vehicle Extension (s)		2.5	2.5					4.0	4.0	2.0	4.0		
Lane Grp Cap (vph)		599	940					1548	692	110	1946		
v/s Ratio Prot								c0.42		c0.05	0.26		
v/s Ratio Perm		0.34	0.24						0.14				
v/c Ratio		1.01	0.71					0.95	0.31	0.84	0.48		
Uniform Delay, d1		26.5	23.1					21.7	14.7	37.1	11.0		
Progression Factor		1.00	1.00					1.00	1.00	0.88	0.65		
Incremental Delay, d2		38.9	2.4					13.8	1.2	38.1	0.8		
Delay (s)		65.4	25.6					35.4	15.9	70.6	7.9		
Level of Service		E	C					D	B	E	A		
Approach Delay (s)		42.6			0.0			30.5			13.6		
Approach LOS		D			A			C			B		
Intersection Summary													
HCM 2000 Control Delay			30.5									HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio			0.96										
Actuated Cycle Length (s)			80.0									Sum of lost time (s)	13.0
Intersection Capacity Utilization			83.7%									ICU Level of Service	E
Analysis Period (min)			15										
c Critical Lane Group													

HCM Signalized Intersection Capacity Analysis
42: 1st St & Mines Rd

BART to Livermore Extension Project
2025 Express Bus + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↘	↑	↗	↘↗	↑	↗	↘	↑↑↑	↗	↘↗	↑↑↑	↗
Traffic Volume (vph)	70	239	58	414	302	389	76	1471	867	360	849	51
Future Volume (vph)	70	239	58	414	302	389	76	1471	867	360	849	51
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	0.97	1.00	1.00	1.00	0.91	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	1863	1583	3433	1863	1583	1770	5085	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	1863	1583	3433	1863	1583	1770	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	76	260	63	450	328	423	83	1599	942	391	923	55
RTOR Reduction (vph)	0	0	54	0	0	33	0	0	157	0	0	27
Lane Group Flow (vph)	76	260	9	450	328	390	83	1599	785	391	923	28
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8	1	5	2		1	6	
Permitted Phases			4			8			2			6
Actuated Green, G (s)	6.0	16.0	16.0	14.0	24.0	37.0	8.3	51.8	51.8	13.0	56.5	56.5
Effective Green, g (s)	6.0	16.0	16.0	14.0	24.0	37.0	8.3	51.8	51.8	13.0	56.5	56.5
Actuated g/C Ratio	0.05	0.14	0.14	0.13	0.22	0.33	0.07	0.47	0.47	0.12	0.51	0.51
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	95	269	228	433	403	585	132	2377	740	402	2592	807
v/s Ratio Prot	0.04	c0.14		c0.13	0.18	0.08	0.05	0.31		c0.11	0.18	
v/s Ratio Perm			0.01			0.17			c0.50			0.02
v/c Ratio	0.80	0.97	0.04	1.04	0.81	0.67	0.63	0.67	1.06	0.97	0.36	0.03
Uniform Delay, d1	51.8	47.1	40.8	48.4	41.3	31.6	49.8	22.9	29.5	48.7	16.3	13.5
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	36.6	45.2	0.1	53.8	11.9	2.9	9.0	0.8	50.6	37.5	0.1	0.0
Delay (s)	88.4	92.3	40.9	102.2	53.2	34.5	58.8	23.7	80.1	86.2	16.3	13.6
Level of Service	F	F	D	F	D	C	E	C	F	F	B	B
Approach Delay (s)		83.5			65.0			45.0			36.2	
Approach LOS		F			E			D			D	




















Intersection Summary

HCM 2000 Control Delay	49.9	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	1.03		
Actuated Cycle Length (s)	110.8	Sum of lost time (s)	16.0
Intersection Capacity Utilization	86.5%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group




















HCM Unsignalized Intersection Capacity Analysis
 43: Vasco Rd & I-580 WB Ramps

BART to Livermore Extension Project
 2025 Express Bus + Garage PM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations								 				
Traffic Volume (veh/h)	0	0	0	0	0	88	0	1830	0	0	429	0
Future Volume (Veh/h)	0	0	0	0	0	88	0	1830	0	0	429	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	0	0	0	96	0	1989	0	0	466	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage (veh)												
Upstream signal (ft)											487	
pX, platoon unblocked												
vC, conflicting volume	1556	2455	466	2455	2455	994	466			1989		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1556	2455	466	2455	2455	994	466			1989		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	100	100	61	100			100		
cM capacity (veh/h)	46	30	543	16	30	244	1092			286		
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	SB 1	SB 2					
Volume Total	0	96	994	994	0	466	0					
Volume Left	0	0	0	0	0	0	0					
Volume Right	0	96	0	0	0	0	0					
cSH	1700	244	1700	1700	1700	1700	1700					
Volume to Capacity	0.00	0.39	0.58	0.58	0.00	0.27	0.00					
Queue Length 95th (ft)	0	45	0	0	0	0	0					
Control Delay (s)	0.0	29.1	0.0	0.0	0.0	0.0	0.0					
Lane LOS	A	D										
Approach Delay (s)	0.0	29.1	0.0			0.0						
Approach LOS	A	D										
Intersection Summary												
Average Delay			1.1									
Intersection Capacity Utilization			62.7%	ICU Level of Service	B							
Analysis Period (min)			15									

HCM Unsignalized Intersection Capacity Analysis
 44: Vasco Rd & I-580 EB Ramps

BART to Livermore Extension Project
 2025 Express Bus + Garage PM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	0	0	0	0	2084	0	64	560	0
Future Volume (Veh/h)	0	0	0	0	0	0	0	2084	0	64	560	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	0	0	0	0	0	2265	0	70	609	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1882	3014	609	3014	3014	1132	609			2265		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1882	3014	609	3014	3014	1132	609			2265		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	100	100	100	100			69		
cM capacity (veh/h)	33	9	438	4	9	197	966			222		
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2						
Volume Total	0	0	1510	755	70	609						
Volume Left	0	0	0	0	70	0						
Volume Right	0	0	0	0	0	0						
cSH	1700	1700	1700	1700	222	1700						
Volume to Capacity	0.00	0.00	0.89	0.44	0.31	0.36						
Queue Length 95th (ft)	0	0	0	0	32	0						
Control Delay (s)	0.0	0.0	0.0	0.0	28.4	0.0						
Lane LOS	A	A			D							
Approach Delay (s)	0.0	0.0	0.0		2.9							
Approach LOS	A	A										
Intersection Summary												
Average Delay			0.7									
Intersection Capacity Utilization			60.9%	ICU Level of Service	B							
Analysis Period (min)			15									

HCM Signalized Intersection Capacity Analysis
45: Vasco Rd & East Ave

BART to Livermore Extension Project
2025 Express Bus + Garage PM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	466	27	96	142	364	235	102	339	12	12	346	358
Future Volume (vph)	466	27	96	142	364	235	102	339	12	12	346	358
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	0.95		0.97	1.00	1.00
Frt	1.00	0.88		1.00	0.94		1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	3124		1770	3331		1770	3521		3433	1863	1583
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1770	3124		1770	3331		1770	3521		3433	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	507	29	104	154	396	255	111	368	13	13	376	389
RTOR Reduction (vph)	0	66	0	0	131	0	0	3	0	0	0	291
Lane Group Flow (vph)	507	67	0	154	520	0	111	378	0	13	376	98
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												6
Actuated Green, G (s)	23.7	30.2		9.5	16.0		6.0	26.0		0.8	20.8	20.8
Effective Green, g (s)	23.7	30.2		9.5	16.0		6.0	26.0		0.8	20.8	20.8
Actuated g/C Ratio	0.29	0.37		0.12	0.19		0.07	0.32		0.01	0.25	0.25
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	508	1143		203	646		128	1109		33	469	399
v/s Ratio Prot	c0.29	0.02		0.09	c0.16		c0.06	0.11		0.00	c0.20	
v/s Ratio Perm												0.06
v/c Ratio	1.00	0.06		0.76	0.80		0.87	0.34		0.39	0.80	0.25
Uniform Delay, d1	29.4	16.9		35.4	31.8		37.9	21.7		40.6	28.9	24.6
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	39.1	0.0		14.9	7.2		41.9	0.2		7.6	9.5	0.3
Delay (s)	68.5	17.0		50.3	39.0		79.7	21.9		48.2	38.4	24.9
Level of Service	E	B		D	D		E	C		D	D	C
Approach Delay (s)		57.8			41.1			34.9			31.8	
Approach LOS		E			D			C			C	

Intersection Summary

HCM 2000 Control Delay	41.3	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.88		
Actuated Cycle Length (s)	82.5	Sum of lost time (s)	16.0
Intersection Capacity Utilization	80.6%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Unsignalized Intersection Capacity Analysis
 46: I-580 WB Ramps & Northfront Rd/Northfront Road



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	→			←	←	→
Traffic Volume (veh/h)	627	36	221	211	5	131
Future Volume (Veh/h)	627	36	221	211	5	131
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	682	39	240	229	5	142
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage (veh)						
Upstream signal (ft)	1007					
pX, platoon unblocked						
vC, conflicting volume			682	1410		702
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			682	1410		702
tC, single (s)			4.1	6.4		6.2
tC, 2 stage (s)						
tF (s)			2.2	3.5		3.3
p0 queue free %			74	96		68
cM capacity (veh/h)			911	112		438
Direction, Lane #	EB 1	WB 1	NB 1	NB 2		
Volume Total	721	469	5	142		
Volume Left	0	240	5	0		
Volume Right	39	0	0	142		
cSH	1700	911	112	438		
Volume to Capacity	0.42	0.26	0.04	0.32		
Queue Length 95th (ft)	0	26	3	35		
Control Delay (s)	0.0	6.8	38.6	17.1		
Lane LOS	A		E	C		
Approach Delay (s)	0.0	6.8	17.8			
Approach LOS	C					
Intersection Summary						
Average Delay	4.4					
Intersection Capacity Utilization	71.8%		ICU Level of Service		C	
Analysis Period (min)	15					

Intersection	
Intersection Delay, s/veh	13.9
Intersection LOS	B

Movement	EBU	EBL	EBT	WBU	WBT	WBR	SBU	SBL	SBR
Lane Configurations		↘	↗↗		↗	↘		↘↘	↗
Traffic Vol, veh/h	0	295	253	0	84	267	0	194	7
Future Vol, veh/h	0	295	253	0	84	267	0	194	7
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	321	275	0	91	290	0	211	8
Number of Lanes	0	1	2	0	1	1	0	2	1

Approach	EB	WB	SB
Opposing Approach	WB	EB	
Opposing Lanes	2	3	0
Conflicting Approach Left	SB		WB
Conflicting Lanes Left	3	0	2
Conflicting Approach Right		SB	EB
Conflicting Lanes Right	0	3	3
HCM Control Delay	14.9	13.4	12
HCM LOS	B	B	B

Lane	EBLn1	EBLn2	EBLn3	WBLn1	WBLn2	SBLn1	SBLn2	SBLn3
Vol Left, %	100%	0%	0%	0%	0%	100%	100%	0%
Vol Thru, %	0%	100%	100%	100%	0%	0%	0%	0%
Vol Right, %	0%	0%	0%	0%	100%	0%	0%	100%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	295	127	127	84	267	97	97	7
LT Vol	295	0	0	0	0	97	97	0
Through Vol	0	127	127	84	0	0	0	0
RT Vol	0	0	0	0	267	0	0	7
Lane Flow Rate	321	138	138	91	290	105	105	8
Geometry Grp	8	8	8	8	8	7	7	7
Degree of Util (X)	0.605	0.24	0.173	0.17	0.482	0.216	0.216	0.009
Departure Headway (Hd)	6.796	6.291	4.538	6.684	5.976	7.389	7.389	4.423
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cap	529	569	787	535	601	485	485	804
Service Time	4.55	4.044	2.29	4.441	3.733	5.148	5.148	2.18
HCM Lane V/C Ratio	0.607	0.243	0.175	0.17	0.483	0.216	0.216	0.01
HCM Control Delay	19.5	11	8.2	10.8	14.2	12.2	12.2	7.2
HCM Lane LOS	C	B	A	B	B	B	B	A
HCM 95th-tile Q	4	0.9	0.6	0.6	2.6	0.8	0.8	0

HCM Signalized Intersection Capacity Analysis
 48: Greenville Rd & Northfront Road/Altamont Pass Road

BART to Livermore Extension Project
 2025 Express Bus + Garage PM



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↑	↑	↑	↑	↑
Traffic Volume (vph)	605	147	1	52	398	1039
Future Volume (vph)	605	147	1	52	398	1039
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	1863	1583	1770	1863	1770	1583
Flt Permitted	1.00	1.00	0.10	1.00	0.95	1.00
Satd. Flow (perm)	1863	1583	191	1863	1770	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	658	160	1	57	433	1129
RTOR Reduction (vph)	0	65	0	0	0	29
Lane Group Flow (vph)	658	95	1	57	433	1100
Turn Type	NA	Perm	Perm	NA	Prot	Perm
Protected Phases	4			8	2	
Permitted Phases		4	8			2
Actuated Green, G (s)	39.0	39.0	39.0	39.0	73.0	73.0
Effective Green, g (s)	39.0	39.0	39.0	39.0	73.0	73.0
Actuated g/C Ratio	0.32	0.32	0.32	0.32	0.61	0.61
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	605	514	62	605	1076	962
v/s Ratio Prot	c0.35			0.03	0.24	
v/s Ratio Perm		0.06	0.01			c0.69
v/c Ratio	1.09	0.18	0.02	0.09	0.40	1.14
Uniform Delay, d1	40.5	29.1	27.5	28.2	12.2	23.5
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	62.7	0.2	0.1	0.1	0.2	77.2
Delay (s)	103.2	29.2	27.6	28.3	12.4	100.7
Level of Service	F	C	C	C	B	F
Approach Delay (s)	88.7			28.3	76.2	
Approach LOS	F			C	E	

Intersection Summary

HCM 2000 Control Delay	79.3	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.12		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	102.8%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
49: Greenville Rd & Southfront Rd

BART to Livermore Extension Project
2025 Express Bus + Garage PM



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	416	113	242	985	67	81
Future Volume (vph)	416	113	242	985	67	81
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.2	5.2	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.88	0.97	0.95	0.95	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	3433	2787	3433	3539	3539	1583
Flt Permitted	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (perm)	3433	2787	3433	3539	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	452	123	263	1071	73	88
RTOR Reduction (vph)	0	93	0	0	0	61
Lane Group Flow (vph)	452	30	263	1071	73	27
Turn Type	Prot	Perm	Prot	NA	NA	Perm
Protected Phases	8		1	6	2	
Permitted Phases		8				2
Actuated Green, G (s)	10.6	10.6	5.0	19.8	10.8	10.8
Effective Green, g (s)	10.0	10.0	5.0	21.5	12.5	12.5
Actuated g/C Ratio	0.25	0.25	0.12	0.53	0.31	0.31
Clearance Time (s)	4.6	4.6	4.0	5.7	5.7	5.7
Vehicle Extension (s)	5.0	5.0	6.0	2.5	2.5	2.5
Lane Grp Cap (vph)	843	684	421	1869	1086	486
v/s Ratio Prot	c0.13		0.08	c0.30	0.02	
v/s Ratio Perm		0.01				0.02
v/c Ratio	0.54	0.04	0.62	0.57	0.07	0.06
Uniform Delay, d1	13.3	11.7	17.0	6.5	10.0	9.9
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.2	0.1	4.9	0.4	0.0	0.0
Delay (s)	14.5	11.8	21.8	6.8	10.0	10.0
Level of Service	B	B	C	A	A	A
Approach Delay (s)	13.9			9.8	10.0	
Approach LOS	B			A	A	

Intersection Summary

HCM 2000 Control Delay	11.0	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.64		
Actuated Cycle Length (s)	40.7	Sum of lost time (s)	13.2
Intersection Capacity Utilization	46.8%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
50: Greenville Rd & Patterson Pass Rd

BART to Livermore Extension Project
2025 Express Bus + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	36	524	59	5	13	7	71	406	320	422	206	46
Future Volume (vph)	36	524	59	5	13	7	71	406	320	422	206	46
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.98		1.00	0.95		1.00	0.93		1.00	0.97	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1835		1770	1761		1770	1740		1770	1812	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	1835		1770	1761		1770	1740		1770	1812	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	39	570	64	5	14	8	77	441	348	459	224	50
RTOR Reduction (vph)	0	4	0	0	6	0	0	23	0	0	6	0
Lane Group Flow (vph)	39	630	0	5	16	0	77	766	0	459	268	0
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												
Actuated Green, G (s)	9.0	33.0		0.8	24.8		8.1	43.8		24.0	59.7	
Effective Green, g (s)	9.0	33.0		0.8	24.8		8.1	43.8		24.0	59.7	
Actuated g/C Ratio	0.08	0.28		0.01	0.21		0.07	0.37		0.20	0.51	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	135	514		12	371		121	648		361	919	
v/s Ratio Prot	c0.02	c0.34		0.00	0.01		0.04	c0.44		c0.26	0.15	
v/s Ratio Perm												
v/c Ratio	0.29	1.23		0.42	0.04		0.64	1.18		1.27	0.29	
Uniform Delay, d1	51.3	42.3		58.2	36.9		53.3	36.9		46.8	16.7	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	1.2	118.3		21.8	0.0		10.5	97.0		142.2	0.8	
Delay (s)	52.5	160.6		79.9	37.0		63.8	133.9		189.0	17.5	
Level of Service	D	F		E	D		E	F		F	B	
Approach Delay (s)		154.3			44.9			127.7			124.9	
Approach LOS		F			D			F			F	

Intersection Summary

HCM 2000 Control Delay	133.6	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.21		
Actuated Cycle Length (s)	117.6	Sum of lost time (s)	16.0
Intersection Capacity Utilization	105.5%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 1: Dougherty Rd & Amador Valley Rd



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	84	498	385	714	1771	137
Future Volume (vph)	84	498	385	714	1771	137
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5	5.7	5.7	
Lane Util. Factor	1.00	1.00	0.97	0.91	0.91	
Frt	1.00	0.85	1.00	1.00	0.99	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1770	1583	3433	5085	5030	
Flt Permitted	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	1770	1583	3433	5085	5030	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	91	541	418	776	1925	149
RTOR Reduction (vph)	0	194	0	0	9	0
Lane Group Flow (vph)	91	347	418	776	2065	0
Turn Type	Perm	Perm	Prot	NA	NA	
Protected Phases			5	2	6	
Permitted Phases	4	4				
Actuated Green, G (s)	21.9	21.9	12.2	56.2	39.5	
Effective Green, g (s)	21.9	21.9	12.2	56.2	39.5	
Actuated g/C Ratio	0.25	0.25	0.14	0.64	0.45	
Clearance Time (s)	4.5	4.5	4.5	5.7	5.7	
Vehicle Extension (s)	1.8	1.8	2.0	4.0	4.0	
Lane Grp Cap (vph)	438	392	474	3236	2250	
v/s Ratio Prot			c0.12	0.15	c0.41	
v/s Ratio Perm	0.05	c0.22				
v/c Ratio	0.21	0.89	0.88	0.24	0.92	
Uniform Delay, d1	26.3	32.0	37.3	6.9	22.9	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.1	20.0	16.9	0.1	6.6	
Delay (s)	26.4	52.0	54.2	6.9	29.5	
Level of Service	C	D	D	A	C	
Approach Delay (s)	48.3			23.5	29.5	
Approach LOS	D			C	C	

Intersection Summary

HCM 2000 Control Delay	30.7	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.90		
Actuated Cycle Length (s)	88.3	Sum of lost time (s)	14.7
Intersection Capacity Utilization	76.6%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

2: Dougherty Rd & Dublin Blvd

BART to Livermore Extension Project
2025 Enhanced Bus + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔↔	↑↑↑	↔↔	↔↔↔	↑↑↑	↔	↔↔↔	↑↑↑	↔↔	↔↔	↑↑↑	↔↔
Traffic Volume (vph)	40	355	419	272	609	365	617	995	115	664	1749	74
Future Volume (vph)	40	355	419	272	609	365	617	995	115	664	1749	74
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	6.0	5.0	5.0	5.5	5.0	5.0	5.5	5.0	5.0	5.5	
Lane Util. Factor	0.97	0.91	0.88	0.94	0.91	1.00	0.94	0.91	0.88	0.97	0.86	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	3433	5085	2787	4990	5085	1583	4990	5085	2787	3433	6369	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	3433	5085	2787	4990	5085	1583	4990	5085	2787	3433	6369	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	43	386	455	296	662	397	671	1082	125	722	1901	80
RTOR Reduction (vph)	0	0	41	0	0	103	0	0	74	0	4	0
Lane Group Flow (vph)	43	386	414	296	662	294	671	1082	51	722	1977	0
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	
Protected Phases	5	2	3	1	6	7	3	8	1	7	4	
Permitted Phases			2			6			8			
Actuated Green, G (s)	11.8	22.5	39.5	15.0	26.2	52.3	17.0	33.0	48.0	26.1	42.1	
Effective Green, g (s)	11.8	22.5	39.5	15.0	26.2	52.3	17.0	33.0	48.0	26.1	42.1	
Actuated g/C Ratio	0.10	0.19	0.33	0.13	0.22	0.44	0.14	0.28	0.41	0.22	0.36	
Clearance Time (s)	5.0	6.0	5.0	5.0	5.5	5.0	5.0	5.5	5.0	5.0	5.5	
Vehicle Extension (s)	2.0	4.5	2.0	2.0	4.5	2.0	2.0	4.5	2.0	2.0	4.5	
Lane Grp Cap (vph)	343	968	932	633	1128	701	718	1420	1132	758	2270	
v/s Ratio Prot	0.01	0.08	0.06	c0.06	c0.13	0.09	0.13	0.21	0.01	c0.21	c0.31	
v/s Ratio Perm			0.08			0.09			0.01			
v/c Ratio	0.13	0.40	0.44	0.47	0.59	0.42	0.93	0.76	0.04	0.95	0.87	
Uniform Delay, d1	48.4	41.9	30.7	47.8	41.1	22.5	50.0	39.0	21.2	45.4	35.5	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.1	0.5	0.1	0.2	1.1	0.1	19.0	2.8	0.0	21.6	4.2	
Delay (s)	48.5	42.3	30.8	48.0	42.2	22.7	69.0	41.7	21.2	67.0	39.7	
Level of Service	D	D	C	D	D	C	E	D	C	E	D	
Approach Delay (s)		36.7			37.7			50.1			47.0	
Approach LOS		D			D			D			D	

Intersection Summary

HCM 2000 Control Delay	44.7	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.81		
Actuated Cycle Length (s)	118.1	Sum of lost time (s)	21.5
Intersection Capacity Utilization	81.7%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

3: Dougherty Rd & I-580 WB Ramps

BART to Livermore Extension Project
2025 Enhanced Bus + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↔↔		↔↔		↑↑↑			↑↑↑	↔
Traffic Volume (vph)	0	0	0	394	0	637	0	1303	0	0	1666	0
Future Volume (vph)	0	0	0	394	0	637	0	1303	0	0	1666	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0		4.0		4.0			4.0	
Lane Util. Factor				0.97		0.88		0.91			0.86	
Frt				1.00		0.85		1.00			1.00	
Flt Protected				0.95		1.00		1.00			1.00	
Satd. Flow (prot)				3433		2787		5085			4806	
Flt Permitted				0.95		1.00		1.00			1.00	
Satd. Flow (perm)				3433		2787		5085			4806	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	428	0	692	0	1416	0	0	1811	0
RTOR Reduction (vph)	0	0	0	0	0	32	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	428	0	660	0	1416	0	0	1811	0
Turn Type				Prot		Prot		NA			NA	Perm
Protected Phases				4		4		2			6	
Permitted Phases												6
Actuated Green, G (s)				18.0		18.0		31.2			31.2	
Effective Green, g (s)				19.4		19.4		32.6			32.6	
Actuated g/C Ratio				0.32		0.32		0.54			0.54	
Clearance Time (s)				5.4		5.4		5.4			5.4	
Vehicle Extension (s)				3.0		3.0		3.0			3.0	
Lane Grp Cap (vph)				1110		901		2762			2611	
v/s Ratio Prot				0.12		c0.24		0.28			c0.38	
v/s Ratio Perm												
v/c Ratio				0.39		0.73		0.51			0.69	
Uniform Delay, d1				15.7		18.0		8.7			10.0	
Progression Factor				1.00		1.00		0.71			1.00	
Incremental Delay, d2				0.2		3.1		0.6			1.5	
Delay (s)				15.9		21.1		6.7			11.6	
Level of Service				B		C		A			B	
Approach Delay (s)		0.0			19.1			6.7			11.6	
Approach LOS		A			B			A			B	

Intersection Summary

HCM 2000 Control Delay	11.9	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.71		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	54.1%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

4: Hopyard Rd/Dougherty Rd & I-580 EB Ramps

BART to Livermore Extension Project
2025 Enhanced Bus + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗		↖↗					↑↑↑	↖		↑↑↑	↖
Traffic Volume (vph)	756	0	1447	0	0	0	0	786	0	0	1527	0
Future Volume (vph)	756	0	1447	0	0	0	0	786	0	0	1527	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0					4.0			4.0	
Lane Util. Factor	0.97		0.88					0.91			0.86	
Frt	1.00		0.85					1.00			1.00	
Flt Protected	0.95		1.00					1.00			1.00	
Satd. Flow (prot)	3433		2787					5085			4806	
Flt Permitted	0.95		1.00					1.00			1.00	
Satd. Flow (perm)	3433		2787					5085			4806	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	822	0	1573	0	0	0	0	854	0	0	1660	0
RTOR Reduction (vph)	0	0	22	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	822	0	1551	0	0	0	0	854	0	0	1660	0
Turn Type	Prot		Prot					NA	Free		NA	Perm
Protected Phases	4		4					2			6	
Permitted Phases									Free			6
Actuated Green, G (s)	29.2		29.2					20.0			20.0	
Effective Green, g (s)	30.6		30.6					21.4			21.4	
Actuated g/C Ratio	0.51		0.51					0.36			0.36	
Clearance Time (s)	5.4		5.4					5.4			5.4	
Vehicle Extension (s)	3.0		3.0					3.0			3.0	
Lane Grp Cap (vph)	1750		1421					1813			1714	
v/s Ratio Prot	0.24		c0.56					0.17			c0.35	
v/s Ratio Perm												
v/c Ratio	0.47		1.09					0.47			0.97	
Uniform Delay, d1	9.5		14.7					14.9			19.0	
Progression Factor	1.00		1.00					1.00			0.75	
Incremental Delay, d2	0.2		53.0					0.9			13.0	
Delay (s)	9.7		67.7					15.8			27.3	
Level of Service	A		E					B			C	
Approach Delay (s)		47.8			0.0			15.8			27.3	
Approach LOS		D			A			B			C	

Intersection Summary

HCM 2000 Control Delay	35.3	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	1.04		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	86.8%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
5: Hopyard Rd & Owens Rd

BART to Livermore Extension Project
2025 Enhanced Bus + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	200	97	52	116	132	199	139	684	144	845	1626	554
Future Volume (vph)	200	97	52	116	132	199	139	684	144	845	1626	554
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	2.7	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	0.91	0.91		1.00	0.95	0.95	1.00	0.91	1.00	0.97	0.91	
Frt	1.00	0.97		1.00	0.95	0.85	1.00	1.00	0.85	1.00	0.96	
Flt Protected	0.95	0.98		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1610	3218		1770	1685	1504	1770	5085	1583	3433	4891	
Flt Permitted	0.95	0.98		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1610	3218		1770	1685	1504	1770	5085	1583	3433	4891	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	217	105	57	126	143	216	151	743	157	918	1767	602
RTOR Reduction (vph)	0	26	0	0	18	49	0	0	117	0	68	0
Lane Group Flow (vph)	119	234	0	126	192	100	151	743	40	918	2301	0
Turn Type	Split	NA		Split	NA	pm+ov	Prot	NA	Perm	Prot	NA	
Protected Phases	8	8		4	4	1	5	2		1	6	
Permitted Phases						4			2			
Actuated Green, G (s)	6.5	6.5		9.7	9.7	41.7	8.0	21.5	21.5	32.0	45.5	
Effective Green, g (s)	7.8	7.8		11.0	11.0	44.3	8.0	23.2	23.2	32.0	47.2	
Actuated g/C Ratio	0.09	0.09		0.12	0.12	0.49	0.09	0.26	0.26	0.36	0.52	
Clearance Time (s)	5.3	5.3		5.3	5.3	4.0	4.0	5.7	5.7	4.0	5.7	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	139	278		216	205	785	157	1310	408	1220	2565	
v/s Ratio Prot	c0.07	0.07		0.07	c0.11	0.05	0.09	0.15		c0.27	c0.47	
v/s Ratio Perm						0.02			0.03			
v/c Ratio	0.86	0.84		0.58	0.93	0.13	0.96	0.57	0.10	0.75	0.90	
Uniform Delay, d1	40.5	40.5		37.3	39.1	12.4	40.8	29.0	25.4	25.5	19.2	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	37.2	19.5		4.0	44.4	0.1	60.1	0.6	0.1	2.7	4.6	
Delay (s)	77.7	60.0		41.3	83.5	12.5	100.9	29.6	25.5	28.2	23.8	
Level of Service	E	E		D	F	B	F	C	C	C	C	
Approach Delay (s)		65.5			50.7			39.2			25.0	
Approach LOS		E			D			D			C	



































Intersection Summary

HCM 2000 Control Delay	33.2	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.91		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	82.6%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
6: Hopyard Rd & Stoneridge Dr

BART to Livermore Extension Project
2025 Enhanced Bus + Garage AM


































												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 	  		 	  		  	 		 	 	
Traffic Volume (vph)	146	731	438	85	1019	118	649	728	87	280	972	232
Future Volume (vph)	146	731	438	85	1019	118	649	728	87	280	972	232
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.91	1.00	0.97	0.91	1.00	0.94	0.95	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5085	1583	3433	5085	1583	4990	3539	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5085	1583	3433	5085	1583	4990	3539	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	159	795	476	92	1108	128	705	791	95	304	1057	252
RTOR Reduction (vph)	0	0	222	0	0	93	0	0	68	0	0	121
Lane Group Flow (vph)	159	795	254	92	1108	35	705	791	27	304	1057	131
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8			2			6
Actuated Green, G (s)	4.0	17.6	17.6	3.2	16.8	16.8	8.0	17.0	17.0	7.0	16.0	16.0
Effective Green, g (s)	4.0	17.6	17.6	3.2	16.8	16.8	8.0	17.0	17.0	7.0	16.0	16.0
Actuated g/C Ratio	0.07	0.29	0.29	0.05	0.28	0.28	0.13	0.28	0.28	0.12	0.26	0.26
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	225	1471	458	180	1405	437	656	989	442	395	1338	416
v/s Ratio Prot	c0.05	0.16		0.03	c0.22		c0.14	c0.22		0.09	0.21	
v/s Ratio Perm			0.16			0.02			0.02			0.08
v/c Ratio	0.71	0.54	0.56	0.51	0.79	0.08	1.07	0.80	0.06	0.77	0.79	0.32
Uniform Delay, d1	27.8	18.2	18.3	28.0	20.4	16.3	26.4	20.3	16.0	26.1	20.8	18.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	9.7	0.4	1.5	2.4	3.0	0.1	56.9	4.6	0.1	8.8	3.2	0.4
Delay (s)	37.5	18.6	19.7	30.5	23.4	16.4	83.3	24.9	16.1	34.9	24.0	18.4
Level of Service	D	B	B	C	C	B	F	C	B	C	C	B
Approach Delay (s)		21.1			23.2			50.3			25.2	
Approach LOS		C			C			D			C	

Intersection Summary		
HCM 2000 Control Delay	30.5	HCM 2000 Level of Service C
HCM 2000 Volume to Capacity ratio	0.85	
Actuated Cycle Length (s)	60.8	Sum of lost time (s) 16.0
Intersection Capacity Utilization	68.3%	ICU Level of Service C
Analysis Period (min)	15	

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
7: Hopyard Rd & Las Positas Blvd

BART to Livermore Extension Project
2025 Enhanced Bus + Garage AM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 	 		 	 		 	  		 	  	
Traffic Volume (vph)	149	463	373	350	448	56	411	1131	364	111	1011	90
Future Volume (vph)	149	463	373	350	448	56	411	1131	364	111	1011	90
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.95	1.00	0.97	0.95	1.00	0.97	0.91	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	3433	3539	1583	3433	5085	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	3433	3539	1583	3433	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	162	503	405	380	487	61	447	1229	396	121	1099	98
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	72
Lane Group Flow (vph)	162	503	405	380	487	61	447	1229	396	121	1099	26
Turn Type	Prot	NA	Free	Prot	NA	Free	Prot	NA	Free	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			Free			Free			Free			6
Actuated Green, G (s)	4.7	14.6	64.5	8.0	17.9	64.5	9.0	22.7	64.5	3.2	16.9	16.9
Effective Green, g (s)	4.7	14.6	64.5	8.0	17.9	64.5	9.0	22.7	64.5	3.2	16.9	16.9
Actuated g/C Ratio	0.07	0.23	1.00	0.12	0.28	1.00	0.14	0.35	1.00	0.05	0.26	0.26
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	250	801	1583	425	982	1583	479	1789	1583	170	1332	414
v/s Ratio Prot	0.05	c0.14		c0.11	0.14		c0.13	0.24		0.04	c0.22	
v/s Ratio Perm			c0.26			0.04			0.25			0.02
v/c Ratio	0.65	0.63	0.26	0.89	0.50	0.04	0.93	0.69	0.25	0.71	0.83	0.06
Uniform Delay, d1	29.1	22.5	0.0	27.8	19.5	0.0	27.5	17.9	0.0	30.2	22.4	17.9
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	5.7	1.5	0.4	20.6	0.4	0.0	25.3	1.1	0.4	13.2	4.3	0.1
Delay (s)	34.8	24.0	0.4	48.4	19.9	0.0	52.8	19.0	0.4	43.3	26.7	17.9
Level of Service	C	C	A	D	B	A	D	B	A	D	C	B
Approach Delay (s)		16.7			30.3			22.7			27.6	
Approach LOS		B			C			C			C	

Intersection Summary		
HCM 2000 Control Delay	24.0	HCM 2000 Level of Service C
HCM 2000 Volume to Capacity ratio	0.78	
Actuated Cycle Length (s)	64.5	Sum of lost time (s) 16.0
Intersection Capacity Utilization	67.4%	ICU Level of Service C
Analysis Period (min)	15	

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
8: Willow Rd & Owens Rd

BART to Livermore Extension Project
2025 Enhanced Bus + Garage AM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	125	391	194	109	322	100	88	99	0	146	109	104
Future Volume (vph)	125	391	194	109	322	100	88	99	0	146	109	104
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	5.3	4.0		5.3	4.0	4.0
Lane Util. Factor	0.97	0.91		0.97	0.91	1.00	1.00	0.95		1.00	1.00	1.00
Frt	1.00	0.95		1.00	1.00	0.85	1.00	1.00		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	4832		3433	5085	1583	1770	3539		1770	1863	1583
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.68	1.00		0.68	1.00	1.00
Satd. Flow (perm)	3433	4832		3433	5085	1583	1269	3539		1274	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	136	425	211	118	350	109	96	108	0	159	118	113
RTOR Reduction (vph)	0	128	0	0	0	69	0	0	0	0	0	86
Lane Group Flow (vph)	136	508	0	118	350	40	96	108	0	159	118	27
Turn Type	Prot	NA		Prot	NA	Perm	Perm	NA	Perm	Perm	NA	Perm
Protected Phases	1	6		5	2			4			8	
Permitted Phases						2	4		4	8		8
Actuated Green, G (s)	4.4	14.5		3.7	13.8	13.8	8.9	8.9		8.9	8.9	8.9
Effective Green, g (s)	4.4	16.2		3.7	15.5	15.5	8.9	10.2		8.9	10.2	10.2
Actuated g/C Ratio	0.10	0.38		0.09	0.37	0.37	0.21	0.24		0.21	0.24	0.24
Clearance Time (s)	4.0	5.7		4.0	5.7	5.7	5.3	5.3		5.3	5.3	5.3
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	358	1859		301	1872	582	268	857		269	451	383
v/s Ratio Prot	c0.04	c0.11		0.03	0.07			0.03			0.06	
v/s Ratio Perm						0.03	0.08			c0.12		0.02
v/c Ratio	0.38	0.27		0.39	0.19	0.07	0.36	0.13		0.59	0.26	0.07
Uniform Delay, d1	17.6	8.9		18.1	9.0	8.6	14.2	12.5		15.0	12.9	12.3
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	0.7	0.1		0.8	0.0	0.1	0.8	0.1		3.5	0.3	0.1
Delay (s)	18.3	9.0		19.0	9.1	8.7	15.0	12.5		18.4	13.2	12.4
Level of Service	B	A		B	A	A	B	B		B	B	B
Approach Delay (s)		10.6			11.0			13.7			15.1	
Approach LOS		B			B			B			B	

Intersection Summary

HCM 2000 Control Delay	12.0	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.38		
Actuated Cycle Length (s)	42.1	Sum of lost time (s)	12.0
Intersection Capacity Utilization	40.0%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 9: Hacienda Dr & Dublin Blvd

BART to Livermore Extension Project
 2025 Enhanced Bus + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↑↑↑	↖↗	↖↗	↑↑↑		↖↗	↑↑	↖↗	↖↗	↑↑↑	↖↗
Traffic Volume (vph)	73	336	93	272	745	80	157	633	115	12	390	132
Future Volume (vph)	73	336	93	272	745	80	157	633	115	12	390	132
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	6.0	5.0	4.5	6.0		5.0	6.0	6.0	4.5	5.5	5.5
Lane Util. Factor	0.97	0.91	0.88	0.97	0.91		0.94	0.95	0.88	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5085	2787	3433	5011		4990	3539	2787	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5085	2787	3433	5011		4990	3539	2787	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	79	365	101	296	810	87	171	688	125	13	424	143
RTOR Reduction (vph)	0	0	71	0	12	0	0	0	86	0	0	117
Lane Group Flow (vph)	79	365	30	296	885	0	171	688	39	13	424	26
Turn Type	Prot	NA	pm+ov	Prot	NA		Prot	NA	Perm	Prot	NA	Perm
Protected Phases	5	2	3	1	6		3	8		7	NA	4
Permitted Phases			2						8			4
Actuated Green, G (s)	4.8	12.1	22.4	17.4	24.7		10.3	23.5	23.5	0.6	13.8	13.8
Effective Green, g (s)	4.8	12.1	22.4	17.4	24.7		10.3	23.5	23.5	0.6	13.8	13.8
Actuated g/C Ratio	0.06	0.16	0.30	0.23	0.33		0.14	0.32	0.32	0.01	0.18	0.18
Clearance Time (s)	4.5	6.0	5.0	4.5	6.0		5.0	6.0	6.0	4.5	5.5	5.5
Vehicle Extension (s)	2.0	3.5	2.0	2.0	3.5		2.0	3.5	3.5	2.0	3.5	3.5
Lane Grp Cap (vph)	220	824	1023	800	1659		688	1114	877	27	940	292
v/s Ratio Prot	0.02	c0.07	0.00	0.09	c0.18		0.03	c0.19		0.00	c0.08	
v/s Ratio Perm			0.01						0.01			0.02
v/c Ratio	0.36	0.44	0.03	0.37	0.53		0.25	0.62	0.04	0.48	0.45	0.09
Uniform Delay, d1	33.4	28.2	18.4	24.0	20.3		28.7	21.7	17.8	36.8	27.0	25.2
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.4	0.5	0.0	0.1	0.4		0.1	1.1	0.0	4.9	0.4	0.2
Delay (s)	33.8	28.7	18.4	24.1	20.6		28.8	22.8	17.8	41.7	27.4	25.4
Level of Service	C	C	B	C	C		C	C	B	D	C	C
Approach Delay (s)		27.5			21.5			23.2			27.2	
Approach LOS		C			C			C			C	

Intersection Summary		
HCM 2000 Control Delay	24.0	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.59	C
Actuated Cycle Length (s)	74.6	Sum of lost time (s)
Intersection Capacity Utilization	57.8%	21.0
Analysis Period (min)	15	ICU Level of Service
		B

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 10: Hacienda Dr & Martinelli Blvd/Hacienda Crossings

BART to Livermore Extension Project
 2025 Enhanced Bus + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗	↖↗	↖↗	↗		↖↗↘	↖↗↘	↖	↖↗	↖↗↘	
Traffic Volume (vph)	11	8	174	109	12	8	244	867	112	17	728	50
Future Volume (vph)	11	8	174	109	12	8	244	867	112	17	728	50
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	3.0	3.0	5.5	3.0		3.5	3.0	3.0	5.0	3.5	
Lane Util. Factor	1.00	0.91	0.91	0.97	1.00		0.94	0.91	1.00	0.97	0.86	
Frt	1.00	0.90	0.85	1.00	0.94		1.00	1.00	0.85	1.00	0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1770	1523	2882	3433	1748		4990	5085	1583	3433	6346	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1770	1523	2882	3433	1748		4990	5085	1583	3433	6346	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	12	9	189	118	13	9	265	942	122	18	791	54
RTOR Reduction (vph)	0	14	129	0	6	0	0	0	54	0	9	0
Lane Group Flow (vph)	12	14	41	118	16	0	265	942	68	18	836	0
Turn Type	Prot	NA	Perm	Prot	NA		Prot	NA	pm+ov	Prot	NA	
Protected Phases	5	2		1	6		3	8	1	7	4	
Permitted Phases			2						8			
Actuated Green, G (s)	1.7	15.8	15.8	6.9	21.5		8.2	29.7	36.6	1.1	22.6	
Effective Green, g (s)	1.2	17.8	17.8	6.4	23.5		9.2	31.7	40.6	0.6	24.1	
Actuated g/C Ratio	0.02	0.24	0.24	0.09	0.32		0.13	0.43	0.56	0.01	0.33	
Clearance Time (s)	4.5	5.0	5.0	5.0	5.0		4.5	5.0	5.0	4.5	5.0	
Vehicle Extension (s)	3.0	4.0	4.0	2.0	4.0		3.0	4.0	2.0	3.0	4.0	
Lane Grp Cap (vph)	29	371	702	300	562		628	2208	945	28	2095	
v/s Ratio Prot	c0.01	0.01		c0.03	0.01		c0.05	c0.19	0.01	0.01	0.13	
v/s Ratio Perm			c0.01						0.03			
v/c Ratio	0.41	0.04	0.06	0.39	0.03		0.42	0.43	0.07	0.64	0.40	
Uniform Delay, d1	35.6	21.1	21.2	31.5	16.9		29.4	14.3	7.5	36.1	18.9	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	9.3	0.1	0.0	0.3	0.0		0.5	0.2	0.0	40.9	0.2	
Delay (s)	44.9	21.1	21.2	31.8	17.0		29.9	14.5	7.5	77.0	19.0	
Level of Service	D	C	C	C	B		C	B	A	E	B	
Approach Delay (s)		22.6			29.4			16.9			20.2	
Approach LOS		C			C			B			C	

Intersection Summary

HCM 2000 Control Delay	19.2	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.34		
Actuated Cycle Length (s)	73.0	Sum of lost time (s)	16.5
Intersection Capacity Utilization	42.6%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 11: Hacienda Dr & I-580 WB Ramps

BART to Livermore Extension Project
 2025 Enhanced Bus + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↔↔		↔↔		↑↑↑			↑↑↑	↔
Traffic Volume (vph)	0	0	0	337	0	453	0	1063	183	0	625	416
Future Volume (vph)	0	0	0	337	0	453	0	1063	183	0	625	416
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0		4.0		4.0			4.0	4.0
Lane Util. Factor				0.97		0.88		0.91			0.86	0.86
Frt				1.00		0.85		0.98			0.96	0.85
Flt Protected				0.95		1.00		1.00			1.00	1.00
Satd. Flow (prot)				3433		2787		4973			4626	1362
Flt Permitted				0.95		1.00		1.00			1.00	1.00
Satd. Flow (perm)				3433		2787		4973			4626	1362
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	366	0	492	0	1155	199	0	679	452
RTOR Reduction (vph)	0	0	0	0	0	95	0	35	0	0	86	86
Lane Group Flow (vph)	0	0	0	366	0	397	0	1319	0	0	819	140
Turn Type				Prot		Prot		NA			NA	Perm
Protected Phases				4		4		2			6	
Permitted Phases												6
Actuated Green, G (s)				13.5		13.5		35.2			35.2	35.2
Effective Green, g (s)				14.9		14.9		37.1			37.1	37.1
Actuated g/C Ratio				0.25		0.25		0.62			0.62	0.62
Clearance Time (s)				5.4		5.4		5.9			5.9	5.9
Vehicle Extension (s)				3.0		3.0		3.0			3.0	3.0
Lane Grp Cap (vph)				852		692		3074			2860	842
v/s Ratio Prot				0.11		c0.14		c0.27			0.18	
v/s Ratio Perm												0.10
v/c Ratio				0.43		0.57		0.43			0.29	0.17
Uniform Delay, d1				19.0		19.8		5.9			5.3	4.9
Progression Factor				1.00		1.00		0.62			1.00	1.00
Incremental Delay, d2				0.3		1.2		0.4			0.3	0.4
Delay (s)				19.3		20.9		4.1			5.6	5.3
Level of Service				B		C		A			A	A
Approach Delay (s)		0.0			20.2			4.1			5.5	
Approach LOS		A			C			A			A	

Intersection Summary			
HCM 2000 Control Delay	8.7	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.47		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	47.1%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 12: Hacienda Dr & I-580 EB Ramps

BART to Livermore Extension Project
 2025 Enhanced Bus + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗		↖↗					↑↑↑	↖		↑↑↑	
Traffic Volume (vph)	751	0	1096	0	0	0	0	459	250	0	1066	149
Future Volume (vph)	751	0	1096	0	0	0	0	459	250	0	1066	149
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0					4.0	4.0		4.0	
Lane Util. Factor	0.97		0.88					0.86	0.86		0.91	
Frt	1.00		0.85					0.98	0.85		0.98	
Flt Protected	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (prot)	3433		2787					4702	1362		4992	
Flt Permitted	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (perm)	3433		2787					4702	1362		4992	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	816	0	1191	0	0	0	0	499	272	0	1159	162
RTOR Reduction (vph)	0	0	41	0	0	0	0	40	110	0	34	0
Lane Group Flow (vph)	816	0	1150	0	0	0	0	543	78	0	1287	0
Turn Type	Prot		Prot					NA	Perm		NA	
Protected Phases	4		4					2			6	
Permitted Phases									2			
Actuated Green, G (s)	25.7		25.7					23.0	23.0		23.0	
Effective Green, g (s)	27.1		27.1					24.9	24.9		24.9	
Actuated g/C Ratio	0.45		0.45					0.41	0.41		0.41	
Clearance Time (s)	5.4		5.4					5.9	5.9		5.9	
Vehicle Extension (s)	2.0		2.0					2.0	2.0		2.0	
Lane Grp Cap (vph)	1550		1258					1951	565		2071	
v/s Ratio Prot	0.24		c0.41					0.12			c0.26	
v/s Ratio Perm									0.06			
v/c Ratio	0.53		0.91					0.28	0.14		0.62	
Uniform Delay, d1	11.8		15.4					11.6	10.9		13.8	
Progression Factor	1.00		1.00					1.00	1.00		0.85	
Incremental Delay, d2	0.1		10.1					0.4	0.5		1.4	
Delay (s)	12.0		25.5					12.0	11.4		13.1	
Level of Service	B		C					B	B		B	
Approach Delay (s)		20.0			0.0			11.8			13.1	
Approach LOS		B			A			B			B	


































Intersection Summary

HCM 2000 Control Delay	16.2	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.77		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	68.9%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
13: Hacienda Dr & Owens Rd

BART to Livermore Extension Project
2025 Enhanced Bus + Garage AM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 	  		 	  		 	  		  		
Traffic Volume (vph)	154	224	29	106	285	270	26	280	105	527	1014	594
Future Volume (vph)	154	224	29	106	285	270	26	280	105	527	1014	594
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	2.3	4.0	4.0	2.3	4.0	4.0	2.7	4.0	4.0	2.7
Lane Util. Factor	0.97	0.91	1.00	0.97	0.91	1.00	0.97	0.91	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5085	1583	3433	5085	1583	3433	5085	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5085	1583	3433	5085	1583	3433	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	167	243	32	115	310	293	28	304	114	573	1102	646
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	167	243	32	115	310	293	28	304	114	573	1102	646
Turn Type	Prot	NA	Free	Prot	NA	Free	Prot	NA	Free	Prot	NA	Free
Protected Phases	1	6		5	2		7	4		3	8	
Permitted Phases			Free			Free			Free			Free
Actuated Green, G (s)	4.0	9.2	60.4	4.0	9.2	60.4	1.4	9.2	60.4	19.0	26.8	60.4
Effective Green, g (s)	4.0	10.9	60.4	4.0	10.9	60.4	1.4	10.5	60.4	19.0	28.1	60.4
Actuated g/C Ratio	0.07	0.18	1.00	0.07	0.18	1.00	0.02	0.17	1.00	0.31	0.47	1.00
Clearance Time (s)	4.0	5.7		4.0	5.7		4.0	5.3		4.0	5.3	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	227	917	1583	227	917	1583	79	883	1583	1079	2365	1583
v/s Ratio Prot	0.05	0.05		0.03	0.06		0.01	0.06		c0.17	0.22	
v/s Ratio Perm			0.02			0.19			0.07			c0.41
v/c Ratio	0.74	0.26	0.02	0.51	0.34	0.19	0.35	0.34	0.07	0.53	0.47	0.41
Uniform Delay, d1	27.7	21.3	0.0	27.2	21.6	0.0	29.1	21.9	0.0	17.0	11.0	0.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	11.7	0.2	0.0	1.8	0.2	0.3	2.7	0.2	0.1	0.5	0.1	0.8
Delay (s)	39.4	21.5	0.0	29.0	21.8	0.3	31.8	22.2	0.1	17.5	11.2	0.8
Level of Service	D	C	A	C	C	A	C	C	A	B	B	A
Approach Delay (s)		26.7			14.2			17.1			9.9	
Approach LOS		C			B			B			A	
Intersection Summary												
HCM 2000 Control Delay			13.4				HCM 2000 Level of Service			B		
HCM 2000 Volume to Capacity ratio			0.57									
Actuated Cycle Length (s)			60.4				Sum of lost time (s)			16.0		
Intersection Capacity Utilization			46.5%				ICU Level of Service			A		
Analysis Period (min)			15									

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
14: Tassajara Rd & Dublin Blvd

BART to Livermore Extension Project
2025 Enhanced Bus + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↑↑	↖↗	↖↗↖↗	↑↓		↖↗↖↗	↑↑↑	↖	↖↗	↑↑↑	↖↗
Traffic Volume (vph)	92	150	160	525	665	43	226	508	146	25	1240	231
Future Volume (vph)	92	150	160	525	665	43	226	508	146	25	1240	231
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	6.0	6.0	5.0	6.0		5.0	6.0	6.0	5.0	6.0	6.0
Lane Util. Factor	0.97	0.95	0.88	0.94	0.95		0.94	0.91	1.00	0.97	0.86	0.88
Frt	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	2787	4990	3507		4990	5085	1583	3433	6408	2787
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	2787	4990	3507		4990	5085	1583	3433	6408	2787
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	100	163	174	571	723	47	246	552	159	27	1348	251
RTOR Reduction (vph)	0	0	132	0	4	0	0	0	98	0	0	169
Lane Group Flow (vph)	100	163	42	571	766	0	246	552	61	27	1348	82
Turn Type	Prot	NA	Perm	Prot	NA		Prot	NA	Perm	Prot	NA	Perm
Protected Phases	5	2		1	6		3	8		7	NA	4
Permitted Phases			2						8			4
Actuated Green, G (s)	16.2	32.7	32.7	19.6	36.1		16.2	52.0	52.0	8.4	44.2	44.2
Effective Green, g (s)	16.2	32.7	32.7	19.6	36.1		16.2	52.0	52.0	8.4	44.2	44.2
Actuated g/C Ratio	0.12	0.24	0.24	0.15	0.27		0.12	0.39	0.39	0.06	0.33	0.33
Clearance Time (s)	5.0	6.0	6.0	5.0	6.0		5.0	6.0	6.0	5.0	6.0	6.0
Vehicle Extension (s)	2.0	3.0	3.0	2.0	3.0		2.0	4.0	4.0	2.0	4.0	4.0
Lane Grp Cap (vph)	412	859	676	726	939		600	1963	611	214	2102	914
v/s Ratio Prot	0.03	0.05		c0.11	c0.22		c0.05	0.11		0.01	c0.21	
v/s Ratio Perm			0.02						0.04			0.03
v/c Ratio	0.24	0.19	0.06	0.79	0.82		0.41	0.28	0.10	0.13	0.64	0.09
Uniform Delay, d1	53.7	40.5	39.2	55.5	46.2		54.8	28.5	26.4	59.7	38.5	31.3
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.1	0.1	0.0	5.2	5.5		0.2	0.1	0.1	0.1	0.8	0.1
Delay (s)	53.8	40.6	39.3	60.7	51.7		55.0	28.6	26.5	59.8	39.3	31.4
Level of Service	D	D	D	E	D		D	C	C	E	D	C
Approach Delay (s)		43.1			55.6			35.0			38.4	
Approach LOS		D			E			D			D	

Intersection Summary		
HCM 2000 Control Delay	43.4	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.70	D
Actuated Cycle Length (s)	134.7	Sum of lost time (s)
Intersection Capacity Utilization	82.7%	22.0
Analysis Period (min)	15	ICU Level of Service
		E

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 15: Tassajara Rd & I-580 WB Ramps

BART to Livermore Extension Project
 2025 Enhanced Bus + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↔		↔		↑↑	↔		↑↑↑	↔
Traffic Volume (vph)	0	0	0	559	0	294	0	1037	468	0	940	935
Future Volume (vph)	0	0	0	559	0	294	0	1037	468	0	940	935
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0		4.0		4.0	4.0		4.0	4.0
Lane Util. Factor				0.97		0.88		0.95	1.00		0.86	0.86
Frt				1.00		0.85		1.00	0.85		0.95	0.85
Flt Protected				0.95		1.00		1.00	1.00		1.00	1.00
Satd. Flow (prot)				3433		2787		3539	1583		4567	1362
Flt Permitted				0.95		1.00		1.00	1.00		1.00	1.00
Satd. Flow (perm)				3433		2787		3539	1583		4567	1362
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	608	0	320	0	1127	509	0	1022	1016
RTOR Reduction (vph)	0	0	0	0	0	91	0	0	205	0	134	205
Lane Group Flow (vph)	0	0	0	608	0	229	0	1127	304	0	1396	303
Turn Type				Perm		Perm		NA	Perm		NA	Perm
Protected Phases								2			6	
Permitted Phases				8		8			2			6
Actuated Green, G (s)				16.2		16.2		35.8	35.8		35.8	35.8
Effective Green, g (s)				16.2		16.2		35.8	35.8		35.8	35.8
Actuated g/C Ratio				0.27		0.27		0.60	0.60		0.60	0.60
Clearance Time (s)				4.0		4.0		4.0	4.0		4.0	4.0
Vehicle Extension (s)				3.0		3.0		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)				926		752		2111	944		2724	812
v/s Ratio Prot								c0.32			0.31	
v/s Ratio Perm				c0.18		0.08			0.19			0.22
v/c Ratio				0.66		0.30		0.53	0.32		0.51	0.37
Uniform Delay, d1				19.4		17.4		7.2	6.0		7.0	6.3
Progression Factor				1.00		1.00		1.00	1.00		1.00	1.00
Incremental Delay, d2				1.7		0.2		1.0	0.9		0.7	1.3
Delay (s)				21.1		17.6		8.1	6.9		7.7	7.6
Level of Service				C		B		A	A		A	A
Approach Delay (s)		0.0			19.9			7.8			7.7	
Approach LOS		A			B			A			A	

Intersection Summary		
HCM 2000 Control Delay	10.2	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.57	B
Actuated Cycle Length (s)	60.0	Sum of lost time (s)
Intersection Capacity Utilization	51.3%	8.0
Analysis Period (min)	15	ICU Level of Service
		A

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 16: Santa Rita Rd & I-580 EB Ramps/Pimilco Dr

BART to Livermore Extension Project
 2025 Enhanced Bus + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	538	119	676	182	0	192	0	735	106	192	1249	0
Future Volume (vph)	538	119	676	182	0	192	0	735	106	192	1249	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0		4.0		4.0		4.0	4.0	
Lane Util. Factor	0.97	1.00	1.00	0.97		0.88		0.86		1.00	0.95	
Frt	1.00	1.00	0.85	1.00		0.85		0.98		1.00	1.00	
Flt Protected	0.95	1.00	1.00	0.95		1.00		1.00		0.95	1.00	
Satd. Flow (prot)	3433	1863	1583	3433		2787		6287		1770	3539	
Flt Permitted	0.95	1.00	1.00	0.95		1.00		1.00		0.95	1.00	
Satd. Flow (perm)	3433	1863	1583	3433		2787		6287		1770	3539	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	585	129	735	198	0	209	0	799	115	209	1358	0
RTOR Reduction (vph)	0	0	0	0	0	71	0	43	0	0	0	0
Lane Group Flow (vph)	585	129	735	198	0	138	0	871	0	209	1358	0
Turn Type	Perm	NA	Free	Prot		pm+ov		NA		Prot	NA	Perm
Protected Phases		4		3		1		2		1	6	
Permitted Phases	4		Free			3						6
Actuated Green, G (s)	14.7	14.7	60.0	4.7		13.3		16.0		8.6	28.6	
Effective Green, g (s)	14.7	14.7	60.0	4.7		13.3		16.0		8.6	28.6	
Actuated g/C Ratio	0.24	0.24	1.00	0.08		0.22		0.27		0.14	0.48	
Clearance Time (s)	4.0	4.0		4.0		4.0		4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0		3.0		3.0		3.0	3.0	
Lane Grp Cap (vph)	841	456	1583	268		617		1676		253	1686	
v/s Ratio Prot		0.07		0.06		0.03		0.14		0.12	c0.38	
v/s Ratio Perm	c0.17		c0.46			0.02						
v/c Ratio	0.70	0.28	0.46	0.74		0.22		0.52		0.83	0.81	
Uniform Delay, d1	20.6	18.4	0.0	27.0		19.1		18.7		25.0	13.3	
Progression Factor	1.00	1.00	1.00	1.00		1.00		1.00		1.00	1.00	
Incremental Delay, d2	2.5	0.3	1.0	10.2		0.2		1.2		19.3	4.2	
Delay (s)	23.1	18.7	1.0	37.2		19.3		19.9		44.3	17.6	
Level of Service	C	B	A	D		B		B		D	B	
Approach Delay (s)		11.5			28.0			19.9			21.1	
Approach LOS		B			C			B			C	

Intersection Summary

HCM 2000 Control Delay	18.3	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.85		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	56.5%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
17: Santa Rita Rd & Valley Ave

BART to Livermore Extension Project
2025 Enhanced Bus + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔↔	↑↑	↗	↖	↑↑	↗	↔↔	↑↑		↔↔	↑↑	↗
Traffic Volume (vph)	187	223	78	179	330	828	92	476	72	573	917	155
Future Volume (vph)	187	223	78	179	330	828	92	476	72	573	917	155
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.97	0.95		0.97	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.98		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	3433	3470		3433	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	3433	3470		3433	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	203	242	85	195	359	900	100	517	78	623	997	168
RTOR Reduction (vph)	0	0	70	0	0	0	0	17	0	0	0	100
Lane Group Flow (vph)	203	242	15	195	359	900	100	578	0	623	997	68
Turn Type	Prot	NA	Perm	Prot	NA	Free	Prot	NA		Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1		6
Permitted Phases			4			Free						6
Actuated Green, G (s)	7.7	11.5	11.5	8.1	11.9	64.8	3.1	16.1		13.1	26.1	26.1
Effective Green, g (s)	7.7	11.5	11.5	8.1	11.9	64.8	3.1	16.1		13.1	26.1	26.1
Actuated g/C Ratio	0.12	0.18	0.18	0.12	0.18	1.00	0.05	0.25		0.20	0.40	0.40
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	407	628	280	221	649	1583	164	862		694	1425	637
v/s Ratio Prot	0.06	0.07		c0.11	0.10		0.03	0.17		c0.18	c0.28	
v/s Ratio Perm			0.01			c0.57						0.04
v/c Ratio	0.50	0.39	0.05	0.88	0.55	0.57	0.61	0.67		0.90	0.70	0.11
Uniform Delay, d1	26.7	23.5	22.1	27.9	24.0	0.0	30.3	22.0		25.2	16.1	12.1
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	1.0	0.4	0.1	31.1	1.0	1.5	6.3	2.1		14.3	1.5	0.1
Delay (s)	27.7	23.9	22.2	59.0	25.1	1.5	36.5	24.0		39.5	17.6	12.1
Level of Service	C	C	C	E	C	A	D	C		D	B	B
Approach Delay (s)		25.1			15.0			25.8			24.7	
Approach LOS		C			B			C			C	

Intersection Summary

HCM 2000 Control Delay	21.8	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.84		
Actuated Cycle Length (s)	64.8	Sum of lost time (s)	16.0
Intersection Capacity Utilization	61.2%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
18: Bernal Ave/Valley Ave & Stanley Blvd

BART to Livermore Extension Project
2025 Enhanced Bus + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	204	202	52	251	895	954	173	476	106	139	344	116
Future Volume (vph)	204	202	52	251	895	954	173	476	106	139	344	116
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.95	1.00	0.97	0.91	0.91	1.00	0.95	1.00	0.97	0.95	0.95
Frt	1.00	1.00	0.85	1.00	0.96	0.85	1.00	1.00	0.85	1.00	0.96	0.96
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	3433	3238	1441	1770	3539	1583	3433	3405	3405
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	3433	3238	1441	1770	3539	1583	3433	3405	3405
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	222	220	57	273	973	1037	188	517	115	151	374	126
RTOR Reduction (vph)	0	0	28	0	46	28	0	0	91	0	38	0
Lane Group Flow (vph)	222	220	29	273	1342	594	188	517	24	151	462	0
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	NA
Protected Phases	7	4	5	3	8	1	5	2		1	6	
Permitted Phases			4			8			2			
Actuated Green, G (s)	6.0	32.1	43.7	11.0	37.1	46.9	11.6	18.2	18.2	9.8	16.4	
Effective Green, g (s)	6.0	32.1	43.7	11.0	37.1	46.9	11.6	18.2	18.2	9.8	16.4	
Actuated g/C Ratio	0.07	0.37	0.50	0.13	0.43	0.54	0.13	0.21	0.21	0.11	0.19	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	236	1304	866	433	1379	842	235	739	330	386	641	
v/s Ratio Prot	c0.06	0.06	0.00	0.08	c0.41	0.08	c0.11	c0.15		0.04	0.14	
v/s Ratio Perm			0.01			0.33			0.02			
v/c Ratio	0.94	0.17	0.03	0.63	0.97	0.71	0.80	0.70	0.07	0.39	0.72	
Uniform Delay, d1	40.4	18.5	11.0	36.1	24.5	15.0	36.6	31.9	27.7	35.9	33.2	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	42.3	0.1	0.0	3.0	18.0	2.7	17.5	2.9	0.1	0.7	4.0	
Delay (s)	82.7	18.6	11.0	39.1	42.5	17.7	54.1	34.8	27.8	36.5	37.2	
Level of Service	F	B	B	D	D	B	D	C	C	D	D	
Approach Delay (s)		46.2			35.3			38.2			37.0	
Approach LOS		D			D			D			D	

Intersection Summary

HCM 2000 Control Delay	37.4	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.89		
Actuated Cycle Length (s)	87.1	Sum of lost time (s)	16.0
Intersection Capacity Utilization	76.9%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 19: Fallon Rd & Dublin Blvd

BART to Livermore Extension Project
 2025 Enhanced Bus + Garage AM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations													
Traffic Volume (vph)	45	53	83	284	1146	346	746	232	26	55	658	329	
Future Volume (vph)	45	53	83	284	1146	346	746	232	26	55	658	329	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)	5.3	5.3	5.3	4.0	4.0	4.0	5.3	4.9	4.9	5.3	4.9	4.9	
Lane Util. Factor	0.97	0.91	0.88	0.94	0.91	1.00	0.97	0.91	0.88	0.97	0.91	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	3090	4577	2508	4491	4577	1425	3090	4577	2508	3090	4577	1425	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	3090	4577	2508	4491	4577	1425	3090	4577	2508	3090	4577	1425	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	
Adj. Flow (vph)	49	58	90	309	1246	376	811	252	28	60	715	358	
RTOR Reduction (vph)	0	0	59	0	0	274	0	0	14	0	0	149	
Lane Group Flow (vph)	49	58	31	309	1246	102	811	252	14	60	715	209	
Turn Type	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm	
Protected Phases	5	2	3	1	6		3	8		7	NA	4	
Permitted Phases			2			6			8			4	
Actuated Green, G (s)	3.1	9.3	38.2	23.8	30.0	30.0	28.9	53.4	53.4	4.5	29.0	29.0	
Effective Green, g (s)	3.1	9.3	38.2	23.8	30.0	30.0	28.9	53.4	53.4	4.5	29.0	29.0	
Actuated g/C Ratio	0.03	0.08	0.35	0.22	0.27	0.27	0.26	0.48	0.48	0.04	0.26	0.26	
Clearance Time (s)	5.3	5.3	5.3	4.0	4.0	4.0	5.3	4.9	4.9	5.3	4.9	4.9	
Vehicle Extension (s)	2.0	4.0	2.0	2.0	2.0	2.0	2.0	4.0	4.0	2.0	4.0	4.0	
Lane Grp Cap (vph)	86	385	867	967	1242	386	808	2211	1212	125	1201	373	
v/s Ratio Prot	0.02	0.01	0.01	c0.07	c0.27		c0.26	0.06		0.02	c0.16		
v/s Ratio Perm			0.00			0.07			0.01			0.15	
v/c Ratio	0.57	0.15	0.04	0.32	1.00	0.26	1.00	0.11	0.01	0.48	0.60	0.56	
Uniform Delay, d1	53.0	46.9	24.0	36.5	40.2	31.6	40.8	15.6	14.8	51.9	35.6	35.2	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	5.1	0.2	0.0	0.1	26.3	0.1	32.6	0.0	0.0	1.1	0.9	2.3	
Delay (s)	58.1	47.2	24.0	36.6	66.6	31.7	73.4	15.6	14.8	52.9	36.6	37.6	
Level of Service	E	D	C	D	E	C	E	B	B	D	D	D	
Approach Delay (s)		39.3			55.0			58.5			37.7		
Approach LOS		D			D			E			D		
Intersection Summary													
HCM 2000 Control Delay			50.7									HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio			0.86										
Actuated Cycle Length (s)			110.5									Sum of lost time (s)	19.5
Intersection Capacity Utilization			82.4%									ICU Level of Service	E
Analysis Period (min)			15										

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
20: El Charro Rd/Fallon Rd & I-580 WB Ramps

BART to Livermore Extension Project
2025 Enhanced Bus + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↙	↖	↗		↑	↘		↑↑	↗
Traffic Volume (vph)	0	0	0	167	0	609	0	554	478	0	523	399
Future Volume (vph)	0	0	0	167	0	609	0	554	478	0	523	399
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0	4.0	4.0		4.0	4.0		4.0	4.0
Lane Util. Factor				0.95	0.95	0.88		0.95	0.95		0.95	1.00
Frt				1.00	1.00	0.85		0.99	0.85		1.00	0.85
Flt Protected				0.95	0.95	1.00		1.00	1.00		1.00	1.00
Satd. Flow (prot)				1681	1681	2787		1749	1504		3539	1583
Flt Permitted				0.95	0.95	1.00		1.00	1.00		1.00	1.00
Satd. Flow (perm)				1681	1681	2787		1749	1504		3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	182	0	662	0	602	520	0	568	434
RTOR Reduction (vph)	0	0	0	0	0	401	0	4	151	0	0	140
Lane Group Flow (vph)	0	0	0	93	89	261	0	650	317	0	568	294
Turn Type				Perm	NA	Perm		NA	Perm		NA	Perm
Protected Phases					8			2			6	
Permitted Phases				8		8			2			6
Actuated Green, G (s)				11.8	11.8	11.8		40.7	40.7		40.7	40.7
Effective Green, g (s)				11.3	11.3	11.3		40.7	40.7		40.7	40.7
Actuated g/C Ratio				0.19	0.19	0.19		0.68	0.68		0.68	0.68
Clearance Time (s)				3.5	3.5	3.5		4.0	4.0		4.0	4.0
Vehicle Extension (s)				2.0	2.0	2.0		2.0	2.0		2.0	2.0
Lane Grp Cap (vph)				316	316	524		1186	1020		2400	1073
v/s Ratio Prot								c0.37			0.16	
v/s Ratio Perm				0.06	0.05	c0.09			0.21			0.19
v/c Ratio				0.29	0.28	0.50		0.55	0.31		0.24	0.27
Uniform Delay, d1				20.9	20.9	21.8		4.9	3.9		3.7	3.8
Progression Factor				1.00	1.00	1.00		0.71	0.19		1.00	1.00
Incremental Delay, d2				0.2	0.2	0.3		1.8	0.8		0.2	0.6
Delay (s)				21.1	21.0	22.1		5.3	1.5		3.9	4.4
Level of Service				C	C	C		A	A		A	A
Approach Delay (s)		0.0			21.9			3.7			4.2	
Approach LOS		A			C			A			A	

Intersection Summary

HCM 2000 Control Delay	9.0	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.54		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	66.8%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 21: El Charro Rd & I-580 EB Ramps

BART to Livermore Extension Project
 2025 Enhanced Bus + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔↔		↔↔					↕↔	↔		↕↔	↔
Traffic Volume (vph)	245	0	402	0	0	0	0	766	142	0	371	0
Future Volume (vph)	245	0	402	0	0	0	0	766	142	0	371	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0					4.0	4.0		4.0	
Lane Util. Factor	0.97		0.88					0.91	0.91		0.91	
Frt	1.00		0.85					1.00	0.85		1.00	
Flt Protected	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (prot)	3433		2787					3379	1441		3390	
Flt Permitted	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (perm)	3433		2787					3379	1441		3390	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	266	0	437	0	0	0	0	833	154	0	403	0
RTOR Reduction (vph)	0	0	371	0	0	0	0	2	39	0	0	0
Lane Group Flow (vph)	266	0	66	0	0	0	0	849	97	0	403	0
Turn Type	Prot		Perm					NA	Perm		NA	Perm
Protected Phases	4							2			6	
Permitted Phases			4						2			6
Actuated Green, G (s)	9.0		9.0					43.0	43.0		43.0	
Effective Green, g (s)	9.0		9.0					43.0	43.0		43.0	
Actuated g/C Ratio	0.15		0.15					0.72	0.72		0.72	
Clearance Time (s)	4.0		4.0					4.0	4.0		4.0	
Vehicle Extension (s)	2.0		2.0					3.0	3.0		3.0	
Lane Grp Cap (vph)	514		418					2421	1032		2429	
v/s Ratio Prot	c0.08							c0.25			0.12	
v/s Ratio Perm			0.02						0.07			
v/c Ratio	0.52		0.16					0.35	0.09		0.17	
Uniform Delay, d1	23.5		22.2					3.2	2.6		2.7	
Progression Factor	1.00		1.00					1.00	1.00		0.75	
Incremental Delay, d2	0.4		0.1					0.4	0.2		0.1	
Delay (s)	23.9		22.3					3.6	2.8		2.2	
Level of Service	C		C					A	A		A	
Approach Delay (s)		22.9			0.0			3.5			2.2	
Approach LOS		C			A			A			A	

Intersection Summary		
HCM 2000 Control Delay	9.8	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.38	A
Actuated Cycle Length (s)	60.0	Sum of lost time (s)
Intersection Capacity Utilization	36.3%	8.0
Analysis Period (min)	15	ICU Level of Service
		A

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 22: El Charro Rd & Stoneridge Dr/Jack London Blvd

BART to Livermore Extension Project
 2025 Enhanced Bus + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔↔↔	↑↑	↔	↔	↑↑	↔↔	↔	↑↑		↔↔↔	↑	↔↔
Traffic Volume (vph)	145	100	8	16	594	634	7	97	2	210	90	171
Future Volume (vph)	145	100	8	16	594	634	7	97	2	210	90	171
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	0.94	0.95	1.00	1.00	0.95	0.88	1.00	0.95		0.94	1.00	0.88
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	4491	3185	1425	1593	3185	2508	1593	3176		4491	1676	2508
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	4491	3185	1425	1593	3185	2508	1593	3176		4491	1676	2508
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	158	109	9	17	646	689	8	105	2	228	98	186
RTOR Reduction (vph)	0	0	5	0	0	392	0	2	0	0	0	129
Lane Group Flow (vph)	158	109	4	17	646	297	8	105	0	228	98	57
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Prot	NA		Prot	NA	Perm
Protected Phases	7	4		3	8	1	5	2		1	6	
Permitted Phases			4			8						6
Actuated Green, G (s)	10.9	29.0	29.0	0.8	18.9	28.9	0.8	11.2		10.0	20.4	20.4
Effective Green, g (s)	10.9	29.0	29.0	0.8	18.9	28.9	0.8	11.2		10.0	20.4	20.4
Actuated g/C Ratio	0.16	0.43	0.43	0.01	0.28	0.43	0.01	0.17		0.15	0.30	0.30
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	730	1378	616	19	898	1081	19	530		670	510	763
v/s Ratio Prot	c0.04	0.03		0.01	c0.20	0.04	0.01	0.03		c0.05	c0.06	
v/s Ratio Perm			0.00			0.08						0.02
v/c Ratio	0.22	0.08	0.01	0.89	0.72	0.27	0.42	0.20		0.34	0.19	0.07
Uniform Delay, d1	24.3	11.2	10.8	33.1	21.7	12.3	32.9	24.0		25.5	17.2	16.6
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	0.1	0.0	0.0	155.2	2.8	0.1	14.4	0.2		0.3	0.2	0.0
Delay (s)	24.5	11.2	10.8	188.2	24.4	12.4	47.2	24.2		25.8	17.4	16.6
Level of Service	C	B	B	F	C	B	D	C		C	B	B
Approach Delay (s)		18.8			20.4			25.8			20.9	
Approach LOS		B			C			C			C	

Intersection Summary

HCM 2000 Control Delay	20.6	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.43		
Actuated Cycle Length (s)	67.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	42.7%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
24: Airway Blvd/Driveway & N Canyons Pkwy

BART to Livermore Extension Project
2025 Enhanced Bus + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑	↑	↑↑	↑	↑		↑	↑↑		↑	
Traffic Volume (vph)	0	56	80	687	496	0	1191	0	895	0	0	0
Future Volume (vph)	0	56	80	687	496	0	1191	0	895	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0	4.0	4.0			4.4	4.0			
Lane Util. Factor		0.95	1.00	0.97	1.00			1.00	0.88			
Frt		1.00	0.85	1.00	1.00			1.00	0.85			
Flt Protected		1.00	1.00	0.95	1.00			0.95	1.00			
Satd. Flow (prot)		3539	1583	3433	1863			1770	2787			
Flt Permitted		1.00	1.00	0.95	1.00			0.95	1.00			
Satd. Flow (perm)		3539	1583	3433	1863			1770	2787			
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	61	87	747	539	0	1295	0	973	0	0	0
RTOR Reduction (vph)	0	0	79	0	0	0	0	0	55	0	0	0
Lane Group Flow (vph)	0	61	8	747	539	0	0	1295	918	0	0	0
Turn Type		NA	Perm	Prot	NA	Perm	Split	NA	pm+ov			
Protected Phases		2		1	6		8	8	1	4	4	
Permitted Phases			2			6			8			
Actuated Green, G (s)		10.2	10.2	36.8	53.0			76.8	113.6			
Effective Green, g (s)		12.2	12.2	38.8	55.0			76.6	117.6			
Actuated g/C Ratio		0.09	0.09	0.28	0.39			0.55	0.84			
Clearance Time (s)		6.0	6.0	6.0	6.0			4.2	6.0			
Vehicle Extension (s)		3.0	3.0	3.0	3.0			3.0	3.0			
Lane Grp Cap (vph)		308	137	951	731			968	2420			
v/s Ratio Prot		0.02		c0.22	c0.29			c0.73	0.11			
v/s Ratio Perm			0.00						0.22			
v/c Ratio		0.20	0.06	0.79	0.74			1.34	0.38			
Uniform Delay, d1		59.4	58.6	46.8	36.3			31.7	2.6			
Progression Factor		1.00	1.00	1.00	1.00			1.00	1.00			
Incremental Delay, d2		1.4	0.8	4.3	6.5			159.1	0.1			
Delay (s)		60.8	59.4	51.1	42.9			190.8	2.7			
Level of Service		E	E	D	D			F	A			
Approach Delay (s)		60.0			47.6			110.1			0.0	
Approach LOS		E			D			F			A	

Intersection Summary

HCM 2000 Control Delay	86.4	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.16		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	16.4
Intersection Capacity Utilization	99.2%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
25: Airway Blvd & I-580 WB Ramps

BART to Livermore Extension Project
2025 Enhanced Bus + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↙	↖	↗		↑↑	↗		↑↑↑	
Traffic Volume (vph)	0	0	0	63	43	841	0	1330	343	0	281	553
Future Volume (vph)	0	0	0	63	43	841	0	1330	343	0	281	553
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0	4.0	4.0		4.0	4.0		4.0	
Lane Util. Factor				0.95	0.95	0.88		0.95	1.00		0.91	
Frt				1.00	1.00	0.85		1.00	0.85		0.90	
Flt Protected				0.95	0.98	1.00		1.00	1.00		1.00	
Satd. Flow (prot)				1681	1734	2787		3539	1583		4579	
Flt Permitted				0.95	0.98	1.00		1.00	1.00		1.00	
Satd. Flow (perm)				1681	1734	2787		3539	1583		4579	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	68	47	914	0	1446	373	0	305	601
RTOR Reduction (vph)	0	0	0	0	0	28	0	0	164	0	264	0
Lane Group Flow (vph)	0	0	0	36	79	886	0	1446	209	0	642	0
Turn Type				Split	NA	Perm		NA	Perm		NA	
Protected Phases				8	8			2			6	
Permitted Phases						8			2			
Actuated Green, G (s)				36.0	36.0	36.0		54.7	54.7		54.7	
Effective Green, g (s)				36.0	36.0	36.0		56.0	56.0		56.0	
Actuated g/C Ratio				0.36	0.36	0.36		0.56	0.56		0.56	
Clearance Time (s)				4.0	4.0	4.0		5.3	5.3		5.3	
Vehicle Extension (s)				2.0	2.0	2.0		4.0	4.0		4.0	
Lane Grp Cap (vph)				605	624	1003		1981	886		2564	
v/s Ratio Prot				0.02	0.05			c0.41			0.14	
v/s Ratio Perm						c0.32			0.13			
v/c Ratio				0.06	0.13	0.88		0.73	0.24		0.25	
Uniform Delay, d1				20.9	21.5	30.0		16.4	11.2		11.3	
Progression Factor				1.00	1.00	1.00		1.00	1.00		1.00	
Incremental Delay, d2				0.0	0.0	9.1		2.4	0.6		0.2	
Delay (s)				20.9	21.5	39.1		18.8	11.8		11.5	
Level of Service				C	C	D		B	B		B	
Approach Delay (s)		0.0			37.1			17.3			11.5	
Approach LOS		A			D			B			B	

Intersection Summary		
HCM 2000 Control Delay	21.4	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.79	C
Actuated Cycle Length (s)	100.0	Sum of lost time (s)
Intersection Capacity Utilization	72.9%	8.0
Analysis Period (min)	15	ICU Level of Service
		C

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 26: Airway Blvd & I-580 EB Ramps/Kitty Hawk Rd

BART to Livermore Extension Project
 2025 Enhanced Bus + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↑	↖	↖	↑	↖	↖	↑↕		↖	↑↕	
Traffic Volume (vph)	651	192	163	22	34	102	26	508	157	82	117	152
Future Volume (vph)	651	192	163	22	34	102	26	508	157	82	117	152
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.4	4.4	4.4	4.0	4.0		4.0	4.0	
Lane Util. Factor	0.97	1.00	1.00	1.00	1.00	1.00	1.00	0.95		1.00	0.95	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.96		1.00	0.92	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	3433	1863	1583	1770	1863	1583	1770	3414		1770	3239	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	3433	1863	1583	1770	1863	1583	1770	3414		1770	3239	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	708	209	177	24	37	111	28	552	171	89	127	165
RTOR Reduction (vph)	0	0	136	0	0	88	0	33	0	0	87	0
Lane Group Flow (vph)	708	209	41	24	37	23	28	690	0	89	205	0
Turn Type	Split	NA	Perm	Split	NA	pm+ov	Prot	NA		Prot	NA	
Protected Phases	7	7		8	8	1	5	2		1	6	
Permitted Phases			7			8						
Actuated Green, G (s)	21.1	21.1	21.1	8.4	8.4	19.7	2.5	31.9		11.3	41.2	
Effective Green, g (s)	21.1	21.1	21.1	8.0	8.0	18.9	2.0	33.2		11.3	42.5	
Actuated g/C Ratio	0.23	0.23	0.23	0.09	0.09	0.21	0.02	0.37		0.13	0.47	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	3.5	5.3		4.0	5.3	
Vehicle Extension (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	3.5		2.0	4.0	
Lane Grp Cap (vph)	804	436	371	157	165	409	39	1259		222	1529	
v/s Ratio Prot	c0.21	0.11		0.01	c0.02	0.01	0.02	c0.20		c0.05	0.06	
v/s Ratio Perm			0.03			0.01						
v/c Ratio	0.88	0.48	0.11	0.15	0.22	0.06	0.72	0.55		0.40	0.13	
Uniform Delay, d1	33.2	29.7	27.1	37.9	38.1	28.4	43.7	22.5		36.2	13.4	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	10.8	0.3	0.0	0.2	0.3	0.0	40.9	1.7		0.4	0.2	
Delay (s)	44.0	30.0	27.1	38.0	38.4	28.4	84.6	24.2		36.7	13.6	
Level of Service	D	C	C	D	D	C	F	C		D	B	
Approach Delay (s)		38.6			31.9			26.4			19.0	
Approach LOS		D			C			C			B	

Intersection Summary		
HCM 2000 Control Delay	31.2	HCM 2000 Level of Service C
HCM 2000 Volume to Capacity ratio	0.59	
Actuated Cycle Length (s)	90.0	Sum of lost time (s) 16.8
Intersection Capacity Utilization	58.8%	ICU Level of Service B
Analysis Period (min)	15	

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 27: Collier Canyon Rd & N Canyons Pkwy/Portola Ave

BART to Livermore Extension Project
 2025 Enhanced Bus + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↖↖	↖	↖	↖↖	↖	↖	↖		↖	↖	↖
Traffic Volume (vph)	190	218	105	230	829	59	50	5	115	64	14	130
Future Volume (vph)	190	218	105	230	829	59	50	5	115	64	14	130
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	5.2	5.2
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.86		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	1770	1594		1770	1863	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	1770	1594		1770	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	207	237	114	250	901	64	54	5	125	70	15	141
RTOR Reduction (vph)	0	0	81	0	0	39	0	102	0	0	0	109
Lane Group Flow (vph)	207	237	33	250	901	25	54	28	0	70	15	32
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA		Prot	NA	Perm
Protected Phases	1	6		5	2		3	8		7		4
Permitted Phases			6			2						4
Actuated Green, G (s)	5.2	17.4	17.4	11.4	23.6	23.6	3.0	11.2		6.6	15.2	15.2
Effective Green, g (s)	5.2	18.7	18.7	11.4	24.9	24.9	3.0	12.2		6.6	14.6	14.6
Actuated g/C Ratio	0.08	0.29	0.29	0.18	0.38	0.38	0.05	0.19		0.10	0.22	0.22
Clearance Time (s)	4.0	5.3	5.3	4.0	5.3	5.3	4.0	5.0		4.0	4.6	4.6
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	275	1019	456	310	1357	607	81	299		180	419	356
v/s Ratio Prot	0.06	0.07		c0.14	c0.25		c0.03	0.02		0.04	0.01	
v/s Ratio Perm			0.02			0.02						c0.02
v/c Ratio	0.75	0.23	0.07	0.81	0.66	0.04	0.67	0.10		0.39	0.04	0.09
Uniform Delay, d1	29.2	17.6	16.8	25.7	16.5	12.5	30.5	21.8		27.3	19.7	19.9
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	11.1	0.1	0.1	14.2	1.2	0.0	18.8	0.1		1.4	0.0	0.1
Delay (s)	40.3	17.7	16.9	39.8	17.8	12.5	49.3	21.9		28.7	19.7	20.0
Level of Service	D	B	B	D	B	B	D	C		C	B	B
Approach Delay (s)		25.9			22.0			29.9			22.7	
Approach LOS		C			C			C			C	

Intersection Summary		
HCM 2000 Control Delay	23.8	HCM 2000 Level of Service C
HCM 2000 Volume to Capacity ratio	0.56	
Actuated Cycle Length (s)	64.9	Sum of lost time (s) 17.2
Intersection Capacity Utilization	49.5%	ICU Level of Service A
Analysis Period (min)	15	

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
28: Isabel Ave/Campus Hill Dr & Portola Ave

BART to Livermore Extension Project
2025 Enhanced Bus + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	1	190	281	631	596	140	507	301	80	39	155	1
Future Volume (vph)	1	190	281	631	596	140	507	301	80	39	155	1
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	5.8	5.8
Lane Util. Factor	1.00	0.95	0.88	0.94	0.95		0.97	0.95	1.00	1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	0.97		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3539	2787	4990	3438		3433	3539	1583	1770	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	3539	2787	4990	3438		3433	3539	1583	1770	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	1	207	305	686	648	152	551	327	87	42	168	1
RTOR Reduction (vph)	0	0	237	0	14	0	0	0	58	0	0	1
Lane Group Flow (vph)	1	207	68	686	786	0	551	327	29	42	168	0
Turn Type	Prot	NA	Perm	Prot	NA		Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4						2			6
Actuated Green, G (s)	1.5	18.3	18.3	17.1	33.9		20.1	28.3	28.3	5.3	13.9	13.9
Effective Green, g (s)	1.5	19.6	19.6	17.1	35.2		20.1	29.6	29.6	5.3	13.0	13.0
Actuated g/C Ratio	0.02	0.22	0.22	0.20	0.40		0.23	0.34	0.34	0.06	0.15	0.15
Clearance Time (s)	4.0	5.3	5.3	4.0	5.3		4.0	5.3	5.3	4.0	4.9	4.9
Vehicle Extension (s)	2.0	3.0	3.0	2.0	3.0		2.0	3.0	3.0	2.0	3.0	3.0
Lane Grp Cap (vph)	30	791	623	974	1381		787	1195	534	107	525	234
v/s Ratio Prot	0.00	0.06		c0.14	c0.23		c0.16	c0.09		0.02	0.05	
v/s Ratio Perm			0.02						0.02			0.00
v/c Ratio	0.03	0.26	0.11	0.70	0.57		0.70	0.27	0.06	0.39	0.32	0.00
Uniform Delay, d1	42.3	28.0	27.1	32.9	20.3		31.0	21.2	19.6	39.6	33.3	31.8
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.2	0.2	0.1	1.9	0.5		2.3	0.1	0.0	0.9	0.4	0.0
Delay (s)	42.5	28.2	27.1	34.8	20.9		33.3	21.3	19.6	40.5	33.7	31.8
Level of Service	D	C	C	C	C		C	C	B	D	C	C
Approach Delay (s)		27.6			27.3			28.0			35.0	
Approach LOS		C			C			C			D	

Intersection Summary

HCM 2000 Control Delay	28.1	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.62		
Actuated Cycle Length (s)	87.6	Sum of lost time (s)	17.8
Intersection Capacity Utilization	67.7%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 29: Isabel Ave & I-580 WB Ramps

BART to Livermore Extension Project
 2025 Enhanced Bus + Garage AM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	652	0	415	0	494	0	0	503	588
Future Volume (vph)	0	0	0	652	0	415	0	494	0	0	503	588
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0		4.0		5.6			5.6	5.6
Lane Util. Factor				0.97		1.00		0.95			0.95	1.00
Frt				1.00		0.85		1.00			1.00	0.85
Flt Protected				0.95		1.00		1.00			1.00	1.00
Satd. Flow (prot)				3433		1583		3539			3539	1583
Flt Permitted				0.95		1.00		1.00			1.00	1.00
Satd. Flow (perm)				3433		1583		3539			3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	709	0	451	0	537	0	0	547	639
RTOR Reduction (vph)	0	0	0	0	0	162	0	0	0	0	0	307
Lane Group Flow (vph)	0	0	0	709	0	289	0	537	0	0	547	332
Turn Type				Prot		Prot		NA	Free		NA	Prot
Protected Phases				8		8		2			6	6
Permitted Phases									Free			
Actuated Green, G (s)				14.4		14.4		26.8			26.8	26.8
Effective Green, g (s)				14.4		14.4		26.0			26.0	26.0
Actuated g/C Ratio				0.29		0.29		0.52			0.52	0.52
Clearance Time (s)				4.0		4.0		4.8			4.8	4.8
Vehicle Extension (s)				2.0		2.0		4.0			4.0	4.0
Lane Grp Cap (vph)				988		455		1840			1840	823
v/s Ratio Prot				c0.21		0.18		0.15			0.15	c0.21
v/s Ratio Perm												
v/c Ratio				0.72		0.63		0.29			0.30	0.40
Uniform Delay, d1				16.0		15.5		6.8			6.8	7.3
Progression Factor				1.00		1.00		0.80			1.00	1.00
Incremental Delay, d2				2.1		2.1		0.4			0.1	0.4
Delay (s)				18.1		17.6		5.8			6.9	7.7
Level of Service				B		B		A			A	A
Approach Delay (s)		0.0			17.9			5.8			7.4	
Approach LOS		A			B			A			A	
Intersection Summary												
HCM 2000 Control Delay			11.3									B
HCM 2000 Volume to Capacity ratio			0.52									
Actuated Cycle Length (s)			50.0								9.6	
Intersection Capacity Utilization			47.4%									A
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis
30: Isabel Ave & I-580 EB Ramps

BART to Livermore Extension Project
2025 Enhanced Bus + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗		↖↗					↕↕	↖		↕↕	↖
Traffic Volume (vph)	205	0	463	0	0	0	0	721	507	0	948	265
Future Volume (vph)	205	0	463	0	0	0	0	721	507	0	948	265
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0					4.0	4.0		4.0	4.0
Lane Util. Factor	0.97		0.88					0.95	1.00		0.95	1.00
Frt	1.00		0.85					1.00	0.85		1.00	0.85
Flt Protected	0.95		1.00					1.00	1.00		1.00	1.00
Satd. Flow (prot)	3433		2787					3539	1583		3539	1583
Flt Permitted	0.95		1.00					1.00	1.00		1.00	1.00
Satd. Flow (perm)	3433		2787					3539	1583		3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	223	0	503	0	0	0	0	784	551	0	1030	288
RTOR Reduction (vph)	0	0	174	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	223	0	329	0	0	0	0	784	551	0	1030	288
Turn Type	Prot		Perm					NA	Free		NA	Free
Protected Phases	4							2			6	
Permitted Phases			4						Free			Free
Actuated Green, G (s)	9.3		9.3					31.7	50.0		31.7	50.0
Effective Green, g (s)	9.3		9.3					32.7	50.0		32.7	50.0
Actuated g/C Ratio	0.19		0.19					0.65	1.00		0.65	1.00
Clearance Time (s)	4.0		4.0					5.0			5.0	
Vehicle Extension (s)	2.0		2.0					4.0			4.0	
Lane Grp Cap (vph)	638		518					2314	1583		2314	1583
v/s Ratio Prot	0.06							0.22			c0.29	
v/s Ratio Perm			c0.12						0.35			0.18
v/c Ratio	0.35		0.63					0.34	0.35		0.45	0.18
Uniform Delay, d1	17.7		18.8					3.8	0.0		4.2	0.0
Progression Factor	1.00		1.00					1.00	1.00		0.42	1.00
Incremental Delay, d2	0.1		1.9					0.1	0.6		0.6	0.2
Delay (s)	17.8		20.7					4.0	0.6		2.4	0.2
Level of Service	B		C					A	A		A	A
Approach Delay (s)		19.8			0.0			2.6			1.9	
Approach LOS		B			A			A			A	

Intersection Summary

HCM 2000 Control Delay	6.0	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.49		
Actuated Cycle Length (s)	50.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	49.1%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 31: Isabel Ave & Airway Blvd

BART to Livermore Extension Project
 2025 Enhanced Bus + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↑	↗	↖	↑	↗	↖	↑↑↑	↗	↖↗	↑↑↑	↗
Traffic Volume (vph)	0	56	183	137	246	111	333	1068	20	259	1341	19
Future Volume (vph)	0	56	183	137	246	111	333	1068	20	259	1341	19
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.2	5.6	5.2	5.2	5.6	4.0	4.0	4.0	4.0	4.0	5.0
Lane Util. Factor		1.00	1.00	1.00	1.00	1.00	1.00	0.91	1.00	0.97	0.91	1.00
Frt		1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1863	1583	1770	1863	1583	1770	5085	1583	3433	5085	1583
Flt Permitted		1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)		1863	1583	1770	1863	1583	1770	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	61	199	149	267	121	362	1161	22	282	1458	21
RTOR Reduction (vph)	0	0	72	0	0	76	0	0	12	0	0	14
Lane Group Flow (vph)	0	61	127	149	267	45	362	1161	10	282	1458	7
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4	5	3	8	1	5	2		1	6	
Permitted Phases			4			8			2			6
Actuated Green, G (s)		6.9	26.0	9.9	21.4	33.2	19.1	37.8	37.8	11.8	30.5	30.5
Effective Green, g (s)		6.3	24.8	9.3	20.8	32.0	20.1	38.8	38.8	12.8	31.5	30.5
Actuated g/C Ratio		0.07	0.29	0.11	0.24	0.37	0.23	0.45	0.45	0.15	0.37	0.36
Clearance Time (s)		4.6	5.0	4.6	4.6	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Extension (s)		3.0	3.0	3.0	3.0	3.0	3.0	5.0	5.0	3.0	5.0	5.0
Lane Grp Cap (vph)		137	458	192	452	591	415	2304	717	513	1871	564
v/s Ratio Prot		0.03	0.06	c0.08	c0.14	0.01	c0.20	0.23		0.08	c0.29	
v/s Ratio Perm			0.02			0.02			0.01			0.00
v/c Ratio		0.45	0.28	0.78	0.59	0.08	0.87	0.50	0.01	0.55	0.78	0.01
Uniform Delay, d1		38.0	23.5	37.1	28.6	17.3	31.5	16.6	12.9	33.7	24.0	17.8
Progression Factor		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2		2.3	0.3	17.6	2.1	0.1	17.9	0.4	0.0	1.2	2.5	0.0
Delay (s)		40.3	23.8	54.8	30.7	17.3	49.4	16.9	12.9	34.9	26.5	17.8
Level of Service		D	C	D	C	B	D	B	B	C	C	B
Approach Delay (s)		27.7			34.4			24.5			27.7	
Approach LOS		C			C			C			C	

Intersection Summary		
HCM 2000 Control Delay	27.4	HCM 2000 Level of Service C
HCM 2000 Volume to Capacity ratio	0.83	
Actuated Cycle Length (s)	85.6	Sum of lost time (s) 20.0
Intersection Capacity Utilization	69.6%	ICU Level of Service C
Analysis Period (min)	15	

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
32: Isabel Ave & Jack London Blvd

BART to Livermore Extension Project
2025 Enhanced Bus + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↕	↖	↖	↕	↖	↖↗	↕↕	↖	↖↗	↕↕	↖
Traffic Volume (vph)	26	53	53	212	758	304	354	855	97	157	1168	284
Future Volume (vph)	26	53	53	212	758	304	354	855	97	157	1168	284
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.97	0.91	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	3433	5085	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	3433	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	28	58	58	230	824	330	385	929	105	171	1270	309
RTOR Reduction (vph)	0	0	49	0	0	70	0	0	67	0	0	116
Lane Group Flow (vph)	28	58	9	230	824	260	385	929	38	171	1270	193
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8	1	5	2		1	NA	6
Permitted Phases			4			8			2			6
Actuated Green, G (s)	3.8	16.1	16.1	17.9	30.2	40.3	14.6	37.8	37.8	10.1	33.3	33.3
Effective Green, g (s)	3.8	16.1	16.1	17.9	30.2	40.3	14.6	37.8	37.8	10.1	33.3	33.3
Actuated g/C Ratio	0.04	0.16	0.16	0.17	0.29	0.39	0.14	0.37	0.37	0.10	0.32	0.32
Clearance Time (s)	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	126	552	247	307	1036	700	486	1864	580	336	1642	511
v/s Ratio Prot	0.01	0.02		c0.13	c0.23	0.04	c0.11	c0.18		0.05	c0.25	
v/s Ratio Perm			0.01			0.13			0.02			0.12
v/c Ratio	0.22	0.11	0.04	0.75	0.80	0.37	0.79	0.50	0.07	0.51	0.77	0.38
Uniform Delay, d1	48.2	37.3	36.9	40.5	33.6	22.4	42.8	25.3	21.2	44.1	31.5	26.9
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.9	0.1	0.1	9.6	4.3	0.3	8.6	0.2	0.0	1.2	2.3	0.5
Delay (s)	49.1	37.4	37.0	50.1	37.9	22.7	51.4	25.5	21.2	45.4	33.8	27.4
Level of Service	D	D	D	D	D	C	D	C	C	D	C	C
Approach Delay (s)		39.5			36.3			32.2			33.8	
Approach LOS		D			D			C			C	

Intersection Summary

HCM 2000 Control Delay	34.2	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.80		
Actuated Cycle Length (s)	103.1	Sum of lost time (s)	21.2
Intersection Capacity Utilization	66.9%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 33: Isabel Ave Connector & Stanley Blvd



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑	↑	↔	↑↑	↔	↔
Traffic Volume (vph)	338	162	318	1968	385	204
Future Volume (vph)	338	162	318	1968	385	204
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	3.8	4.0	4.0	4.0	2.5
Lane Util. Factor	0.95	1.00	0.97	0.95	0.97	0.88
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	3539	1583	3433	3539	3433	2787
Flt Permitted	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (perm)	3539	1583	3433	3539	3433	2787
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	367	176	346	2139	418	222
RTOR Reduction (vph)	0	17	0	0	0	141
Lane Group Flow (vph)	367	159	346	2139	418	81
Turn Type	NA	pm+ov	Prot	NA	Prot	pm+ov
Protected Phases	2	8	1	6	8	1
Permitted Phases		2				8
Actuated Green, G (s)	38.0	51.8	11.9	53.9	13.8	25.7
Effective Green, g (s)	39.7	55.2	11.9	55.6	15.3	28.7
Actuated g/C Ratio	0.50	0.70	0.15	0.70	0.19	0.36
Clearance Time (s)	5.7	5.5	4.0	5.7	5.5	4.0
Vehicle Extension (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Grp Cap (vph)	1780	1107	517	2493	665	1013
v/s Ratio Prot	0.10	0.03	0.10	c0.60	c0.12	0.01
v/s Ratio Perm		0.07				0.02
v/c Ratio	0.21	0.14	0.67	0.86	0.63	0.08
Uniform Delay, d1	10.9	4.0	31.6	8.7	29.2	16.4
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.0	0.0	2.5	3.0	1.3	0.0
Delay (s)	10.9	4.0	34.2	11.7	30.5	16.5
Level of Service	B	A	C	B	C	B
Approach Delay (s)	8.6			14.9	25.7	
Approach LOS	A			B	C	

Intersection Summary

HCM 2000 Control Delay	15.8	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.86		
Actuated Cycle Length (s)	78.9	Sum of lost time (s)	12.0
Intersection Capacity Utilization	72.1%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 34: Murrieta Blvd/Driveway & Portola Ave

BART to Livermore Extension Project
 2025 Enhanced Bus + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗		↖	↗		↖	↗	↗		↗	
Traffic Volume (vph)	0	385	93	268	1212	1	188	6	148	1	3	0
Future Volume (vph)	0	385	93	268	1212	1	188	6	148	1	3	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.8		4.0	5.8		5.2	5.2	5.2		4.0	
Lane Util. Factor		0.95		1.00	0.95		0.95	0.95	1.00		1.00	
Frt		0.97		1.00	1.00		1.00	1.00	0.85		1.00	
Flt Protected		1.00		0.95	1.00		0.95	0.96	1.00		0.99	
Satd. Flow (prot)		3436		1770	3539		1681	1691	1583		1840	
Flt Permitted		1.00		0.95	1.00		0.95	0.96	1.00		0.99	
Satd. Flow (perm)		3436		1770	3539		1681	1691	1583		1840	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	418	101	291	1317	1	204	7	161	1	3	0
RTOR Reduction (vph)	0	27	0	0	0	0	0	0	138	0	0	0
Lane Group Flow (vph)	0	492	0	291	1318	0	106	105	23	0	4	0
Turn Type	Prot	NA		Prot	NA		Split	NA	Perm		Split	NA
Protected Phases	5	2		1	6		8	8		4	4	
Permitted Phases									8			
Actuated Green, G (s)		12.5		14.5	31.0		8.1	8.1	8.1		0.6	
Effective Green, g (s)		11.6		14.5	30.1		7.5	7.5	7.5		0.6	
Actuated g/C Ratio		0.22		0.27	0.57		0.14	0.14	0.14		0.01	
Clearance Time (s)		4.9		4.0	4.9		4.6	4.6	4.6		4.0	
Vehicle Extension (s)		2.0		2.0	2.0		2.0	2.0	2.0		2.0	
Lane Grp Cap (vph)		749		482	2002		236	238	223		20	
v/s Ratio Prot		0.14		0.16	c0.37		c0.06	0.06			c0.00	
v/s Ratio Perm									0.01			
v/c Ratio		0.66		0.60	0.66		0.45	0.44	0.10		0.20	
Uniform Delay, d1		19.0		16.8	8.0		21.0	20.9	19.9		26.1	
Progression Factor		1.00		1.00	1.00		1.00	1.00	1.00		1.00	
Incremental Delay, d2		1.6		1.5	0.6		0.5	0.5	0.1		1.8	
Delay (s)		20.6		18.3	8.6		21.5	21.4	20.0		27.9	
Level of Service		C		B	A		C	C	B		C	
Approach Delay (s)		20.6			10.4			20.8			27.9	
Approach LOS		C			B			C			C	

Intersection Summary		
HCM 2000 Control Delay	14.1	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.68	B
Actuated Cycle Length (s)	53.2	Sum of lost time (s)
Intersection Capacity Utilization	61.4%	19.0
Analysis Period (min)	15	ICU Level of Service
		B

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
35: Murrieta Blvd & Jack London Blvd

BART to Livermore Extension Project
2025 Enhanced Bus + Garage AM



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	76	256	623	206	246	167
Future Volume (vph)	76	256	623	206	246	167
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00	1.00	0.95	0.91	
Frt	1.00	0.85	1.00	1.00	0.94	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1770	1583	1770	3539	4776	
Flt Permitted	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	1770	1583	1770	3539	4776	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	83	278	677	224	267	182
RTOR Reduction (vph)	0	237	0	0	152	0
Lane Group Flow (vph)	83	41	677	224	297	0
Turn Type	Prot	Perm	Prot	NA	NA	
Protected Phases	4		5	2	6	
Permitted Phases		4				
Actuated Green, G (s)	8.5	8.5	27.3	40.8	9.5	
Effective Green, g (s)	8.5	8.5	27.3	40.8	9.5	
Actuated g/C Ratio	0.15	0.15	0.48	0.71	0.17	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	262	234	843	2519	791	
v/s Ratio Prot	c0.05		c0.38	0.06	c0.06	
v/s Ratio Perm		0.03				
v/c Ratio	0.32	0.18	0.80	0.09	0.38	
Uniform Delay, d1	21.8	21.3	12.7	2.5	21.3	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.7	0.4	5.6	0.0	0.3	
Delay (s)	22.5	21.7	18.3	2.6	21.6	
Level of Service	C	C	B	A	C	
Approach Delay (s)	21.9			14.4	21.6	
Approach LOS	C			B	C	

Intersection Summary

HCM 2000 Control Delay	17.8	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.62		
Actuated Cycle Length (s)	57.3	Sum of lost time (s)	12.0
Intersection Capacity Utilization	57.2%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 36: Murrieta Blvd & Stanley Blvd

BART to Livermore Extension Project
 2025 Enhanced Bus + Garage AM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	210	434	223	17	820	113	436	336	8	153	224	448
Future Volume (vph)	210	434	223	17	820	113	436	336	8	153	224	448
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.9	4.9	4.0	4.9	4.9	4.9	4.9		4.9	4.9	4.0
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.97	0.95		1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	3433	3526		1770	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	3433	3526		1770	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	228	472	242	18	891	123	474	365	9	166	243	487
RTOR Reduction (vph)	0	0	159	0	0	70	0	2	0	0	0	90
Lane Group Flow (vph)	228	472	83	18	891	53	474	372	0	166	243	397
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Prot	NA		Prot	NA	Perm
Protected Phases	7	4		3	8	1	5	2		1	6	
Permitted Phases			4			8						6
Actuated Green, G (s)	6.0	28.9	28.9	1.6	24.5	36.6	13.0	22.6		12.1	21.7	21.7
Effective Green, g (s)	6.0	28.0	28.0	1.6	23.6	34.8	12.1	21.7		11.2	20.8	21.7
Actuated g/C Ratio	0.07	0.34	0.34	0.02	0.29	0.43	0.15	0.27		0.14	0.26	0.27
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	253	1220	545	34	1028	773	511	942		244	906	423
v/s Ratio Prot	c0.07	0.13		0.01	c0.25	0.01	c0.14	0.11		0.09	0.07	
v/s Ratio Perm			0.05			0.02						c0.25
v/c Ratio	0.90	0.39	0.15	0.53	0.87	0.07	0.93	0.39		0.68	0.27	0.94
Uniform Delay, d1	37.3	20.1	18.4	39.4	27.3	13.7	34.1	24.4		33.3	24.1	29.1
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	31.8	0.2	0.1	14.1	7.8	0.0	23.0	0.3		7.6	0.2	28.4
Delay (s)	69.1	20.3	18.5	53.5	35.1	13.7	57.2	24.6		40.9	24.3	57.5
Level of Service	E	C	B	D	D	B	E	C		D	C	E
Approach Delay (s)		31.7			32.9			42.8			45.4	
Approach LOS		C			C			D			D	

Intersection Summary		
HCM 2000 Control Delay	37.9	HCM 2000 Level of Service D
HCM 2000 Volume to Capacity ratio	0.92	
Actuated Cycle Length (s)	81.2	Sum of lost time (s) 18.7
Intersection Capacity Utilization	74.3%	ICU Level of Service D
Analysis Period (min)	15	

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 37: Livermore Ave & I-580 WB Ramps

BART to Livermore Extension Project
 2025 Enhanced Bus + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↖	↔		↗	↑			↕	
Traffic Volume (vph)	0	0	0	344	88	28	444	79	0	0	151	0
Future Volume (vph)	0	0	0	344	88	28	444	79	0	0	151	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)					4.0		4.0	4.0			4.0	
Lane Util. Factor					0.95		0.97	1.00			0.95	
Frt					0.99		1.00	1.00			1.00	
Flt Protected					0.96		0.95	1.00			1.00	
Satd. Flow (prot)					1690		3433	1863			3539	
Flt Permitted					0.96		0.95	1.00			1.00	
Satd. Flow (perm)					1690		3433	1863			3539	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	374	96	30	483	86	0	0	164	0
RTOR Reduction (vph)	0	0	0	0	5	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	0	495	0	483	86	0	0	164	0
Turn Type				Split	NA		Prot	NA			NA	
Protected Phases				8	8		5	2			6	
Permitted Phases												
Actuated Green, G (s)					21.1		12.0	29.2			13.7	
Effective Green, g (s)					21.1		11.5	30.9			15.4	
Actuated g/C Ratio					0.35		0.19	0.51			0.26	
Clearance Time (s)					4.0		3.5	5.7			5.7	
Vehicle Extension (s)					2.0		2.0	2.5			2.5	
Lane Grp Cap (vph)					594		657	959			908	
v/s Ratio Prot					c0.29		c0.14	0.05			c0.05	
v/s Ratio Perm												
v/c Ratio					0.83		0.74	0.09			0.18	
Uniform Delay, d1					17.8		22.8	7.4			17.4	
Progression Factor					1.00		0.73	0.26			1.00	
Incremental Delay, d2					9.4		3.4	0.2			0.4	
Delay (s)					27.2		20.0	2.1			17.8	
Level of Service					C		B	A			B	
Approach Delay (s)		0.0			27.2			17.3			17.8	
Approach LOS		A			C			B			B	

Intersection Summary			
HCM 2000 Control Delay	21.4	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.60		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	46.9%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

38: Livermore Ave & I-580 EB Ramps

BART to Livermore Extension Project
2025 Enhanced Bus + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕	↗					↕		↘	↕	
Traffic Volume (vph)	15	1	602	0	0	0	0	506	198	17	482	0
Future Volume (vph)	15	1	602	0	0	0	0	506	198	17	482	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0					4.0		4.0	4.0	
Lane Util. Factor		0.95	0.95					0.95		1.00	0.95	
Frt		0.86	0.85					0.96		1.00	1.00	
Flt Protected		1.00	1.00					1.00		0.95	1.00	
Satd. Flow (prot)		1514	1504					3390		1770	3539	
Flt Permitted		1.00	1.00					1.00		0.95	1.00	
Satd. Flow (perm)		1514	1504					3390		1770	3539	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	16	1	654	0	0	0	0	550	215	18	524	0
RTOR Reduction (vph)	0	224	224	0	0	0	0	51	0	0	0	0
Lane Group Flow (vph)	0	113	110	0	0	0	0	714	0	18	524	0
Turn Type	Prot	NA	Perm					NA		Prot	NA	
Protected Phases	7	4						2		1	6	
Permitted Phases			4									
Actuated Green, G (s)		15.9	15.9					30.8		1.3	35.1	
Effective Green, g (s)		15.9	15.9					31.8		0.3	36.1	
Actuated g/C Ratio		0.27	0.27					0.53		0.00	0.60	
Clearance Time (s)		4.0	4.0					5.0		3.0	5.0	
Vehicle Extension (s)		2.0	2.0					2.5		2.0	2.5	
Lane Grp Cap (vph)		401	398					1796		8	2129	
v/s Ratio Prot								c0.21		c0.01	0.15	
v/s Ratio Perm		0.07	0.07									
v/c Ratio		0.28	0.28					0.40		2.25	0.25	
Uniform Delay, d1		17.5	17.5					8.4		29.9	5.6	
Progression Factor		1.00	1.00					1.00		1.10	0.23	
Incremental Delay, d2		0.1	0.1					0.7		803.6	0.2	
Delay (s)		17.7	17.6					9.1		836.3	1.5	
Level of Service		B	B					A		F	A	
Approach Delay (s)		17.6			0.0			9.1			29.2	
Approach LOS		B			A			A			C	

Intersection Summary

HCM 2000 Control Delay	17.5	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.37		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	46.9%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 39: Livermore Ave & Portola Ave

BART to Livermore Extension Project
 2025 Enhanced Bus + Garage AM
























Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔↔	↕↔		↔	↕↔		↔	↕↔		↔	↕↕	↔
Traffic Volume (vph)	212	264	101	29	732	59	353	435	87	97	546	352
Future Volume (vph)	212	264	101	29	732	59	353	435	87	97	546	352
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	5.8		4.0	5.8	4.9
Lane Util. Factor	0.97	0.95		1.00	0.95		1.00	0.95		1.00	0.95	1.00
Frt	1.00	0.96		1.00	0.99		1.00	0.97		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3392		1770	3500		1770	3450		1770	3539	1583
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3392		1770	3500		1770	3450		1770	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	230	287	110	32	796	64	384	473	95	105	593	383
RTOR Reduction (vph)	0	32	0	0	5	0	0	15	0	0	0	95
Lane Group Flow (vph)	230	365	0	32	855	0	384	553	0	105	593	288
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	pm+ov
Protected Phases	3	8		7	4		1	6		5	2	3
Permitted Phases												2
Actuated Green, G (s)	9.9	36.9		3.4	30.4		23.2	36.0		10.7	23.5	33.4
Effective Green, g (s)	9.9	38.2		3.4	31.7		23.2	35.1		10.7	22.6	31.6
Actuated g/C Ratio	0.09	0.36		0.03	0.30		0.22	0.33		0.10	0.21	0.30
Clearance Time (s)	4.0	5.3		4.0	5.3		4.0	4.9		4.0	4.9	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	323	1231		57	1054		390	1151		180	760	475
v/s Ratio Prot	c0.07	0.11		0.02	c0.24		c0.22	0.16		0.06	c0.17	0.05
v/s Ratio Perm												0.13
v/c Ratio	0.71	0.30		0.56	0.81		0.98	0.48		0.58	0.78	0.61
Uniform Delay, d1	46.3	23.9		50.2	34.0		40.8	27.8		45.1	39.0	31.5
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	7.2	0.1		12.0	4.8		41.2	0.3		4.8	5.2	2.2
Delay (s)	53.5	24.0		62.2	38.8		82.0	28.1		49.9	44.2	33.7
Level of Service	D	C		E	D		F	C		D	D	C
Approach Delay (s)		34.8			39.7			49.9			41.0	
Approach LOS		C			D			D			D	

Intersection Summary		
HCM 2000 Control Delay	41.9	HCM 2000 Level of Service D
HCM 2000 Volume to Capacity ratio	0.85	
Actuated Cycle Length (s)	105.2	Sum of lost time (s) 18.7
Intersection Capacity Utilization	77.6%	ICU Level of Service D
Analysis Period (min)	15	

c Critical Lane Group



















HCM Signalized Intersection Capacity Analysis
 40: First St/Springtown Blvd & I-580 WB Ramps

BART to Livermore Extension Project
 2025 Enhanced Bus + Garage AM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations			 				 				 	
Traffic Volume (vph)	0	0	443	0	0	0	341	375	0	0	875	612
Future Volume (vph)	0	0	443	0	0	0	341	375	0	0	875	612
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)			4.0				4.0	4.0			5.0	5.0
Lane Util. Factor			0.88				0.97	1.00			0.95	1.00
Frt			0.85				1.00	1.00			1.00	0.85
Flt Protected			1.00				0.95	1.00			1.00	1.00
Satd. Flow (prot)			2787				3433	1863			3539	1583
Flt Permitted			1.00				0.95	1.00			1.00	1.00
Satd. Flow (perm)			2787				3433	1863			3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	482	0	0	0	371	408	0	0	951	665
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	62
Lane Group Flow (vph)	0	0	482	0	0	0	371	408	0	0	951	603
Turn Type			Over			Free	Prot	NA			NA	Perm
Protected Phases			5				5	2			6	
Permitted Phases						Free						6
Actuated Green, G (s)			21.7				21.7	100.0			70.3	70.3
Effective Green, g (s)			21.2				21.2	100.0			69.8	69.8
Actuated g/C Ratio			0.21				0.21	1.00			0.70	0.70
Clearance Time (s)			3.5				3.5	4.0			4.5	4.5
Vehicle Extension (s)			2.0				2.0	0.2			4.0	4.0
Lane Grp Cap (vph)			590				727	1863			2470	1104
v/s Ratio Prot			c0.17				0.11	0.22			0.27	
v/s Ratio Perm												c0.38
v/c Ratio			0.82				0.51	0.22			0.39	0.55
Uniform Delay, d1			37.6				34.8	0.0			6.2	7.4
Progression Factor			1.00				1.02	1.00			1.00	1.00
Incremental Delay, d2			8.2				0.2	0.3			0.1	0.7
Delay (s)			45.7				35.7	0.3			6.4	8.1
Level of Service			D				D	A			A	A
Approach Delay (s)		45.7			0.0			17.1			7.1	
Approach LOS		D			A			B			A	
Intersection Summary												
HCM 2000 Control Delay			16.3				HCM 2000 Level of Service				B	
HCM 2000 Volume to Capacity ratio			0.61									
Actuated Cycle Length (s)			100.0				Sum of lost time (s)				9.0	
Intersection Capacity Utilization			55.1%				ICU Level of Service				B	
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis
41: First St & I-580 EB Ramps

BART to Livermore Extension Project
2025 Enhanced Bus + Garage AM

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations													
Traffic Volume (vph)	94	1	356	0	0	0	0	629	323	66	1222	0	
Future Volume (vph)	94	1	356	0	0	0	0	629	323	66	1222	0	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)		4.0	4.0					5.0	5.0	4.0	5.0		
Lane Util. Factor		1.00	0.88					0.95	1.00	1.00	0.95		
Frt		1.00	0.85					1.00	0.85	1.00	1.00		
Flt Protected		0.95	1.00					1.00	1.00	0.95	1.00		
Satd. Flow (prot)		1775	2787					3539	1583	1770	3539		
Flt Permitted		0.95	1.00					1.00	1.00	0.95	1.00		
Satd. Flow (perm)		1775	2787					3539	1583	1770	3539		
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	
Adj. Flow (vph)	102	1	387	0	0	0	0	684	351	72	1328	0	
RTOR Reduction (vph)	0	0	108	0	0	0	0	0	174	0	0	0	
Lane Group Flow (vph)	0	103	279	0	0	0	0	684	177	72	1328	0	
Turn Type	Perm	NA	Perm					NA	Perm	Prot	NA		
Protected Phases		4						2		1	6		
Permitted Phases	4		4						2				
Actuated Green, G (s)		9.2	9.2					25.7	25.7	4.1	32.8		
Effective Green, g (s)		8.7	8.7					25.2	25.2	3.1	32.3		
Actuated g/C Ratio		0.17	0.17					0.50	0.50	0.06	0.65		
Clearance Time (s)		3.5	3.5					4.5	4.5	3.0	4.5		
Vehicle Extension (s)		2.5	2.5					4.0	4.0	2.0	4.0		
Lane Grp Cap (vph)		308	484					1783	797	109	2286		
v/s Ratio Prot								0.19		0.04	c0.38		
v/s Ratio Perm		0.06	c0.10						0.11				
v/c Ratio		0.33	0.58					0.38	0.22	0.66	0.58		
Uniform Delay, d1		18.1	19.0					7.6	6.9	22.9	5.0		
Progression Factor		1.00	1.00					1.00	1.00	0.99	1.04		
Incremental Delay, d2		0.5	1.4					0.6	0.6	10.0	1.0		
Delay (s)		18.6	20.3					8.3	7.6	32.8	6.2		
Level of Service		B	C					A	A	C	A		
Approach Delay (s)		20.0			0.0			8.0			7.6		
Approach LOS		B			A			A			A		
Intersection Summary													
HCM 2000 Control Delay			9.8									HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio			0.64										
Actuated Cycle Length (s)			50.0									Sum of lost time (s)	13.0
Intersection Capacity Utilization			53.7%									ICU Level of Service	A
Analysis Period (min)			15										
c Critical Lane Group													

HCM Signalized Intersection Capacity Analysis
42: 1st St & Mines Rd

BART to Livermore Extension Project
2025 Enhanced Bus + Garage AM





















Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗		↖↗	↑	↖	↖	↑↑↑		↖↗	↑↑↑	
Traffic Volume (vph)	33	70	42	537	107	334	18	852	307	214	1246	20
Future Volume (vph)	33	70	42	537	107	334	18	852	307	214	1246	20
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		0.97	1.00	1.00	1.00	0.91		0.97	0.91	
Frt	1.00	0.94		1.00	1.00	0.85	1.00	0.96		1.00	1.00	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1757		3433	1863	1583	1770	4883		3433	5073	
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	1757		3433	1863	1583	1770	4883		3433	5073	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	36	76	46	584	116	363	20	926	334	233	1354	22
RTOR Reduction (vph)	0	35	0	0	0	78	0	85	0	0	2	0
Lane Group Flow (vph)	36	87	0	584	116	285	20	1175	0	233	1374	0
Turn Type	Prot	NA		Prot	NA	pm+ov	Prot	NA		Prot	NA	
Protected Phases	7	4		3	8	1	5	2		1	6	
Permitted Phases						8						
Actuated Green, G (s)	1.8	8.5		12.2	18.9	24.0	0.7	23.4		5.1	27.8	
Effective Green, g (s)	1.8	8.5		12.2	18.9	24.0	0.7	23.4		5.1	27.8	
Actuated g/C Ratio	0.03	0.13		0.19	0.29	0.37	0.01	0.36		0.08	0.43	
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	48	229		642	540	679	19	1752		268	2163	
v/s Ratio Prot	0.02	0.05		c0.17	0.06	c0.03	0.01	0.24		c0.07	c0.27	
v/s Ratio Perm						0.15						
v/c Ratio	0.75	0.38		0.91	0.21	0.42	1.05	0.67		0.87	0.64	
Uniform Delay, d1	31.5	25.9		26.0	17.5	15.4	32.2	17.6		29.7	14.7	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	48.1	1.1		16.8	0.2	0.4	224.0	1.0		24.5	0.6	
Delay (s)	79.6	27.0		42.7	17.7	15.8	256.3	18.7		54.2	15.3	
Level of Service	E	C		D	B	B	F	B		D	B	
Approach Delay (s)		39.0			30.8			22.4			21.0	
Approach LOS		D			C			C			C	

Intersection Summary		
HCM 2000 Control Delay	24.6	HCM 2000 Level of Service C
HCM 2000 Volume to Capacity ratio	0.76	
Actuated Cycle Length (s)	65.2	Sum of lost time (s) 16.0
Intersection Capacity Utilization	61.4%	ICU Level of Service B
Analysis Period (min)	15	

c Critical Lane Group




















HCM Unsignalized Intersection Capacity Analysis
 43: Vasco Rd & I-580 WB Ramps

BART to Livermore Extension Project
 2025 Enhanced Bus + Garage AM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	0	0	169	0	830	0	0	1532	0
Future Volume (Veh/h)	0	0	0	0	0	169	0	830	0	0	1532	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	0	0	0	184	0	902	0	0	1665	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage (veh)												
Upstream signal (ft)											487	
pX, platoon unblocked												
vC, conflicting volume	2300	2567	1665	2567	2567	451	1665			902		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	2300	2567	1665	2567	2567	451	1665			902		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	100	100	67	100			100		
cM capacity (veh/h)	14	26	86	13	26	556	382			749		
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	SB 1	SB 2					
Volume Total	0	184	451	451	0	1665	0					
Volume Left	0	0	0	0	0	0	0					
Volume Right	0	184	0	0	0	0	0					
cSH	1700	556	1700	1700	1700	1700	1700					
Volume to Capacity	0.00	0.33	0.27	0.27	0.00	0.98	0.00					
Queue Length 95th (ft)	0	36	0	0	0	0	0					
Control Delay (s)	0.0	14.7	0.0	0.0	0.0	0.0	0.0					
Lane LOS	A	B										
Approach Delay (s)	0.0	14.7	0.0			0.0						
Approach LOS	A	B										
Intersection Summary												
Average Delay			1.0									
Intersection Capacity Utilization			84.0%	ICU Level of Service	E							
Analysis Period (min)			15									

HCM Unsignalized Intersection Capacity Analysis
44: Vasco Rd & I-580 EB Ramps

BART to Livermore Extension Project
2025 Enhanced Bus + Garage AM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	0	0	0	0	1183	0	73	1754	0
Future Volume (Veh/h)	0	0	0	0	0	0	0	1183	0	73	1754	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	0	0	0	0	0	1286	0	79	1907	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	2708	3351	1907	3351	3351	643	1907			1286		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	2708	3351	1907	3351	3351	643	1907			1286		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	100	100	100	100			85		
cM capacity (veh/h)	9	7	58	3	7	416	308			535		
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2						
Volume Total	0	0	857	429	79	1907						
Volume Left	0	0	0	0	79	0						
Volume Right	0	0	0	0	0	0						
cSH	1700	1700	1700	1700	535	1700						
Volume to Capacity	0.00	0.00	0.50	0.25	0.15	1.12						
Queue Length 95th (ft)	0	0	0	0	13	0						
Control Delay (s)	0.0	0.0	0.0	0.0	12.9	0.0						
Lane LOS	A	A			B							
Approach Delay (s)	0.0	0.0	0.0		0.5							
Approach LOS	A	A										
Intersection Summary												
Average Delay			0.3									
Intersection Capacity Utilization			95.6%	ICU Level of Service	F							
Analysis Period (min)			15									

HCM Signalized Intersection Capacity Analysis

45: Vasco Rd & East Ave

BART to Livermore Extension Project

2025 Enhanced Bus + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	280	324	50	7	17	14	63	255	183	234	286	278
Future Volume (vph)	280	324	50	7	17	14	63	255	183	234	286	278
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	0.95		0.97	1.00	1.00
Frt	1.00	0.98		1.00	0.93		1.00	0.94		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	3469		1770	3298		1770	3317		3433	1863	1583
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1770	3469		1770	3298		1770	3317		3433	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	304	352	54	8	18	15	68	277	199	254	311	302
RTOR Reduction (vph)	0	21	0	0	14	0	0	146	0	0	0	203
Lane Group Flow (vph)	304	385	0	8	19	0	68	330	0	254	311	99
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												6
Actuated Green, G (s)	12.3	14.4		0.6	2.7		2.2	13.2		5.2	16.2	16.2
Effective Green, g (s)	12.3	14.4		0.6	2.7		2.2	13.2		5.2	16.2	16.2
Actuated g/C Ratio	0.25	0.29		0.01	0.05		0.04	0.27		0.11	0.33	0.33
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	440	1011		21	180		78	886		361	610	519
v/s Ratio Prot	c0.17	c0.11		0.00	0.01		0.04	0.10		c0.07	c0.17	
v/s Ratio Perm												0.06
v/c Ratio	0.69	0.38		0.38	0.10		0.87	0.37		0.70	0.51	0.19
Uniform Delay, d1	16.8	13.9		24.2	22.2		23.5	14.7		21.4	13.4	11.9
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	4.6	0.2		11.2	0.3		60.6	0.3		6.1	0.7	0.2
Delay (s)	21.5	14.2		35.4	22.5		84.1	15.0		27.5	14.1	12.1
Level of Service	C	B		D	C		F	B		C	B	B
Approach Delay (s)		17.3			25.0			23.6			17.3	
Approach LOS		B			C			C			B	

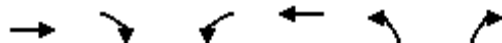
Intersection Summary

HCM 2000 Control Delay	19.0	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.64		
Actuated Cycle Length (s)	49.4	Sum of lost time (s)	16.0
Intersection Capacity Utilization	51.8%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Unsignalized Intersection Capacity Analysis
 46: I-580 WB Ramps & Northfront Rd/Northfront Road

BART to Livermore Extension Project
 2025 Enhanced Bus + Garage AM



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↻			↻	↻	↻
Traffic Volume (veh/h)	116	214	1317	124	64	541
Future Volume (Veh/h)	116	214	1317	124	64	541
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	126	233	1432	135	70	588
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None		None			
Median storage veh						
Upstream signal (ft)	1007					
pX, platoon unblocked					0.51	
vC, conflicting volume			126		3242	242
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			126		4948	242
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			2		0	26
cM capacity (veh/h)			1460		0	796
Direction, Lane #	EB 1	WB 1	NB 1	NB 2		
Volume Total	359	1567	70	588		
Volume Left	0	1432	70	0		
Volume Right	233	0	0	588		
cSH	1700	1460	0	796		
Volume to Capacity	0.21	0.98	9721.42	0.74		
Queue Length 95th (ft)	0	537	Err	168		
Control Delay (s)	0.0	36.4	Err	21.1		
Lane LOS		E	F	C		
Approach Delay (s)	0.0	36.4	1082.6			
Approach LOS			F			
Intersection Summary						
Average Delay			297.7			
Intersection Capacity Utilization			112.3%	ICU Level of Service	H	
Analysis Period (min)			15			

Intersection	
Intersection Delay, s/veh	10
Intersection LOS	A

Movement	EBU	EBL	EBT	WBU	WBT	WBR	SBU	SBL	SBR
Lane Configurations		↘	↕↕		↕	↘		↘↘	↘
Traffic Vol, veh/h	0	43	26	0	166	106	0	311	83
Future Vol, veh/h	0	43	26	0	166	106	0	311	83
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	47	28	0	180	115	0	338	90
Number of Lanes	0	1	2	0	1	1	0	2	1

Approach	EB	WB	SB
Opposing Approach	WB	EB	
Opposing Lanes	2	3	0
Conflicting Approach Left	SB		WB
Conflicting Lanes Left	3	0	2
Conflicting Approach Right		SB	EB
Conflicting Lanes Right	0	3	3
HCM Control Delay	9.6	10.2	10
HCM LOS	A	B	A

Lane	EBLn1	EBLn2	EBLn3	WBLn1	WBLn2	SBLn1	SBLn2	SBLn3
Vol Left, %	100%	0%	0%	0%	0%	100%	100%	0%
Vol Thru, %	0%	100%	100%	100%	0%	0%	0%	0%
Vol Right, %	0%	0%	0%	0%	100%	0%	0%	100%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	43	13	13	166	106	156	156	83
LT Vol	43	0	0	0	0	156	156	0
Through Vol	0	13	13	166	0	0	0	0
RT Vol	0	0	0	0	106	0	0	83
Lane Flow Rate	47	14	14	180	115	169	169	90
Geometry Grp	8	8	8	8	8	7	7	7
Degree of Util (X)	0.09	0.025	0.018	0.293	0.164	0.28	0.28	0.076
Departure Headway (Hd)	6.897	6.392	4.638	5.841	5.135	5.955	5.955	3.019
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cap	523	563	776	610	690	598	598	1162
Service Time	4.597	4.092	2.338	3.632	2.925	3.738	3.738	0.802
HCM Lane V/C Ratio	0.09	0.025	0.018	0.295	0.167	0.283	0.283	0.077
HCM Control Delay	10.3	9.3	7.4	11.1	8.9	11.1	11.1	6.1
HCM Lane LOS	B	A	A	B	A	B	B	A
HCM 95th-tile Q	0.3	0.1	0.1	1.2	0.6	1.1	1.1	0.2

HCM Signalized Intersection Capacity Analysis
 48: Greenville Rd & Northfront Road/Altamont Pass Road

BART to Livermore Extension Project
 2025 Enhanced Bus + Garage AM



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↗	↘	↑	↘	↗
Traffic Volume (vph)	4	652	270	854	603	62
Future Volume (vph)	4	652	270	854	603	62
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	1863	1583	1770	1863	1770	1583
Flt Permitted	1.00	1.00	0.76	1.00	0.95	1.00
Satd. Flow (perm)	1863	1583	1407	1863	1770	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	4	709	293	928	655	67
RTOR Reduction (vph)	0	334	0	0	0	22
Lane Group Flow (vph)	4	375	293	928	655	45
Turn Type	NA	Perm	Perm	NA	Prot	Perm
Protected Phases	4			8	2	
Permitted Phases		4	8			2
Actuated Green, G (s)	59.5	59.5	59.5	59.5	44.9	44.9
Effective Green, g (s)	59.5	59.5	59.5	59.5	44.9	44.9
Actuated g/C Ratio	0.53	0.53	0.53	0.53	0.40	0.40
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	986	837	744	986	707	632
v/s Ratio Prot	0.00			c0.50	c0.37	
v/s Ratio Perm		0.24	0.21			0.03
v/c Ratio	0.00	0.45	0.39	0.94	0.93	0.07
Uniform Delay, d1	12.5	16.3	15.7	24.8	32.2	20.9
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.0	0.4	0.3	16.3	18.1	0.0
Delay (s)	12.5	16.7	16.1	41.1	50.3	20.9
Level of Service	B	B	B	D	D	C
Approach Delay (s)	16.7			35.1	47.5	
Approach LOS	B			D	D	

Intersection Summary

HCM 2000 Control Delay	33.5	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.93		
Actuated Cycle Length (s)	112.4	Sum of lost time (s)	8.0
Intersection Capacity Utilization	85.0%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
49: Greenville Rd & Southfront Rd



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	119	231	137	540	745	131
Future Volume (vph)	119	231	137	540	745	131
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.2	5.2	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.88	0.97	0.95	0.95	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	3433	2787	3433	3539	3539	1583
Flt Permitted	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (perm)	3433	2787	3433	3539	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	129	251	149	587	810	142
RTOR Reduction (vph)	0	219	0	0	0	75
Lane Group Flow (vph)	129	32	149	587	810	67
Turn Type	Prot	Perm	Prot	NA	NA	Perm
Protected Phases	8		1	6	2	
Permitted Phases		8				2
Actuated Green, G (s)	5.7	5.7	3.1	24.4	17.3	17.3
Effective Green, g (s)	5.1	5.1	3.1	26.1	19.0	19.0
Actuated g/C Ratio	0.13	0.13	0.08	0.65	0.47	0.47
Clearance Time (s)	4.6	4.6	4.0	5.7	5.7	5.7
Vehicle Extension (s)	5.0	5.0	6.0	2.5	2.5	2.5
Lane Grp Cap (vph)	433	351	263	2286	1664	744
v/s Ratio Prot	c0.04		c0.04	0.17	c0.23	
v/s Ratio Perm		0.01				0.04
v/c Ratio	0.30	0.09	0.57	0.26	0.49	0.09
Uniform Delay, d1	16.0	15.6	18.0	3.0	7.4	5.9
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.8	0.2	5.7	0.0	0.2	0.0
Delay (s)	16.8	15.8	23.7	3.1	7.5	6.0
Level of Service	B	B	C	A	A	A
Approach Delay (s)	16.2			7.3	7.3	
Approach LOS	B			A	A	

Intersection Summary

HCM 2000 Control Delay	8.9	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.46		
Actuated Cycle Length (s)	40.4	Sum of lost time (s)	13.2
Intersection Capacity Utilization	38.9%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
50: Greenville Rd & Patterson Pass Rd

BART to Livermore Extension Project
2025 Enhanced Bus + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↗	↘		↗	↘		↗	↘		↗	↘	
Traffic Volume (vph)	29	3	25	226	404	578	10	146	1	9	340	53
Future Volume (vph)	29	3	25	226	404	578	10	146	1	9	340	53
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.86		1.00	0.91		1.00	1.00		1.00	0.98	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1611		1770	1698		1770	1861		1770	1825	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	1611		1770	1698		1770	1861		1770	1825	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	32	3	27	246	439	628	11	159	1	10	370	58
RTOR Reduction (vph)	0	20	0	0	40	0	0	0	0	0	5	0
Lane Group Flow (vph)	32	10	0	246	1027	0	11	160	0	10	423	0
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												
Actuated Green, G (s)	2.3	30.0		40.5	68.2		0.7	28.1		0.7	28.1	
Effective Green, g (s)	2.3	30.0		40.5	68.2		0.7	28.1		0.7	28.1	
Actuated g/C Ratio	0.02	0.26		0.35	0.59		0.01	0.24		0.01	0.24	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	35	419		621	1004		10	453		10	444	
v/s Ratio Prot	c0.02	0.01		0.14	c0.60		c0.01	0.09		0.01	c0.23	
v/s Ratio Perm												
v/c Ratio	0.91	0.02		0.40	1.02		1.10	0.35		1.00	0.95	
Uniform Delay, d1	56.4	31.8		28.2	23.5		57.3	36.1		57.3	43.0	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	116.7	0.0		0.4	34.2		321.8	2.2		284.6	32.6	
Delay (s)	173.1	31.8		28.6	57.8		379.1	38.2		341.9	75.5	
Level of Service	F	C		C	E		F	D		F	E	
Approach Delay (s)		104.7			52.3			60.2			81.6	
Approach LOS		F			D			E			F	

Intersection Summary

HCM 2000 Control Delay	61.1	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.00		
Actuated Cycle Length (s)	115.3	Sum of lost time (s)	16.0
Intersection Capacity Utilization	84.5%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
1: Dougherty Rd & Amador Valley Rd

BART to Livermore Extension Project
2025 Enhanced Bus + Garage PM



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	335	436	595	1960	1074	213
Future Volume (vph)	335	436	595	1960	1074	213
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5	5.7	5.7	
Lane Util. Factor	1.00	1.00	0.97	0.91	0.91	
Frt	1.00	0.85	1.00	1.00	0.98	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1770	1583	3433	5085	4959	
Flt Permitted	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	1770	1583	3433	5085	4959	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	364	474	647	2130	1167	232
RTOR Reduction (vph)	0	228	0	0	30	0
Lane Group Flow (vph)	364	246	647	2130	1369	0
Turn Type	Perm	Perm	Prot	NA	NA	
Protected Phases			5	2	6	
Permitted Phases	4	4				
Actuated Green, G (s)	21.3	21.3	13.6	55.1	37.0	
Effective Green, g (s)	21.3	21.3	13.6	55.1	37.0	
Actuated g/C Ratio	0.25	0.25	0.16	0.64	0.43	
Clearance Time (s)	4.5	4.5	4.5	5.7	5.7	
Vehicle Extension (s)	1.8	1.8	2.0	4.0	4.0	
Lane Grp Cap (vph)	435	389	539	3235	2118	
v/s Ratio Prot			c0.19	c0.42	0.28	
v/s Ratio Perm	c0.21	0.16				
v/c Ratio	0.84	0.63	1.20	0.66	0.65	
Uniform Delay, d1	31.0	29.2	36.5	9.9	19.6	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	12.6	2.5	107.0	0.5	0.8	
Delay (s)	43.6	31.6	143.5	10.4	20.4	
Level of Service	D	C	F	B	C	
Approach Delay (s)	36.8			41.4	20.4	
Approach LOS	D			D	C	

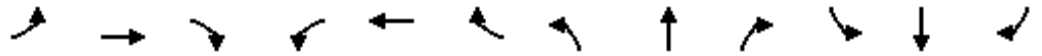
Intersection Summary

HCM 2000 Control Delay	34.8	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.84		
Actuated Cycle Length (s)	86.6	Sum of lost time (s)	14.7
Intersection Capacity Utilization	73.3%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
2: Dougherty Rd & Dublin Blvd

BART to Livermore Extension Project
2025 Enhanced Bus + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔↔	↑↑↑	↔↔	↔↔↔	↑↑↑	↔	↔↔↔	↑↑↑	↔↔	↔↔	↑↑↑	↔↔
Traffic Volume (vph)	85	1036	960	552	794	676	811	1858	300	603	1248	34
Future Volume (vph)	85	1036	960	552	794	676	811	1858	300	603	1248	34
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	6.0	5.0	5.0	5.5	5.0	5.0	5.5	5.0	5.0	5.5	
Lane Util. Factor	0.97	0.91	0.88	0.94	0.91	1.00	0.94	0.91	0.88	0.97	0.86	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	3433	5085	2787	4990	5085	1583	4990	5085	2787	3433	6382	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	3433	5085	2787	4990	5085	1583	4990	5085	2787	3433	6382	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	92	1126	1043	600	863	735	882	2020	326	655	1357	37
RTOR Reduction (vph)	0	0	36	0	0	59	0	0	34	0	3	0
Lane Group Flow (vph)	92	1126	1007	600	863	676	882	2020	292	655	1391	0
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	
Protected Phases	5	2	3	1	6	7	3	8	1	7	4	
Permitted Phases			2			6			8			
Actuated Green, G (s)	15.0	34.5	54.3	18.4	38.4	52.4	19.8	45.0	63.4	14.0	39.2	
Effective Green, g (s)	15.0	34.5	54.3	18.4	38.4	52.4	19.8	45.0	63.4	14.0	39.2	
Actuated g/C Ratio	0.11	0.26	0.41	0.14	0.29	0.39	0.15	0.34	0.48	0.10	0.29	
Clearance Time (s)	5.0	6.0	5.0	5.0	5.5	5.0	5.0	5.5	5.0	5.0	5.5	
Vehicle Extension (s)	2.0	4.5	2.0	2.0	4.5	2.0	2.0	4.5	2.0	2.0	4.5	
Lane Grp Cap (vph)	386	1315	1134	688	1463	621	740	1715	1324	360	1875	
v/s Ratio Prot	0.03	0.22	0.13	c0.12	0.17	c0.11	c0.18	c0.40	0.03	c0.19	0.22	
v/s Ratio Perm			0.23			0.31			0.07			
v/c Ratio	0.24	0.86	0.89	0.87	0.59	1.09	1.19	1.18	0.22	1.82	0.74	
Uniform Delay, d1	54.0	47.1	36.7	56.3	40.7	40.5	56.8	44.2	20.5	59.7	42.5	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.1	6.1	8.4	11.4	0.8	62.6	99.5	86.5	0.0	379.5	1.8	
Delay (s)	54.1	53.2	45.2	67.8	41.6	103.1	156.3	130.7	20.5	439.2	44.4	
Level of Service	D	D	D	E	D	F	F	F	C	F	D	
Approach Delay (s)		49.5			69.3			126.5			170.6	
Approach LOS		D			E			F			F	

Intersection Summary

HCM 2000 Control Delay	105.0	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.22		
Actuated Cycle Length (s)	133.4	Sum of lost time (s)	21.5
Intersection Capacity Utilization	103.5%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

3: Dougherty Rd & I-580 WB Ramps

BART to Livermore Extension Project
2025 Enhanced Bus + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↔↔		↔↔		↑↑↑			↑↑↑	↔
Traffic Volume (vph)	0	0	0	313	0	649	0	2349	0	0	1691	0
Future Volume (vph)	0	0	0	313	0	649	0	2349	0	0	1691	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0		4.0		4.0			4.0	
Lane Util. Factor				0.97		0.88		0.91			0.86	
Frt				1.00		0.85		1.00			1.00	
Flt Protected				0.95		1.00		1.00			1.00	
Satd. Flow (prot)				3433		2787		5085			4806	
Flt Permitted				0.95		1.00		1.00			1.00	
Satd. Flow (perm)				3433		2787		5085			4806	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	340	0	705	0	2553	0	0	1838	0
RTOR Reduction (vph)	0	0	0	0	0	15	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	340	0	690	0	2553	0	0	1838	0
Turn Type				Prot		Prot		NA			NA	Perm
Protected Phases				4		4		2			6	
Permitted Phases												6
Actuated Green, G (s)				34.3		34.3		74.9			74.9	
Effective Green, g (s)				35.7		35.7		76.3			76.3	
Actuated g/C Ratio				0.30		0.30		0.64			0.64	
Clearance Time (s)				5.4		5.4		5.4			5.4	
Vehicle Extension (s)				3.0		3.0		3.0			3.0	
Lane Grp Cap (vph)				1021		829		3233			3055	
v/s Ratio Prot				0.10		c0.25		c0.50			0.38	
v/s Ratio Perm												
v/c Ratio				0.33		0.83		0.79			0.60	
Uniform Delay, d1				32.9		39.3		16.0			12.9	
Progression Factor				1.00		1.00		1.04			1.00	
Incremental Delay, d2				0.2		7.1		0.7			0.9	
Delay (s)				33.1		46.5		17.3			13.8	
Level of Service				C		D		B			B	
Approach Delay (s)		0.0			42.1			17.3			13.8	
Approach LOS		A			D			B			B	

Intersection Summary

HCM 2000 Control Delay	20.9	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.80		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	74.8%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

4: Hopyard Rd/Dougherty Rd & I-580 EB Ramps

BART to Livermore Extension Project
2025 Enhanced Bus + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	1085	0	829	0	0	0	0	2483	0	0	1156	0
Future Volume (vph)	1085	0	829	0	0	0	0	2483	0	0	1156	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0					4.0			4.0	
Lane Util. Factor	0.97		0.88					0.91			0.86	
Frt	1.00		0.85					1.00			1.00	
Flt Protected	0.95		1.00					1.00			1.00	
Satd. Flow (prot)	3433		2787					5085			4806	
Flt Permitted	0.95		1.00					1.00			1.00	
Satd. Flow (perm)	3433		2787					5085			4806	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	1179	0	901	0	0	0	0	2699	0	0	1257	0
RTOR Reduction (vph)	0	0	62	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	1179	0	839	0	0	0	0	2699	0	0	1257	0
Turn Type	Prot		Prot					NA	Free		NA	Perm
Protected Phases	4		4					2			6	
Permitted Phases									Free			6
Actuated Green, G (s)	42.6		42.6					66.6			66.6	
Effective Green, g (s)	44.0		44.0					68.0			68.0	
Actuated g/C Ratio	0.37		0.37					0.57			0.57	
Clearance Time (s)	5.4		5.4					5.4			5.4	
Vehicle Extension (s)	3.0		3.0					3.0			3.0	
Lane Grp Cap (vph)	1258		1021					2881			2723	
v/s Ratio Prot	c0.34		0.30					c0.53			0.26	
v/s Ratio Perm												
v/c Ratio	0.94		0.82					0.94			0.46	
Uniform Delay, d1	36.7		34.4					24.0			15.3	
Progression Factor	1.00		1.00					0.49			0.73	
Incremental Delay, d2	13.0		5.4					6.8			0.5	
Delay (s)	49.7		39.9					18.6			11.6	
Level of Service	D		D					B			B	
Approach Delay (s)		45.4			0.0			18.6			11.6	
Approach LOS		D			A			B			B	

Intersection Summary

HCM 2000 Control Delay	26.4	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.94		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	85.6%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
5: Hopyard Rd & Owens Rd

BART to Livermore Extension Project
2025 Enhanced Bus + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	368	230	312	541	284	285	280	913	247	306	1490	236
Future Volume (vph)	368	230	312	541	284	285	280	913	247	306	1490	236
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	2.7	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	0.91	0.91		1.00	0.95	0.95	1.00	0.91	1.00	0.97	0.91	
Frt	1.00	0.93		1.00	0.96	0.85	1.00	1.00	0.85	1.00	0.98	
Flt Protected	0.95	0.99		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1610	3129		1770	1707	1504	1770	5085	1583	3433	4981	
Flt Permitted	0.95	0.99		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1610	3129		1770	1707	1504	1770	5085	1583	3433	4981	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	400	250	339	588	309	310	304	992	268	333	1620	257
RTOR Reduction (vph)	0	118	0	0	9	41	0	0	188	0	18	0
Lane Group Flow (vph)	220	651	0	588	396	173	304	992	80	333	1859	0
Turn Type	Split	NA		Split	NA	pm+ov	Prot	NA	Perm	Prot	NA	
Protected Phases	8	8		4	4	1	5	2		1	6	
Permitted Phases						4			2			
Actuated Green, G (s)	15.7	15.7		27.7	27.7	50.0	15.0	34.0	34.0	22.3	41.3	
Effective Green, g (s)	17.0	17.0		29.0	29.0	52.6	15.0	35.7	35.7	22.3	43.0	
Actuated g/C Ratio	0.14	0.14		0.24	0.24	0.44	0.12	0.30	0.30	0.19	0.36	
Clearance Time (s)	5.3	5.3		5.3	5.3	4.0	4.0	5.7	5.7	4.0	5.7	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	228	443		427	412	693	221	1512	470	637	1784	
v/s Ratio Prot	0.14	c0.21		c0.33	0.23	0.05	c0.17	0.20		0.10	c0.37	
v/s Ratio Perm						0.07			0.05			
v/c Ratio	0.96	1.47		1.38	0.96	0.25	1.38	0.66	0.17	0.52	1.04	
Uniform Delay, d1	51.2	51.5		45.5	44.9	21.3	52.5	36.8	31.2	44.1	38.5	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.04	0.90	
Incremental Delay, d2	49.3	222.9		183.9	34.2	0.2	194.9	2.2	0.8	0.6	31.1	
Delay (s)	100.5	274.4		229.4	79.1	21.4	247.4	39.0	32.0	46.4	65.7	
Level of Service	F	F		F	E	C	F	D	C	D	E	
Approach Delay (s)		235.7			142.1			78.3			62.8	
Approach LOS		F			F			E			E	

Intersection Summary

HCM 2000 Control Delay	111.5	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.25		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	110.9%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
6: Hopyard Rd & Stoneridge Dr

BART to Livermore Extension Project
2025 Enhanced Bus + Garage PM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	271	1319	711	119	1293	190	587	833	97	288	901	194
Future Volume (vph)	271	1319	711	119	1293	190	587	833	97	288	901	194
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.91	1.00	0.97	0.91	1.00	0.94	0.95	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5085	1583	3433	5085	1583	4990	3539	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5085	1583	3433	5085	1583	4990	3539	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	295	1434	773	129	1405	207	638	905	105	313	979	211
RTOR Reduction (vph)	0	0	174	0	0	138	0	0	75	0	0	120
Lane Group Flow (vph)	295	1434	599	129	1405	69	638	905	30	313	979	91
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8			2			6
Actuated Green, G (s)	9.0	35.0	35.0	4.0	30.0	30.0	13.0	25.6	25.6	9.0	21.6	21.6
Effective Green, g (s)	9.0	35.0	35.0	4.0	30.0	30.0	13.0	25.6	25.6	9.0	21.6	21.6
Actuated g/C Ratio	0.10	0.39	0.39	0.04	0.33	0.33	0.15	0.29	0.29	0.10	0.24	0.24
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	344	1986	618	153	1702	530	723	1011	452	344	1225	381
v/s Ratio Prot	c0.09	0.28		0.04	0.28		c0.13	c0.26		0.09	0.19	
v/s Ratio Perm			c0.38			0.04			0.02			0.06
v/c Ratio	0.86	0.72	0.97	0.84	0.83	0.13	0.88	0.90	0.07	0.91	0.80	0.24
Uniform Delay, d1	39.7	23.2	26.8	42.5	27.4	20.7	37.6	30.7	23.3	39.9	32.0	27.4
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	18.6	1.3	28.4	32.3	3.4	0.1	12.3	10.3	0.1	26.7	3.7	0.3
Delay (s)	58.2	24.5	55.1	74.8	30.8	20.8	49.8	41.0	23.4	66.6	35.7	27.7
Level of Service	E	C	E	E	C	C	D	D	C	E	D	C
Approach Delay (s)		37.9			32.9			43.3			41.0	
Approach LOS		D			C			D			D	

Intersection Summary		
HCM 2000 Control Delay	38.6	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.97	D
Actuated Cycle Length (s)	89.6	Sum of lost time (s)
Intersection Capacity Utilization	77.3%	16.0
Analysis Period (min)	15	ICU Level of Service
		D

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 7: Hopyard Rd & Las Positas Blvd

BART to Livermore Extension Project
 2025 Enhanced Bus + Garage PM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	99	250	433	541	406	50	345	927	243	71	1388	73
Future Volume (vph)	99	250	433	541	406	50	345	927	243	71	1388	73
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.95	1.00	0.97	0.95	1.00	0.97	0.91	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	3433	3539	1583	3433	5085	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	3433	3539	1583	3433	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	108	272	471	588	441	54	375	1008	264	77	1509	79
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	50
Lane Group Flow (vph)	108	272	471	588	441	54	375	1008	264	77	1509	29
Turn Type	Prot	NA	Free	Prot	NA	Free	Prot	NA	Free	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1		6
Permitted Phases			Free			Free			Free			6
Actuated Green, G (s)	4.7	12.6	86.9	16.8	24.7	86.9	10.0	37.6	86.9	3.9	31.5	31.5
Effective Green, g (s)	4.7	12.6	86.9	16.8	24.7	86.9	10.0	37.6	86.9	3.9	31.5	31.5
Actuated g/C Ratio	0.05	0.14	1.00	0.19	0.28	1.00	0.12	0.43	1.00	0.04	0.36	0.36
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	185	513	1583	663	1005	1583	395	2200	1583	154	1843	573
v/s Ratio Prot	0.03	c0.08		c0.17	0.12		c0.11	0.20		0.02	c0.30	
v/s Ratio Perm			0.30			0.03			0.17			0.02
v/c Ratio	0.58	0.53	0.30	0.89	0.44	0.03	0.95	0.46	0.17	0.50	0.82	0.05
Uniform Delay, d1	40.1	34.4	0.0	34.1	25.4	0.0	38.2	17.4	0.0	40.5	25.1	18.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	4.6	1.1	0.5	13.6	0.3	0.0	32.1	0.2	0.2	2.5	3.0	0.0
Delay (s)	44.8	35.5	0.5	47.7	25.7	0.0	70.3	17.6	0.2	43.1	28.1	18.0
Level of Service	D	D	A	D	C	A	E	B	A	D	C	B
Approach Delay (s)		17.3			36.4			26.8			28.3	
Approach LOS		B			D			C			C	
Intersection Summary												
HCM 2000 Control Delay			27.7			HCM 2000 Level of Service			C			
HCM 2000 Volume to Capacity ratio			0.80									
Actuated Cycle Length (s)			86.9			Sum of lost time (s)			16.0			
Intersection Capacity Utilization			72.3%			ICU Level of Service			C			
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis
8: Willow Rd & Owens Rd

BART to Livermore Extension Project
2025 Enhanced Bus + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↖↗↘		↖↗	↖↗↘	↖	↖	↖↗	↖	↖	↖	↖
Traffic Volume (vph)	82	579	159	120	623	88	160	82	0	174	72	122
Future Volume (vph)	82	579	159	120	623	88	160	82	0	174	72	122
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	5.3	4.0		5.3	4.0	4.0
Lane Util. Factor	0.97	0.91		0.97	0.91	1.00	1.00	0.95		1.00	1.00	1.00
Frt	1.00	0.97		1.00	1.00	0.85	1.00	1.00		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	4921		3433	5085	1583	1770	3539		1770	1863	1583
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.71	1.00		0.70	1.00	1.00
Satd. Flow (perm)	3433	4921		3433	5085	1583	1316	3539		1297	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	89	629	173	130	677	96	174	89	0	189	78	133
RTOR Reduction (vph)	0	66	0	0	0	51	0	0	0	0	0	101
Lane Group Flow (vph)	89	736	0	130	677	45	174	89	0	189	78	32
Turn Type	Prot	NA		Prot	NA	Perm	Perm	NA	Perm	Perm	NA	Perm
Protected Phases	1	6		5	2			4				8
Permitted Phases						2	4		4	8		8
Actuated Green, G (s)	2.5	19.2		4.3	21.0	21.0	10.4	10.4		10.4	10.4	10.4
Effective Green, g (s)	2.5	20.9		4.3	22.7	22.7	10.4	11.7		10.4	11.7	11.7
Actuated g/C Ratio	0.05	0.43		0.09	0.46	0.46	0.21	0.24		0.21	0.24	0.24
Clearance Time (s)	4.0	5.7		4.0	5.7	5.7	5.3	5.3		5.3	5.3	5.3
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	175	2103		301	2360	734	279	846		275	445	378
v/s Ratio Prot	0.03	c0.15		c0.04	0.13			0.03			0.04	
v/s Ratio Perm						0.03	0.13			c0.15		0.02
v/c Ratio	0.51	0.35		0.43	0.29	0.06	0.62	0.11		0.69	0.18	0.08
Uniform Delay, d1	22.6	9.4		21.1	8.1	7.2	17.5	14.5		17.8	14.8	14.4
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	2.3	0.1		1.0	0.1	0.0	4.3	0.1		7.0	0.2	0.1
Delay (s)	24.9	9.5		22.1	8.2	7.3	21.8	14.6		24.7	15.0	14.5
Level of Service	C	A		C	A	A	C	B		C	B	B
Approach Delay (s)		11.1			10.1			19.3			19.4	
Approach LOS		B			B			B			B	

Intersection Summary			
HCM 2000 Control Delay	12.9	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.44		
Actuated Cycle Length (s)	48.9	Sum of lost time (s)	12.0
Intersection Capacity Utilization	44.5%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 9: Hacienda Dr & Dublin Blvd

BART to Livermore Extension Project
 2025 Enhanced Bus + Garage PM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	50	1018	131	232	483	34	226	591	476	43	638	163
Future Volume (vph)	50	1018	131	232	483	34	226	591	476	43	638	163
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	6.0	5.0	4.5	6.0		5.0	6.0	6.0	4.5	5.5	5.5
Lane Util. Factor	0.97	0.91	0.88	0.97	0.91		0.94	0.95	0.88	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5085	2787	3433	5035		4990	3539	2787	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5085	2787	3433	5035		4990	3539	2787	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	54	1107	142	252	525	37	246	642	517	47	693	177
RTOR Reduction (vph)	0	0	64	0	7	0	0	0	228	0	0	136
Lane Group Flow (vph)	54	1107	78	252	555	0	246	642	289	47	693	41
Turn Type	Prot	NA	pm+ov	Prot	NA		Prot	NA	Perm	Prot	NA	Perm
Protected Phases	5	2	3	1	6		3	8		7	NA	4
Permitted Phases			2						8			4
Actuated Green, G (s)	4.1	29.8	40.7	10.7	36.4		10.9	29.9	29.9	2.8	21.8	21.8
Effective Green, g (s)	4.1	29.8	40.7	10.7	36.4		10.9	29.9	29.9	2.8	21.8	21.8
Actuated g/C Ratio	0.04	0.32	0.43	0.11	0.39		0.12	0.32	0.32	0.03	0.23	0.23
Clearance Time (s)	4.5	6.0	5.0	4.5	6.0		5.0	6.0	6.0	4.5	5.5	5.5
Vehicle Extension (s)	2.0	3.5	2.0	2.0	3.5		2.0	3.5	3.5	2.0	3.5	3.5
Lane Grp Cap (vph)	149	1608	1352	389	1945		577	1123	884	102	1176	366
v/s Ratio Prot	0.02	c0.22	0.01	c0.07	0.11		0.05	c0.18		0.01	c0.14	
v/s Ratio Perm			0.02						0.10			0.03
v/c Ratio	0.36	0.69	0.06	0.65	0.29		0.43	0.57	0.33	0.46	0.59	0.11
Uniform Delay, d1	43.8	28.1	15.6	39.9	19.9		38.7	26.8	24.5	45.0	32.2	28.6
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.5	1.3	0.0	2.8	0.1		0.2	0.8	0.3	1.2	0.8	0.2
Delay (s)	44.3	29.4	15.6	42.7	20.0		38.9	27.6	24.7	46.2	33.0	28.7
Level of Service	D	C	B	D	C		D	C	C	D	C	C
Approach Delay (s)		28.5			27.1			28.5			32.9	
Approach LOS		C			C			C			C	
Intersection Summary												
HCM 2000 Control Delay			29.2		HCM 2000 Level of Service				C			
HCM 2000 Volume to Capacity ratio			0.65									
Actuated Cycle Length (s)			94.2		Sum of lost time (s)				21.0			
Intersection Capacity Utilization			63.5%		ICU Level of Service				B			
Analysis Period (min)			15									

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 10: Hacienda Dr & Martinelli Blvd/Hacienda Crossings

BART to Livermore Extension Project
 2025 Enhanced Bus + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	24	50	409	290	37	21	442	1279	469	58	926	74
Future Volume (vph)	24	50	409	290	37	21	442	1279	469	58	926	74
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	3.0	3.0	5.5	3.0		3.5	3.0	3.0	5.0	3.5	
Lane Util. Factor	1.00	0.91	0.91	0.97	1.00		0.94	0.91	1.00	0.97	0.86	
Frt	1.00	0.93	0.85	1.00	0.95		1.00	1.00	0.85	1.00	0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1770	1580	2882	3433	1761		4990	5085	1583	3433	6337	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1770	1580	2882	3433	1761		4990	5085	1583	3433	6337	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	26	54	445	315	40	23	480	1390	510	63	1007	80
RTOR Reduction (vph)	0	25	279	0	13	0	0	0	232	0	10	0
Lane Group Flow (vph)	26	74	121	315	50	0	480	1390	278	63	1077	0
Turn Type	Prot	NA	Perm	Prot	NA		Prot	NA	pm+ov	Prot	NA	
Protected Phases	5	2		1	6		3	8	1	7	4	
Permitted Phases			2						8			
Actuated Green, G (s)	3.6	34.2	34.2	19.8	50.9		16.3	41.7	61.5	4.8	30.2	
Effective Green, g (s)	3.1	36.2	36.2	19.3	52.9		17.3	43.7	65.5	4.3	31.7	
Actuated g/C Ratio	0.03	0.30	0.30	0.16	0.44		0.14	0.36	0.55	0.04	0.26	
Clearance Time (s)	4.5	5.0	5.0	5.0	5.0		4.5	5.0	5.0	4.5	5.0	
Vehicle Extension (s)	3.0	4.0	4.0	2.0	4.0		3.0	4.0	2.0	3.0	4.0	
Lane Grp Cap (vph)	45	476	869	552	776		719	1851	864	123	1674	
v/s Ratio Prot	c0.01	c0.05		c0.09	0.03		0.10	c0.27	0.06	0.02	c0.17	
v/s Ratio Perm			0.04						0.12			
v/c Ratio	0.58	0.16	0.14	0.57	0.06		0.67	0.75	0.32	0.51	0.64	
Uniform Delay, d1	57.8	30.7	30.5	46.5	19.3		48.6	33.4	15.0	56.8	39.1	
Progression Factor	1.00	1.00	1.00	1.00	1.00		0.93	0.89	0.92	1.00	1.00	
Incremental Delay, d2	16.7	0.7	0.3	0.9	0.2		1.8	1.4	0.1	3.6	1.0	
Delay (s)	74.5	31.4	30.9	47.4	19.5		46.9	31.2	13.8	60.4	40.1	
Level of Service	E	C	C	D	B		D	C	B	E	D	
Approach Delay (s)		33.1			42.8			30.6			41.2	
Approach LOS		C			D			C			D	

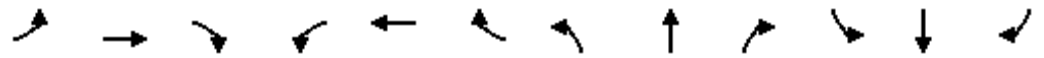
Intersection Summary

HCM 2000 Control Delay	34.7	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.53		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	16.5
Intersection Capacity Utilization	63.0%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 11: Hacienda Dr & I-580 WB Ramps

BART to Livermore Extension Project
 2025 Enhanced Bus + Garage PM




















Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↔↔		↔↔		↑↑↑			↑↑↑	↔
Traffic Volume (vph)	0	0	0	359	0	384	0	1543	772	0	827	761
Future Volume (vph)	0	0	0	359	0	384	0	1543	772	0	827	761
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0		4.0		4.0			4.0	4.0
Lane Util. Factor				0.97		0.88		0.91			0.86	0.86
Frt				1.00		0.85		0.95			0.95	0.85
Flt Protected				0.95		1.00		1.00			1.00	1.00
Satd. Flow (prot)				3433		2787		4831			4579	1362
Flt Permitted				0.95		1.00		1.00			1.00	1.00
Satd. Flow (perm)				3433		2787		4831			4579	1362
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	390	0	417	0	1677	839	0	899	827
RTOR Reduction (vph)	0	0	0	0	0	42	0	144	0	0	132	145
Lane Group Flow (vph)	0	0	0	390	0	375	0	2373	0	0	1181	268
Turn Type				Prot		Prot		NA			NA	Perm
Protected Phases				4		4		2			6	
Permitted Phases												6
Actuated Green, G (s)				11.6		11.6		37.1			37.1	37.1
Effective Green, g (s)				13.0		13.0		39.0			39.0	39.0
Actuated g/C Ratio				0.22		0.22		0.65			0.65	0.65
Clearance Time (s)				5.4		5.4		5.9			5.9	5.9
Vehicle Extension (s)				3.0		3.0		3.0			3.0	3.0
Lane Grp Cap (vph)				743		603		3140			2976	885
v/s Ratio Prot				0.11		c0.13		c0.49			0.26	
v/s Ratio Perm												0.20
v/c Ratio				0.52		0.62		0.76			0.40	0.30
Uniform Delay, d1				20.8		21.3		7.2			5.0	4.6
Progression Factor				1.00		1.00		1.12			0.74	3.75
Incremental Delay, d2				0.7		2.0		1.2			0.3	0.8
Delay (s)				21.4		23.3		9.3			4.0	17.9
Level of Service				C		C		A			A	B
Approach Delay (s)		0.0			22.4			9.3			7.3	
Approach LOS		A			C			A			A	

Intersection Summary		
HCM 2000 Control Delay	10.7	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.72	B
Actuated Cycle Length (s)	60.0	Sum of lost time (s)
Intersection Capacity Utilization	67.2%	8.0
Analysis Period (min)	15	ICU Level of Service
		C

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 12: Hacienda Dr & I-580 EB Ramps

BART to Livermore Extension Project
 2025 Enhanced Bus + Garage PM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	907	0	501	0	0	0	0	1574	811	0	775	313
Future Volume (vph)	907	0	501	0	0	0	0	1574	811	0	775	313
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0					4.0	4.0		4.0	
Lane Util. Factor	0.97		0.88					0.86	0.86		0.91	
Frt	1.00		0.85					0.98	0.85		0.96	
Flt Protected	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (prot)	3433		2787					4707	1362		4866	
Flt Permitted	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (perm)	3433		2787					4707	1362		4866	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	986	0	545	0	0	0	0	1711	882	0	842	340
RTOR Reduction (vph)	0	0	163	0	0	0	0	15	250	0	54	0
Lane Group Flow (vph)	986	0	382	0	0	0	0	1969	359	0	1128	0
Turn Type	Prot		Prot					NA	Perm		NA	
Protected Phases	4		4					2			6	
Permitted Phases									2			
Actuated Green, G (s)	39.9		39.9					68.8	68.8		68.8	
Effective Green, g (s)	41.3		41.3					70.7	70.7		70.7	
Actuated g/C Ratio	0.34		0.34					0.59	0.59		0.59	
Clearance Time (s)	5.4		5.4					5.9	5.9		5.9	
Vehicle Extension (s)	2.0		2.0					2.0	2.0		2.0	
Lane Grp Cap (vph)	1181		959					2773	802		2866	
v/s Ratio Prot	c0.29		0.14					c0.42			0.23	
v/s Ratio Perm									0.26			
v/c Ratio	0.83		0.40					0.71	0.45		0.39	
Uniform Delay, d1	36.2		29.9					17.4	13.8		13.2	
Progression Factor	1.00		1.00					1.00	1.00		0.69	
Incremental Delay, d2	5.0		0.1					1.6	1.8		0.4	
Delay (s)	41.2		30.0					19.0	15.6		9.5	
Level of Service	D		C					B	B		A	
Approach Delay (s)		37.2			0.0			18.2			9.5	
Approach LOS		D			A			B			A	
Intersection Summary												
HCM 2000 Control Delay			21.7					HCM 2000 Level of Service			C	
HCM 2000 Volume to Capacity ratio			0.76									
Actuated Cycle Length (s)			120.0					Sum of lost time (s)			8.0	
Intersection Capacity Utilization			69.0%					ICU Level of Service			C	
Analysis Period (min)			15									

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 13: Hacienda Dr & Owens Rd

BART to Livermore Extension Project
 2025 Enhanced Bus + Garage PM



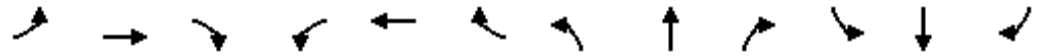
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↖	↑↑↑	↗	↖↖	↑↑↑	↗	↖↖	↑↑↑	↗	↖↖	↑↑↑	↗
Traffic Volume (vph)	660	718	46	115	304	788	32	924	260	503	480	277
Future Volume (vph)	660	718	46	115	304	788	32	924	260	503	480	277
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	2.3	4.0	4.0	2.3	4.0	4.0	2.7	4.0	4.0	2.7
Lane Util. Factor	0.97	0.91	1.00	0.97	0.91	1.00	0.97	0.91	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5085	1583	3433	5085	1583	3433	5085	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5085	1583	3433	5085	1583	3433	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	717	780	50	125	330	857	35	1004	283	547	522	301
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	717	780	50	125	330	857	35	1004	283	547	522	301
Turn Type	Prot	NA	Free	Prot	NA	Free	Prot	NA	Free	Prot	NA	Free
Protected Phases	1	6		5	2		7	4		3	8	
Permitted Phases			Free			Free			Free			Free
Actuated Green, G (s)	37.1	40.4	115.0	7.8	11.1	115.0	2.6	30.9	115.0	16.9	45.2	115.0
Effective Green, g (s)	37.1	42.1	115.0	7.8	12.8	115.0	2.6	32.2	115.0	16.9	46.5	115.0
Actuated g/C Ratio	0.32	0.37	1.00	0.07	0.11	1.00	0.02	0.28	1.00	0.15	0.40	1.00
Clearance Time (s)	4.0	5.7		4.0	5.7		4.0	5.3		4.0	5.3	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	1107	1861	1583	232	565	1583	77	1423	1583	504	2056	1583
v/s Ratio Prot	c0.21	0.15		0.04	0.06		0.01	c0.20		c0.16	0.10	
v/s Ratio Perm			0.03			c0.54			0.18			0.19
v/c Ratio	0.65	0.42	0.03	0.54	0.58	0.54	0.45	0.71	0.18	1.09	0.25	0.19
Uniform Delay, d1	33.4	27.3	0.0	51.9	48.6	0.0	55.5	37.1	0.0	49.0	22.7	0.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.3	0.7	0.0	2.4	4.4	1.3	4.2	1.6	0.2	65.2	0.1	0.3
Delay (s)	34.7	28.0	0.0	54.3	52.9	1.3	59.7	38.8	0.2	114.2	22.8	0.3
Level of Service	C	C	A	D	D	A	E	D	A	F	C	A
Approach Delay (s)		30.2			19.4			31.1			54.3	
Approach LOS		C			B			C			D	

Intersection Summary		
HCM 2000 Control Delay	33.8	HCM 2000 Level of Service C
HCM 2000 Volume to Capacity ratio	0.76	
Actuated Cycle Length (s)	115.0	Sum of lost time (s) 16.0
Intersection Capacity Utilization	70.2%	ICU Level of Service C
Analysis Period (min)	15	

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 14: Tassajara Rd & Dublin Blvd

BART to Livermore Extension Project
 2025 Enhanced Bus + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	257	886	463	245	294	19	381	873	532	32	785	138
Future Volume (vph)	257	886	463	245	294	19	381	873	532	32	785	138
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	6.0	6.0	5.0	6.0		5.0	6.0	6.0	5.0	6.0	6.0
Lane Util. Factor	0.97	0.95	0.88	0.94	0.95		0.94	0.91	1.00	0.97	0.86	0.88
Frt	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	2787	4990	3507		4990	5085	1583	3433	6408	2787
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	2787	4990	3507		4990	5085	1583	3433	6408	2787
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	279	963	503	266	320	21	414	949	578	35	853	150
RTOR Reduction (vph)	0	0	263	0	3	0	0	0	249	0	0	108
Lane Group Flow (vph)	279	963	240	266	338	0	414	949	329	35	853	42
Turn Type	Prot	NA	Perm	Prot	NA		Prot	NA	Perm	Prot	NA	Perm
Protected Phases	5	2		1	6		3	8		7		4
Permitted Phases			2						8			4
Actuated Green, G (s)	16.6	45.0	45.0	16.2	44.6		16.7	44.2	44.2	11.4	38.9	38.9
Effective Green, g (s)	16.6	45.0	45.0	16.2	44.6		16.7	44.2	44.2	11.4	38.9	38.9
Actuated g/C Ratio	0.12	0.32	0.32	0.12	0.32		0.12	0.32	0.32	0.08	0.28	0.28
Clearance Time (s)	5.0	6.0	6.0	5.0	6.0		5.0	6.0	6.0	5.0	6.0	6.0
Vehicle Extension (s)	2.0	3.0	3.0	2.0	3.0		2.0	4.0	4.0	2.0	4.0	4.0
Lane Grp Cap (vph)	410	1147	903	582	1126		600	1619	504	281	1795	781
v/s Ratio Prot	c0.08	c0.27		0.05	0.10		c0.08	0.19		0.01	0.13	
v/s Ratio Perm			0.09						c0.21			0.02
v/c Ratio	0.68	0.84	0.27	0.46	0.30		0.69	0.59	0.65	0.12	0.48	0.05
Uniform Delay, d1	58.6	43.5	34.7	57.2	35.4		58.6	39.6	40.7	59.1	41.5	36.5
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	3.7	5.6	0.2	0.2	0.2		2.6	0.6	3.4	0.1	0.3	0.0
Delay (s)	62.2	49.1	34.8	57.4	35.5		61.2	40.3	44.1	59.1	41.7	36.5
Level of Service	E	D	C	E	D		E	D	D	E	D	D
Approach Delay (s)		47.1			45.1			45.9			41.6	
Approach LOS		D			D			D			D	

Intersection Summary			
HCM 2000 Control Delay	45.3	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.75		
Actuated Cycle Length (s)	138.8	Sum of lost time (s)	22.0
Intersection Capacity Utilization	85.5%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
15: Tassajara Rd & I-580 WB Ramps

BART to Livermore Extension Project
2025 Enhanced Bus + Garage PM






























Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↔↔		↔↔		↑↑	↔		↑↑↔	↔
Traffic Volume (vph)	0	0	0	489	0	228	0	1415	646	0	1205	614
Future Volume (vph)	0	0	0	489	0	228	0	1415	646	0	1205	614
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0		4.0		4.0	4.0		4.0	4.0
Lane Util. Factor				0.97		0.88		0.95	1.00		0.86	0.86
Frt				1.00		0.85		1.00	0.85		0.98	0.85
Flt Protected				0.95		1.00		1.00	1.00		1.00	1.00
Satd. Flow (prot)				3433		2787		3539	1583		4702	1362
Flt Permitted				0.95		1.00		1.00	1.00		1.00	1.00
Satd. Flow (perm)				3433		2787		3539	1583		4702	1362
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	532	0	248	0	1538	702	0	1310	667
RTOR Reduction (vph)	0	0	0	0	0	46	0	0	259	0	32	165
Lane Group Flow (vph)	0	0	0	532	0	202	0	1538	443	0	1498	282
Turn Type				Perm		Perm		NA	Perm		NA	Perm
Protected Phases								2			6	
Permitted Phases				8		8			2			6
Actuated Green, G (s)				14.1		14.1		37.9	37.9		37.9	37.9
Effective Green, g (s)				14.1		14.1		37.9	37.9		37.9	37.9
Actuated g/C Ratio				0.23		0.23		0.63	0.63		0.63	0.63
Clearance Time (s)				4.0		4.0		4.0	4.0		4.0	4.0
Vehicle Extension (s)				3.0		3.0		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)				806		654		2235	999		2970	860
v/s Ratio Prot								c0.43			0.32	
v/s Ratio Perm				c0.15		0.07			0.28			0.21
v/c Ratio				0.66		0.31		0.69	0.44		0.50	0.33
Uniform Delay, d1				20.8		18.9		7.2	5.7		6.0	5.1
Progression Factor				1.00		1.00		1.00	1.00		1.00	1.00
Incremental Delay, d2				2.0		0.3		1.8	1.4		0.6	1.0
Delay (s)				22.8		19.2		9.0	7.1		6.6	6.2
Level of Service				C		B		A	A		A	A
Approach Delay (s)		0.0			21.7			8.4			6.5	
Approach LOS		A			C			A			A	

Intersection Summary			
HCM 2000 Control Delay	9.7	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.68		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	59.7%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group































HCM Signalized Intersection Capacity Analysis
 16: Santa Rita Rd & I-580 EB Ramps/Pimilco Dr

BART to Livermore Extension Project
 2025 Enhanced Bus + Garage PM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 			 		 		  			 	
Traffic Volume (vph)	392	89	235	143	0	315	0	1253	186	315	954	0
Future Volume (vph)	392	89	235	143	0	315	0	1253	186	315	954	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0		4.0		4.0		4.0	4.0	
Lane Util. Factor	0.97	1.00	1.00	0.97		0.88		0.86		1.00	0.95	
Frt	1.00	1.00	0.85	1.00		0.85		0.98		1.00	1.00	
Flt Protected	0.95	1.00	1.00	0.95		1.00		1.00		0.95	1.00	
Satd. Flow (prot)	3433	1863	1583	3433		2787		6284		1770	3539	
Flt Permitted	0.95	1.00	1.00	0.95		1.00		1.00		0.95	1.00	
Satd. Flow (perm)	3433	1863	1583	3433		2787		6284		1770	3539	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	426	97	255	155	0	342	0	1362	202	342	1037	0
RTOR Reduction (vph)	0	0	96	0	0	32	0	20	0	0	0	0
Lane Group Flow (vph)	426	97	159	155	0	310	0	1544	0	342	1037	0
Turn Type	Perm	NA	Perm	Prot		pm+ov		NA		Prot	NA	Perm
Protected Phases		4		3		1		2		1	6	
Permitted Phases	4		4			3						6
Actuated Green, G (s)	21.1	21.1	21.1	8.8		36.7		46.2		27.9	78.1	
Effective Green, g (s)	21.1	21.1	21.1	8.8		36.7		46.2		27.9	78.1	
Actuated g/C Ratio	0.18	0.18	0.18	0.07		0.31		0.39		0.23	0.65	
Clearance Time (s)	4.0	4.0	4.0	4.0		4.0		4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0		3.0		3.0		3.0	3.0	
Lane Grp Cap (vph)	603	327	278	251		852		2419		411	2303	
v/s Ratio Prot		0.05		c0.05		0.08		c0.25		c0.19	0.29	
v/s Ratio Perm	c0.12		0.10			0.03						
v/c Ratio	0.71	0.30	0.57	0.62		0.36		0.64		0.83	0.45	
Uniform Delay, d1	46.5	43.0	45.3	54.0		32.5		30.1		43.8	10.3	
Progression Factor	1.00	1.00	1.00	1.00		1.00		1.00		1.00	1.00	
Incremental Delay, d2	3.8	0.5	2.8	4.5		0.3		1.3		13.4	0.6	
Delay (s)	50.3	43.5	48.2	58.4		32.8		31.4		57.2	11.0	
Level of Service	D	D	D	E		C		C		E	B	
Approach Delay (s)		48.8			40.8			31.4			22.5	
Approach LOS		D			D			C			C	
Intersection Summary												
HCM 2000 Control Delay			32.8									C
HCM 2000 Volume to Capacity ratio			0.70									
Actuated Cycle Length (s)			120.0								16.0	
Intersection Capacity Utilization			60.8%									B
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis
 17: Santa Rita Rd & Valley Ave

BART to Livermore Extension Project
 2025 Enhanced Bus + Garage PM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 	 			 		 	 		 	 	
Traffic Volume (vph)	357	504	119	134	313	780	151	774	139	1013	1086	233
Future Volume (vph)	357	504	119	134	313	780	151	774	139	1013	1086	233
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.97	0.95		0.97	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.98		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	3433	3458		3433	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	3433	3458		3433	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	388	548	129	146	340	848	164	841	151	1101	1180	253
RTOR Reduction (vph)	0	0	106	0	0	0	0	15	0	0	0	130
Lane Group Flow (vph)	388	548	23	146	340	848	164	977	0	1101	1180	123
Turn Type	Prot	NA	Perm	Prot	NA	Free	Prot	NA		Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1		6
Permitted Phases			4			Free						6
Actuated Green, G (s)	11.0	17.6	17.6	9.0	15.6	99.6	8.7	26.0		31.0	48.3	48.3
Effective Green, g (s)	11.0	17.6	17.6	9.0	15.6	99.6	8.7	26.0		31.0	48.3	48.3
Actuated g/C Ratio	0.11	0.18	0.18	0.09	0.16	1.00	0.09	0.26		0.31	0.48	0.48
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	379	625	279	159	554	1583	299	902		1068	1716	767
v/s Ratio Prot	c0.11	c0.15		0.08	0.10		0.05	c0.28		c0.32	0.33	
v/s Ratio Perm			0.01			c0.54						0.08
v/c Ratio	1.02	0.88	0.08	0.92	0.61	0.54	0.55	1.08		1.03	0.69	0.16
Uniform Delay, d1	44.3	39.9	34.2	44.9	39.2	0.0	43.6	36.8		34.3	19.8	14.3
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	52.4	13.1	0.1	47.5	2.0	1.3	2.1	55.2		35.8	1.2	0.1
Delay (s)	96.7	53.1	34.4	92.4	41.2	1.3	45.6	92.0		70.1	21.0	14.4
Level of Service	F	D	C	F	D	A	D	F		E	C	B
Approach Delay (s)		66.7			21.4			85.4			41.7	
Approach LOS		E			C			F			D	
Intersection Summary												
HCM 2000 Control Delay			49.9			HCM 2000 Level of Service				D		
HCM 2000 Volume to Capacity ratio			1.04									
Actuated Cycle Length (s)			99.6			Sum of lost time (s)			16.0			
Intersection Capacity Utilization			89.4%			ICU Level of Service				E		
Analysis Period (min)			15									

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 18: Bernal Ave/Valley Ave & Stanley Blvd

BART to Livermore Extension Project
 2025 Enhanced Bus + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	205	835	61	104	231	343	86	330	303	824	570	120
Future Volume (vph)	205	835	61	104	231	343	86	330	303	824	570	120
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.95	1.00	0.97	0.91	0.91	1.00	0.95	1.00	0.97	0.95	
Frt	1.00	1.00	0.85	1.00	0.94	0.85	1.00	1.00	0.85	1.00	0.97	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	3433	3539	1583	3433	3179	1441	1770	3539	1583	3433	3447	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	3433	3539	1583	3433	3179	1441	1770	3539	1583	3433	3447	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	223	908	66	113	251	373	93	359	329	896	620	130
RTOR Reduction (vph)	0	0	41	0	125	52	0	0	168	0	20	0
Lane Group Flow (vph)	223	908	25	113	305	142	93	359	161	896	730	0
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	
Protected Phases	7	4	5	3	8	1	5	2		1	6	
Permitted Phases			4			8			2			
Actuated Green, G (s)	9.4	25.1	32.5	4.0	19.7	44.8	7.4	15.8	15.8	25.1	33.5	
Effective Green, g (s)	9.4	25.1	32.5	4.0	19.7	44.8	7.4	15.8	15.8	25.1	33.5	
Actuated g/C Ratio	0.11	0.29	0.38	0.05	0.23	0.52	0.09	0.18	0.18	0.29	0.39	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	375	1032	671	159	728	817	152	650	290	1001	1342	
v/s Ratio Prot	c0.06	c0.26	0.00	0.03	0.10	0.05	0.05	0.10		c0.26	c0.21	
v/s Ratio Perm			0.01			0.05			0.10			
v/c Ratio	0.59	0.88	0.04	0.71	0.42	0.17	0.61	0.55	0.55	0.90	0.54	
Uniform Delay, d1	36.5	29.0	16.9	40.4	28.3	10.8	37.9	31.9	31.9	29.2	20.3	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	2.5	8.7	0.0	13.9	0.4	0.1	7.1	1.0	2.3	10.4	0.5	
Delay (s)	39.0	37.7	16.9	54.3	28.7	11.0	45.0	32.9	34.2	39.6	20.8	
Level of Service	D	D	B	D	C	B	D	C	C	D	C	
Approach Delay (s)		36.8			27.9			34.9			31.0	
Approach LOS		D			C			C			C	

Intersection Summary

HCM 2000 Control Delay	32.8	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.82		
Actuated Cycle Length (s)	86.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	75.4%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
19: Fallon Rd & Dublin Blvd

BART to Livermore Extension Project
2025 Enhanced Bus + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↑↑↑	↖↗	↖↗↘	↑↑↑	↖	↖↗	↑↑↑	↖↗	↖↗	↑↑↑	↖
Traffic Volume (vph)	221	710	434	48	18	55	194	619	190	123	577	27
Future Volume (vph)	221	710	434	48	18	55	194	619	190	123	577	27
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.3	5.3	5.3	4.0	4.0	4.0	5.3	4.9	4.9	5.3	4.9	4.9
Lane Util. Factor	0.97	0.91	0.88	0.94	0.91	1.00	0.97	0.91	0.88	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3090	4577	2508	4491	4577	1425	3090	4577	2508	3090	4577	1425
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3090	4577	2508	4491	4577	1425	3090	4577	2508	3090	4577	1425
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	240	772	472	52	20	60	211	673	207	134	627	29
RTOR Reduction (vph)	0	0	98	0	0	57	0	0	145	0	0	21
Lane Group Flow (vph)	240	772	374	52	20	3	211	673	62	134	627	8
Turn Type	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	5	2	3	1	6		3	8		7	NA	4
Permitted Phases			2			6			8			4
Actuated Green, G (s)	20.2	21.9	31.9	2.1	3.8	3.8	10.0	21.9	21.9	8.1	20.0	20.0
Effective Green, g (s)	20.2	21.9	31.9	2.1	3.8	3.8	10.0	21.9	21.9	8.1	20.0	20.0
Actuated g/C Ratio	0.27	0.30	0.43	0.03	0.05	0.05	0.14	0.30	0.30	0.11	0.27	0.27
Clearance Time (s)	5.3	5.3	5.3	4.0	4.0	4.0	5.3	4.9	4.9	5.3	4.9	4.9
Vehicle Extension (s)	2.0	4.0	2.0	2.0	2.0	2.0	2.0	4.0	4.0	2.0	4.0	4.0
Lane Grp Cap (vph)	849	1363	1088	128	236	73	420	1363	747	340	1245	387
v/s Ratio Prot	c0.08	c0.17	0.05	0.01	0.00		c0.07	c0.15		0.04	0.14	
v/s Ratio Perm			0.10			0.00			0.02			0.01
v/c Ratio	0.28	0.57	0.34	0.41	0.08	0.04	0.50	0.49	0.08	0.39	0.50	0.02
Uniform Delay, d1	21.0	21.8	13.8	35.1	33.2	33.1	29.4	21.2	18.6	30.4	22.6	19.6
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.1	0.7	0.1	0.8	0.1	0.1	0.3	0.4	0.1	0.3	0.4	0.0
Delay (s)	21.0	22.5	13.9	35.9	33.3	33.2	29.8	21.6	18.6	30.7	23.0	19.6
Level of Service	C	C	B	D	C	C	C	C	B	C	C	B
Approach Delay (s)		19.5			34.3			22.6			24.2	
Approach LOS		B			C			C			C	

Intersection Summary

HCM 2000 Control Delay	22.1	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.54		
Actuated Cycle Length (s)	73.5	Sum of lost time (s)	19.5
Intersection Capacity Utilization	46.7%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
20: El Charro Rd/Fallon Rd & I-580 WB Ramps

BART to Livermore Extension Project
2025 Enhanced Bus + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↙	↖	↗		↖	↗		↕	↘
Traffic Volume (vph)	0	0	0	266	0	444	0	684	245	0	857	375
Future Volume (vph)	0	0	0	266	0	444	0	684	245	0	857	375
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0	4.0	4.0		4.0	4.0		4.0	4.0
Lane Util. Factor				0.95	0.95	0.88		0.95	0.95		0.95	1.00
Frt				1.00	1.00	0.85		0.99	0.85		1.00	0.85
Flt Protected				0.95	0.95	1.00		1.00	1.00		1.00	1.00
Satd. Flow (prot)				1681	1681	2787		1760	1504		3539	1583
Flt Permitted				0.95	0.95	1.00		1.00	1.00		1.00	1.00
Satd. Flow (perm)				1681	1681	2787		1760	1504		3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	289	0	483	0	743	266	0	932	408
RTOR Reduction (vph)	0	0	0	0	0	355	0	2	74	0	0	127
Lane Group Flow (vph)	0	0	0	147	142	128	0	768	165	0	932	281
Turn Type				Perm	NA	Perm		NA	Perm		NA	Perm
Protected Phases					8			2			6	
Permitted Phases				8		8			2			6
Actuated Green, G (s)				11.2	11.2	11.2		41.3	41.3		41.3	41.3
Effective Green, g (s)				10.7	10.7	10.7		41.3	41.3		41.3	41.3
Actuated g/C Ratio				0.18	0.18	0.18		0.69	0.69		0.69	0.69
Clearance Time (s)				3.5	3.5	3.5		4.0	4.0		4.0	4.0
Vehicle Extension (s)				2.0	2.0	2.0		2.0	2.0		2.0	2.0
Lane Grp Cap (vph)				299	299	497		1211	1035		2436	1089
v/s Ratio Prot								c0.44			0.26	
v/s Ratio Perm				c0.09	0.08	0.05			0.11			0.18
v/c Ratio				0.49	0.47	0.26		0.63	0.16		0.38	0.26
Uniform Delay, d1				22.2	22.1	21.2		5.2	3.3		4.0	3.5
Progression Factor				1.00	1.00	1.00		0.78	1.14		1.00	1.00
Incremental Delay, d2				0.5	0.4	0.1		2.3	0.3		0.5	0.6
Delay (s)				22.7	22.6	21.3		6.4	4.0		4.4	4.1
Level of Service				C	C	C		A	A		A	A
Approach Delay (s)		0.0			21.8			5.8			4.3	
Approach LOS		A			C			A			A	

Intersection Summary

HCM 2000 Control Delay	9.1	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.60		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	63.2%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 21: El Charro Rd & I-580 EB Ramps

BART to Livermore Extension Project
 2025 Enhanced Bus + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	321	0	357	0	0	0	0	907	281	0	865	0
Future Volume (vph)	321	0	357	0	0	0	0	907	281	0	865	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0					4.0	4.0		4.0	
Lane Util. Factor	0.97		0.88					0.91	0.91		0.91	
Frt	1.00		0.85					0.99	0.85		1.00	
Flt Protected	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (prot)	3433		2787					3372	1441		3390	
Flt Permitted	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (perm)	3433		2787					3372	1441		3390	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	349	0	388	0	0	0	0	986	305	0	940	0
RTOR Reduction (vph)	0	0	201	0	0	0	0	3	82	0	0	0
Lane Group Flow (vph)	349	0	187	0	0	0	0	1020	186	0	940	0
Turn Type	Prot		Perm					NA	Perm		NA	Perm
Protected Phases	4							2			6	
Permitted Phases			4						2			6
Actuated Green, G (s)	10.4		10.4					41.6	41.6		41.6	
Effective Green, g (s)	10.4		10.4					41.6	41.6		41.6	
Actuated g/C Ratio	0.17		0.17					0.69	0.69		0.69	
Clearance Time (s)	4.0		4.0					4.0	4.0		4.0	
Vehicle Extension (s)	2.0		2.0					3.0	3.0		3.0	
Lane Grp Cap (vph)	595		483					2337	999		2350	
v/s Ratio Prot	c0.10							c0.30			0.28	
v/s Ratio Perm			0.07						0.13			
v/c Ratio	0.59		0.39					0.44	0.19		0.40	
Uniform Delay, d1	22.8		22.0					4.0	3.2		3.9	
Progression Factor	1.00		1.00					0.70	0.24		0.80	
Incremental Delay, d2	1.0		0.2					0.6	0.4		0.5	
Delay (s)	23.8		22.2					3.4	1.2		3.6	
Level of Service	C		C					A	A		A	
Approach Delay (s)		22.9			0.0			3.0			3.6	
Approach LOS		C			A			A			A	

Intersection Summary

HCM 2000 Control Delay	8.1	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.47		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	43.9%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 22: El Charro Rd & Stoneridge Dr/Jack London Blvd

BART to Livermore Extension Project
 2025 Enhanced Bus + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔↔↔	↑↑	↗	↖	↑↑	↗↗	↖	↑↑		↖↖↖	↑	↗↗
Traffic Volume (vph)	262	580	4	3	312	468	2	33	3	749	25	134
Future Volume (vph)	262	580	4	3	312	468	2	33	3	749	25	134
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	0.94	0.95	1.00	1.00	0.95	0.88	1.00	0.95		0.94	1.00	0.88
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	4491	3185	1425	1593	3185	2508	1593	3149		4491	1676	2508
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	4491	3185	1425	1593	3185	2508	1593	3149		4491	1676	2508
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	285	630	4	3	339	509	2	36	3	814	27	146
RTOR Reduction (vph)	0	0	2	0	0	238	0	3	0	0	0	101
Lane Group Flow (vph)	285	630	2	3	339	271	2	36	0	814	27	45
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Prot	NA		Prot	NA	Perm
Protected Phases	7	4		3	8	1	5	2		1	6	
Permitted Phases			4			8						6
Actuated Green, G (s)	9.0	23.3	23.3	1.0	15.3	31.9	1.4	3.1		16.6	18.3	18.3
Effective Green, g (s)	9.0	23.3	23.3	1.0	15.3	31.9	1.4	3.1		16.6	18.3	18.3
Actuated g/C Ratio	0.15	0.39	0.39	0.02	0.26	0.53	0.02	0.05		0.28	0.31	0.31
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	673	1236	553	26	812	1500	37	162		1242	511	764
v/s Ratio Prot	0.06	c0.20		0.00	c0.11	0.05	0.00	c0.01		c0.18	0.02	
v/s Ratio Perm			0.00			0.06						0.02
v/c Ratio	0.42	0.51	0.00	0.12	0.42	0.18	0.05	0.22		0.66	0.05	0.06
Uniform Delay, d1	23.1	14.0	11.2	29.1	18.6	7.3	28.7	27.3		19.2	14.7	14.8
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		0.90	0.91	2.15
Incremental Delay, d2	0.4	0.3	0.0	2.0	0.3	0.1	0.6	3.2		1.2	0.2	0.1
Delay (s)	23.6	14.3	11.2	31.0	19.0	7.3	29.3	30.5		18.5	13.6	31.8
Level of Service	C	B	B	C	B	A	C	C		B	B	C
Approach Delay (s)		17.2			12.1			30.4			20.3	
Approach LOS		B			B			C			C	

Intersection Summary

HCM 2000 Control Delay	16.9	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.57		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	53.6%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 24: Airway Blvd/Driveway & N Canyons Pkwy

BART to Livermore Extension Project
 2025 Enhanced Bus + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑	↑	↑↑	↑	↑		↑	↑↑		↑	
Traffic Volume (vph)	0	617	357	813	70	0	47	0	744	0	0	0
Future Volume (vph)	0	617	357	813	70	0	47	0	744	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0	4.0	4.0			4.4	4.0			
Lane Util. Factor		0.95	1.00	0.97	1.00			1.00	0.88			
Frt		1.00	0.85	1.00	1.00			1.00	0.85			
Flt Protected		1.00	1.00	0.95	1.00			0.95	1.00			
Satd. Flow (prot)		3539	1583	3433	1863			1770	2787			
Flt Permitted		1.00	1.00	0.95	1.00			0.95	1.00			
Satd. Flow (perm)		3539	1583	3433	1863			1770	2787			
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	671	388	884	76	0	51	0	809	0	0	0
RTOR Reduction (vph)	0	0	247	0	0	0	0	0	421	0	0	0
Lane Group Flow (vph)	0	671	141	884	76	0	0	51	388	0	0	0
Turn Type		NA	Perm	Prot	NA	Perm	Split	NA	pm+ov			
Protected Phases		2		1	6		8	8	1	4	4	
Permitted Phases			2			6			8			
Actuated Green, G (s)		21.6	21.6	23.2	50.8			4.0	27.2			
Effective Green, g (s)		23.6	23.6	25.2	52.8			3.8	31.2			
Actuated g/C Ratio		0.36	0.36	0.39	0.81			0.06	0.48			
Clearance Time (s)		6.0	6.0	6.0	6.0			4.2	6.0			
Vehicle Extension (s)		3.0	3.0	3.0	3.0			3.0	3.0			
Lane Grp Cap (vph)		1284	574	1330	1513			103	1509			
v/s Ratio Prot		c0.19		c0.26	0.04			0.03	c0.10			
v/s Ratio Perm			0.09						0.04			
v/c Ratio		0.52	0.25	0.66	0.05			0.50	0.26			
Uniform Delay, d1		16.3	14.5	16.4	1.2			29.7	10.0			
Progression Factor		1.00	1.00	1.00	1.00			1.00	1.00			
Incremental Delay, d2		0.4	0.2	1.3	0.0			3.7	0.1			
Delay (s)		16.7	14.7	17.7	1.2			33.4	10.1			
Level of Service		B	B	B	A			C	B			
Approach Delay (s)		15.9			16.4			11.5			0.0	
Approach LOS		B			B			B			A	

Intersection Summary

HCM 2000 Control Delay	14.8	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.64		
Actuated Cycle Length (s)	65.0	Sum of lost time (s)	16.4
Intersection Capacity Utilization	53.9%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 25: Airway Blvd & I-580 WB Ramps

BART to Livermore Extension Project
 2025 Enhanced Bus + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↖	↗	↘		↕	↗		↕	↘
Traffic Volume (vph)	0	0	0	74	28	159	0	694	325	0	586	641
Future Volume (vph)	0	0	0	74	28	159	0	694	325	0	586	641
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0	4.0	4.0		4.0	4.0		4.0	
Lane Util. Factor				0.95	0.95	0.88		0.95	1.00		0.91	
Frt				1.00	1.00	0.85		1.00	0.85		0.92	
Flt Protected				0.95	0.97	1.00		1.00	1.00		1.00	
Satd. Flow (prot)				1681	1722	2787		3539	1583		4687	
Flt Permitted				0.95	0.97	1.00		1.00	1.00		1.00	
Satd. Flow (perm)				1681	1722	2787		3539	1583		4687	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	80	30	173	0	754	353	0	637	697
RTOR Reduction (vph)	0	0	0	0	0	148	0	0	134	0	265	0
Lane Group Flow (vph)	0	0	0	42	68	25	0	754	219	0	1069	0
Turn Type				Split	NA	Perm		NA	Perm		NA	
Protected Phases				8	8			2			6	
Permitted Phases						8			2			
Actuated Green, G (s)				5.0	5.0	5.0		19.9	19.9		19.9	
Effective Green, g (s)				5.0	5.0	5.0		21.2	21.2		21.2	
Actuated g/C Ratio				0.15	0.15	0.15		0.62	0.62		0.62	
Clearance Time (s)				4.0	4.0	4.0		5.3	5.3		5.3	
Vehicle Extension (s)				2.0	2.0	2.0		4.0	4.0		4.0	
Lane Grp Cap (vph)				245	251	407		2193	981		2905	
v/s Ratio Prot				0.02	c0.04			0.21			c0.23	
v/s Ratio Perm						0.01			0.14			
v/c Ratio				0.17	0.27	0.06		0.34	0.22		0.37	
Uniform Delay, d1				12.8	13.0	12.6		3.1	2.9		3.2	
Progression Factor				1.00	1.00	1.00		1.00	1.00		1.00	
Incremental Delay, d2				0.1	0.2	0.0		0.1	0.2		0.1	
Delay (s)				12.9	13.2	12.6		3.3	3.0		3.3	
Level of Service				B	B	B		A	A		A	
Approach Delay (s)		0.0			12.8			3.2			3.3	
Approach LOS		A			B			A			A	

Intersection Summary		
HCM 2000 Control Delay	4.2	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.35	A
Actuated Cycle Length (s)	34.2	Sum of lost time (s)
Intersection Capacity Utilization	35.7%	8.0
Analysis Period (min)	15	ICU Level of Service
		A

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 26: Airway Blvd & I-580 EB Ramps/Kitty Hawk Rd

BART to Livermore Extension Project
 2025 Enhanced Bus + Garage PM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	570	218	315	69	67	146	24	345	138	111	270	220
Future Volume (vph)	570	218	315	69	67	146	24	345	138	111	270	220
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.4	4.4	4.4	4.0	4.0		4.0	4.0	
Lane Util. Factor	0.97	1.00	1.00	1.00	1.00	1.00	1.00	0.95		1.00	0.95	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.96		1.00	0.93	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	3433	1863	1583	1770	1863	1583	1770	3388		1770	3301	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	3433	1863	1583	1770	1863	1583	1770	3388		1770	3301	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	620	237	342	75	73	159	26	375	150	121	293	239
RTOR Reduction (vph)	0	0	259	0	0	120	0	56	0	0	158	0
Lane Group Flow (vph)	620	237	83	75	73	39	26	469	0	121	374	0
Turn Type	Split	NA	Perm	Split	NA	pm+ov	Prot	NA		Prot	NA	
Protected Phases	7	7		8	8	1	5	2		1	6	
Permitted Phases			7			8						
Actuated Green, G (s)	17.0	17.0	17.0	10.2	10.2	18.1	3.7	18.0		7.9	22.7	
Effective Green, g (s)	17.0	17.0	17.0	9.8	9.8	17.3	3.2	19.3		7.9	24.0	
Actuated g/C Ratio	0.24	0.24	0.24	0.14	0.14	0.25	0.05	0.27		0.11	0.34	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	3.5	5.3		4.0	5.3	
Vehicle Extension (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	3.5		2.0	4.0	
Lane Grp Cap (vph)	828	449	382	246	259	487	80	928		198	1125	
v/s Ratio Prot	c0.18	0.13		c0.04	0.04	0.01	0.01	c0.14		c0.07	0.11	
v/s Ratio Perm			0.05			0.02						
v/c Ratio	0.75	0.53	0.22	0.30	0.28	0.08	0.33	0.51		0.61	0.33	
Uniform Delay, d1	24.7	23.2	21.4	27.2	27.1	20.4	32.6	21.5		29.8	17.2	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	3.3	0.5	0.1	0.3	0.2	0.0	0.9	0.5		3.9	0.2	
Delay (s)	28.0	23.7	21.5	27.5	27.4	20.5	33.4	22.0		33.7	17.5	
Level of Service	C	C	C	C	C	C	C	C		C	B	
Approach Delay (s)		25.3			23.8			22.6			20.5	
Approach LOS		C			C			C			C	
Intersection Summary												
HCM 2000 Control Delay			23.4									HCM 2000 Level of Service C
HCM 2000 Volume to Capacity ratio			0.56									
Actuated Cycle Length (s)			70.4								16.8	
Intersection Capacity Utilization			61.7%									ICU Level of Service B
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis
 27: Collier Canyon Rd & N Canyons Pkwy/Portola Ave

BART to Livermore Extension Project
 2025 Enhanced Bus + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	311	810	157	79	254	22	48	6	309	132	12	96
Future Volume (vph)	311	810	157	79	254	22	48	6	309	132	12	96
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	5.2	5.2
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.85		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	1770	1589		1770	1863	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	1770	1589		1770	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	338	880	171	86	276	24	52	7	336	143	13	104
RTOR Reduction (vph)	0	0	107	0	0	16	0	215	0	0	0	75
Lane Group Flow (vph)	338	880	64	86	276	8	52	128	0	143	13	29
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA		Prot	NA	Perm
Protected Phases	1	6		5	2		3	8		7	NA	4
Permitted Phases			6			2						4
Actuated Green, G (s)	11.6	28.7	28.7	7.0	24.1	24.1	3.8	16.3		10.3	23.2	23.2
Effective Green, g (s)	11.6	30.0	30.0	7.0	25.4	25.4	3.8	17.3		10.3	22.6	22.6
Actuated g/C Ratio	0.14	0.37	0.37	0.09	0.32	0.32	0.05	0.21		0.13	0.28	0.28
Clearance Time (s)	4.0	5.3	5.3	4.0	5.3	5.3	4.0	5.0		4.0	4.6	4.6
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	494	1317	589	153	1115	498	83	341		226	522	443
v/s Ratio Prot	c0.10	c0.25		0.05	0.08		0.03	c0.08		c0.08	0.01	
v/s Ratio Perm			0.04			0.00						0.02
v/c Ratio	0.68	0.67	0.11	0.56	0.25	0.02	0.63	0.37		0.63	0.02	0.07
Uniform Delay, d1	32.8	21.1	16.5	35.3	20.5	19.0	37.7	27.0		33.4	21.0	21.3
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	3.9	1.3	0.1	4.7	0.1	0.0	13.8	0.7		5.7	0.0	0.1
Delay (s)	36.7	22.4	16.6	40.0	20.6	19.0	51.6	27.7		39.0	21.0	21.3
Level of Service	D	C	B	D	C	B	D	C		D	C	C
Approach Delay (s)		25.2			24.8			30.9			31.0	
Approach LOS		C			C			C			C	

Intersection Summary		
HCM 2000 Control Delay	26.7	HCM 2000 Level of Service C
HCM 2000 Volume to Capacity ratio	0.62	
Actuated Cycle Length (s)	80.6	Sum of lost time (s) 17.2
Intersection Capacity Utilization	66.9%	ICU Level of Service C
Analysis Period (min)	15	

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 28: Isabel Ave/Campus Hill Dr & Portola Ave

BART to Livermore Extension Project
 2025 Enhanced Bus + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↘	↑↑	↗↗	↘↘↘	↑↑		↘↘	↑↑	↗	↘	↑↑	↗
Traffic Volume (vph)	4	719	553	258	187	112	220	333	87	128	263	2
Future Volume (vph)	4	719	553	258	187	112	220	333	87	128	263	2
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	5.8	5.8
Lane Util. Factor	1.00	0.95	0.88	0.94	0.95		0.97	0.95	1.00	1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	0.94		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3539	2787	4990	3340		3433	3539	1583	1770	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	3539	2787	4990	3340		3433	3539	1583	1770	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	4	782	601	280	203	122	239	362	95	139	286	2
RTOR Reduction (vph)	0	0	371	0	62	0	0	0	77	0	0	2
Lane Group Flow (vph)	4	782	230	280	263	0	239	362	18	139	286	0
Turn Type	Prot	NA	Perm	Prot	NA		Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4						2			6
Actuated Green, G (s)	1.5	31.2	31.2	9.2	38.9		9.2	14.8	14.8	11.3	17.3	17.3
Effective Green, g (s)	1.5	32.5	32.5	9.2	40.2		9.2	16.1	16.1	11.3	16.4	16.4
Actuated g/C Ratio	0.02	0.38	0.38	0.11	0.47		0.11	0.19	0.19	0.13	0.19	0.19
Clearance Time (s)	4.0	5.3	5.3	4.0	5.3		4.0	5.3	5.3	4.0	4.9	4.9
Vehicle Extension (s)	2.0	3.0	3.0	2.0	3.0		2.0	3.0	3.0	2.0	3.0	3.0
Lane Grp Cap (vph)	31	1351	1064	539	1577		371	669	299	235	682	305
v/s Ratio Prot	0.00	c0.22		c0.06	0.08		0.07	c0.10		c0.08	0.08	
v/s Ratio Perm			0.08						0.01			0.00
v/c Ratio	0.13	0.58	0.22	0.52	0.17		0.64	0.54	0.06	0.59	0.42	0.00
Uniform Delay, d1	41.2	20.9	17.7	35.9	12.9		36.4	31.2	28.3	34.7	30.2	27.7
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.7	0.6	0.1	0.4	0.1		2.9	0.9	0.1	2.6	0.4	0.0
Delay (s)	41.8	21.5	17.8	36.2	12.9		39.2	32.1	28.4	37.4	30.6	27.7
Level of Service	D	C	B	D	B		D	C	C	D	C	C
Approach Delay (s)		19.9			23.7			34.0			32.8	
Approach LOS		B			C			C			C	

Intersection Summary

HCM 2000 Control Delay	25.6	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.57		
Actuated Cycle Length (s)	85.1	Sum of lost time (s)	17.8
Intersection Capacity Utilization	59.7%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
29: Isabel Ave & I-580 WB Ramps

BART to Livermore Extension Project
2025 Enhanced Bus + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↖↗		↖		↕↕	↖↗		↕↕	↖
Traffic Volume (vph)	0	0	0	680	0	256	0	364	0	0	642	424
Future Volume (vph)	0	0	0	680	0	256	0	364	0	0	642	424
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0		4.0		5.6			5.6	5.6
Lane Util. Factor				0.97		1.00		0.95			0.95	1.00
Frt				1.00		0.85		1.00			1.00	0.85
Flt Protected				0.95		1.00		1.00			1.00	1.00
Satd. Flow (prot)				3433		1583		3539			3539	1583
Flt Permitted				0.95		1.00		1.00			1.00	1.00
Satd. Flow (perm)				3433		1583		3539			3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	739	0	278	0	396	0	0	698	461
RTOR Reduction (vph)	0	0	0	0	0	199	0	0	0	0	0	205
Lane Group Flow (vph)	0	0	0	739	0	79	0	396	0	0	698	256
Turn Type				Prot		Prot		NA	Free		NA	Prot
Protected Phases				8		8		2			6	6
Permitted Phases									Free			
Actuated Green, G (s)				17.1		17.1		34.1			34.1	34.1
Effective Green, g (s)				17.1		17.1		33.3			33.3	33.3
Actuated g/C Ratio				0.29		0.29		0.55			0.55	0.55
Clearance Time (s)				4.0		4.0		4.8			4.8	4.8
Vehicle Extension (s)				2.0		2.0		4.0			4.0	4.0
Lane Grp Cap (vph)				978		451		1964			1964	878
v/s Ratio Prot				c0.22		0.05		0.11			c0.20	0.16
v/s Ratio Perm												
v/c Ratio				0.76		0.18		0.20			0.36	0.29
Uniform Delay, d1				19.5		16.1		6.7			7.4	7.1
Progression Factor				1.00		1.00		0.96			1.00	1.00
Incremental Delay, d2				3.0		0.1		0.2			0.2	0.3
Delay (s)				22.5		16.2		6.7			7.6	7.3
Level of Service				C		B		A			A	A
Approach Delay (s)		0.0			20.8			6.7			7.5	
Approach LOS		A			C			A			A	

Intersection Summary

HCM 2000 Control Delay	12.6	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.49		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	9.6
Intersection Capacity Utilization	45.1%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 30: Isabel Ave & I-580 EB Ramps

BART to Livermore Extension Project
 2025 Enhanced Bus + Garage PM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations													
Traffic Volume (vph)	194	0	438	0	0	0	0	685	736	0	895	653	
Future Volume (vph)	194	0	438	0	0	0	0	685	736	0	895	653	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)	4.0		4.0					4.0	4.0		4.0	4.0	
Lane Util. Factor	0.97		0.88					0.95	1.00		0.95	1.00	
Frt	1.00		0.85					1.00	0.85		1.00	0.85	
Flt Protected	0.95		1.00					1.00	1.00		1.00	1.00	
Satd. Flow (prot)	3433		2787					3539	1583		3539	1583	
Flt Permitted	0.95		1.00					1.00	1.00		1.00	1.00	
Satd. Flow (perm)	3433		2787					3539	1583		3539	1583	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	
Adj. Flow (vph)	211	0	476	0	0	0	0	745	800	0	973	710	
RTOR Reduction (vph)	0	0	200	0	0	0	0	0	0	0	0	0	
Lane Group Flow (vph)	211	0	276	0	0	0	0	745	800	0	973	710	
Turn Type	Prot		Perm					NA	Free		NA	Free	
Protected Phases	4							2			6		
Permitted Phases			4						Free			Free	
Actuated Green, G (s)	10.1		10.1					40.9	60.0		40.9	60.0	
Effective Green, g (s)	10.1		10.1					41.9	60.0		41.9	60.0	
Actuated g/C Ratio	0.17		0.17					0.70	1.00		0.70	1.00	
Clearance Time (s)	4.0		4.0					5.0			5.0		
Vehicle Extension (s)	2.0		2.0					4.0			4.0		
Lane Grp Cap (vph)	577		469					2471	1583		2471	1583	
v/s Ratio Prot	0.06							0.21			0.27		
v/s Ratio Perm			0.10						c0.51			0.45	
v/c Ratio	0.37		0.59					0.30	0.51		0.39	0.45	
Uniform Delay, d1	22.1		23.0					3.5	0.0		3.8	0.0	
Progression Factor	1.00		1.00					1.00	1.00		0.46	1.00	
Incremental Delay, d2	0.1		1.2					0.1	1.2		0.4	0.9	
Delay (s)	22.3		24.3					3.6	1.2		2.2	0.9	
Level of Service	C		C					A	A		A	A	
Approach Delay (s)		23.6			0.0			2.3			1.6		
Approach LOS		C			A			A			A		
Intersection Summary													
HCM 2000 Control Delay			5.8									HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio			0.58										
Actuated Cycle Length (s)			60.0									Sum of lost time (s)	8.0
Intersection Capacity Utilization			46.7%									ICU Level of Service	A
Analysis Period (min)			15										

c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↑	↗	↖	↑	↗	↖	↑↑↑	↗	↖↗	↑↑↑	↗
Traffic Volume (vph)	0	165	437	105	128	77	273	1172	30	318	1334	13
Future Volume (vph)	0	165	437	105	128	77	273	1172	30	318	1334	13
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.2	5.6	5.2	5.2	5.6	4.0	4.0	4.0	4.0	4.0	5.0
Lane Util. Factor		1.00	1.00	1.00	1.00	1.00	1.00	0.91	1.00	0.97	0.91	1.00
Frt		1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1863	1583	1770	1863	1583	1770	5085	1583	3433	5085	1583
Flt Permitted		1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)		1863	1583	1770	1863	1583	1770	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	179	475	114	139	84	297	1274	33	346	1450	14
RTOR Reduction (vph)	0	0	68	0	0	48	0	0	19	0	0	9
Lane Group Flow (vph)	0	179	407	114	139	36	297	1274	14	346	1450	5
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4	5	3	8	1	5	2		1	NA	6
Permitted Phases			4			8			2			6
Actuated Green, G (s)		14.1	32.1	8.8	27.5	40.7	18.0	36.8	36.8	13.2	32.0	32.0
Effective Green, g (s)		13.5	30.9	8.2	26.9	39.5	19.0	37.8	37.8	14.2	33.0	32.0
Actuated g/C Ratio		0.15	0.34	0.09	0.29	0.43	0.21	0.41	0.41	0.15	0.36	0.35
Clearance Time (s)		4.6	5.0	4.6	4.6	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Extension (s)		3.0	3.0	3.0	3.0	3.0	3.0	5.0	5.0	3.0	5.0	5.0
Lane Grp Cap (vph)		273	531	157	544	678	365	2087	649	529	1821	550
v/s Ratio Prot		0.10	c0.14	c0.06	0.07	0.01	c0.17	0.25		0.10	c0.29	
v/s Ratio Perm			0.11			0.02			0.01			0.00
v/c Ratio		0.66	0.77	0.73	0.26	0.05	0.81	0.61	0.02	0.65	0.80	0.01
Uniform Delay, d1		37.1	27.4	40.9	24.9	15.4	34.9	21.4	16.1	36.6	26.5	19.7
Progression Factor		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2		5.6	6.6	15.4	0.2	0.0	13.0	0.8	0.0	2.9	2.9	0.0
Delay (s)		42.7	33.9	56.2	25.2	15.4	47.8	22.1	16.2	39.5	29.4	19.7
Level of Service		D	C	E	C	B	D	C	B	D	C	B
Approach Delay (s)		36.3			33.2			26.8			31.3	
Approach LOS		D			C			C			C	
































Intersection Summary

HCM 2000 Control Delay	30.5	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.80		
Actuated Cycle Length (s)	92.1	Sum of lost time (s)	20.0
Intersection Capacity Utilization	71.0%	ICU Level of Service	C
Analysis Period (min)	15		

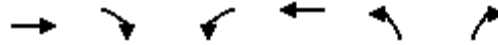
c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
32: Isabel Ave & Jack London Blvd

BART to Livermore Extension Project
2025 Enhanced Bus + Garage PM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 	 			 		 	  		  		
Traffic Volume (vph)	122	689	244	203	147	298	93	1133	359	464	1203	59
Future Volume (vph)	122	689	244	203	147	298	93	1133	359	464	1203	59
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.97	0.91	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	3433	5085	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	3433	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	133	749	265	221	160	324	101	1232	390	504	1308	64
RTOR Reduction (vph)	0	0	133	0	0	42	0	0	153	0	0	41
Lane Group Flow (vph)	133	749	132	221	160	282	101	1232	237	504	1308	23
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8	1	5	2		1	6	
Permitted Phases			4			8			2			6
Actuated Green, G (s)	8.2	27.4	27.4	12.7	31.9	45.6	5.3	29.5	29.5	13.7	37.9	37.9
Effective Green, g (s)	8.2	27.4	27.4	12.7	31.9	45.6	5.3	29.5	29.5	13.7	37.9	37.9
Actuated g/C Ratio	0.08	0.26	0.26	0.12	0.31	0.44	0.05	0.28	0.28	0.13	0.36	0.36
Clearance Time (s)	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	269	927	415	215	1080	771	174	1435	446	450	1844	574
v/s Ratio Prot	0.04	c0.21		c0.12	0.05	c0.05	0.03	c0.24		c0.15	0.26	
v/s Ratio Perm			0.08			0.13			0.15			0.01
v/c Ratio	0.49	0.81	0.32	1.03	0.15	0.37	0.58	0.86	0.53	1.12	0.71	0.04
Uniform Delay, d1	46.2	36.1	31.0	45.9	26.4	19.7	48.5	35.5	31.7	45.4	28.6	21.5
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.4	5.2	0.4	68.8	0.1	0.3	4.9	5.3	1.2	79.4	1.3	0.0
Delay (s)	47.6	41.3	31.5	114.7	26.5	20.0	53.4	40.9	32.9	124.8	29.8	21.6
Level of Service	D	D	C	F	C	C	D	D	C	F	C	C
Approach Delay (s)		39.8			51.2			39.8			55.1	
Approach LOS		D			D			D			E	
Intersection Summary												
HCM 2000 Control Delay			46.5								HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio			0.90									
Actuated Cycle Length (s)			104.5								Sum of lost time (s)	21.2
Intersection Capacity Utilization			83.1%								ICU Level of Service	E
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis
 33: Isabel Ave Connector & Stanley Blvd



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑	↑	↔	↑↑	↔	↔
Traffic Volume (vph)	1681	483	255	574	155	379
Future Volume (vph)	1681	483	255	574	155	379
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	3.8	4.0	4.0	4.0	2.5
Lane Util. Factor	0.95	1.00	0.97	0.95	0.97	0.88
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	3539	1583	3433	3539	3433	2787
Flt Permitted	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (perm)	3539	1583	3433	3539	3433	2787
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	1827	525	277	624	168	412
RTOR Reduction (vph)	0	0	0	0	0	8
Lane Group Flow (vph)	1827	525	277	624	168	404
Turn Type	NA	pm+ov	Prot	NA	Prot	pm+ov
Protected Phases	2	8	1	6	8	1
Permitted Phases		2				8
Actuated Green, G (s)	43.8	52.4	6.0	53.8	8.6	14.6
Effective Green, g (s)	45.5	55.8	6.0	55.5	10.1	17.6
Actuated g/C Ratio	0.62	0.76	0.08	0.75	0.14	0.24
Clearance Time (s)	5.7	5.5	4.0	5.7	5.5	4.0
Vehicle Extension (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Grp Cap (vph)	2187	1200	279	2668	471	666
v/s Ratio Prot	c0.52	0.06	c0.08	0.18	0.05	c0.06
v/s Ratio Perm		0.27				0.08
v/c Ratio	0.84	0.44	0.99	0.23	0.36	0.61
Uniform Delay, d1	11.1	3.2	33.8	2.7	28.8	24.9
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	2.8	0.1	51.6	0.0	0.2	1.1
Delay (s)	13.9	3.3	85.4	2.7	29.0	26.0
Level of Service	B	A	F	A	C	C
Approach Delay (s)	11.5			28.1	26.9	
Approach LOS	B			C	C	

Intersection Summary

HCM 2000 Control Delay	17.8	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.81		
Actuated Cycle Length (s)	73.6	Sum of lost time (s)	12.0
Intersection Capacity Utilization	70.4%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 34: Murrieta Blvd/Driveway & Portola Ave

BART to Livermore Extension Project
 2025 Enhanced Bus + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↗	↕		↖	↕		↗	↕	↖		↕	
Traffic Volume (vph)	0	1063	129	218	636	1	132	5	321	5	6	0
Future Volume (vph)	0	1063	129	218	636	1	132	5	321	5	6	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.8		4.0	5.8		5.2	5.2	5.2		4.0	
Lane Util. Factor		0.95		1.00	0.95		0.95	0.95	1.00		1.00	
Frt		0.98		1.00	1.00		1.00	1.00	0.85		1.00	
Flt Protected		1.00		0.95	1.00		0.95	0.96	1.00		0.98	
Satd. Flow (prot)		3482		1770	3538		1681	1691	1583		1825	
Flt Permitted		1.00		0.95	1.00		0.95	0.96	1.00		0.98	
Satd. Flow (perm)		3482		1770	3538		1681	1691	1583		1825	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	1155	140	237	691	1	143	5	349	5	7	0
RTOR Reduction (vph)	0	9	0	0	0	0	0	0	236	0	0	0
Lane Group Flow (vph)	0	1286	0	237	692	0	74	74	113	0	12	0
Turn Type	Prot	NA		Prot	NA		Split	NA	Perm		Split	NA
Protected Phases	5	2		1	6		8	8			4	4
Permitted Phases									8			
Actuated Green, G (s)		33.0		11.1	48.1		9.8	9.8	9.8		0.7	
Effective Green, g (s)		32.1		11.1	47.2		9.2	9.2	9.2		0.7	
Actuated g/C Ratio		0.45		0.15	0.65		0.13	0.13	0.13		0.01	
Clearance Time (s)		4.9		4.0	4.9		4.6	4.6	4.6		4.0	
Vehicle Extension (s)		2.0		2.0	2.0		2.0	2.0	2.0		2.0	
Lane Grp Cap (vph)		1550		272	2316		214	215	201		17	
v/s Ratio Prot		c0.37		c0.13	0.20		0.04	0.04			c0.01	
v/s Ratio Perm									c0.07			
v/c Ratio		0.83		0.87	0.30		0.35	0.34	0.56		0.71	
Uniform Delay, d1		17.6		29.8	5.3		28.7	28.7	29.5		35.6	
Progression Factor		1.00		1.00	1.00		1.00	1.00	1.00		1.00	
Incremental Delay, d2		3.7		24.2	0.0		0.4	0.4	2.1		72.3	
Delay (s)		21.2		54.0	5.4		29.1	29.0	31.7		107.9	
Level of Service		C		D	A		C	C	C		F	
Approach Delay (s)		21.2			17.8			30.9			107.9	
Approach LOS		C			B			C			F	

Intersection Summary		
HCM 2000 Control Delay	22.2	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.79	C
Actuated Cycle Length (s)	72.1	Sum of lost time (s)
Intersection Capacity Utilization	69.2%	19.0
Analysis Period (min)	15	ICU Level of Service
		C

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 35: Murrieta Blvd & Jack London Blvd



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	265	809	436	243	282	125
Future Volume (vph)	265	809	436	243	282	125
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00	1.00	0.95	0.91	
Frt	1.00	0.85	1.00	1.00	0.95	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1770	1583	1770	3539	4851	
Flt Permitted	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	1770	1583	1770	3539	4851	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	288	879	474	264	307	136
RTOR Reduction (vph)	0	487	0	0	114	0
Lane Group Flow (vph)	288	392	474	264	329	0
Turn Type	Prot	Perm	Prot	NA	NA	
Protected Phases	4		5	2	6	
Permitted Phases		4				
Actuated Green, G (s)	19.1	19.1	20.5	34.5	10.0	
Effective Green, g (s)	19.1	19.1	20.5	34.5	10.0	
Actuated g/C Ratio	0.31	0.31	0.33	0.56	0.16	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	548	490	589	1982	787	
v/s Ratio Prot	0.16		c0.27	0.07	c0.07	
v/s Ratio Perm		c0.25				
v/c Ratio	0.53	0.80	0.80	0.13	0.42	
Uniform Delay, d1	17.5	19.5	18.7	6.4	23.2	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.9	8.9	7.9	0.0	0.4	
Delay (s)	18.4	28.4	26.6	6.5	23.5	
Level of Service	B	C	C	A	C	
Approach Delay (s)	25.9			19.4	23.5	
Approach LOS	C			B	C	

Intersection Summary

HCM 2000 Control Delay	23.4	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.72		
Actuated Cycle Length (s)	61.6	Sum of lost time (s)	12.0
Intersection Capacity Utilization	65.0%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 36: Murrieta Blvd & Stanley Blvd

BART to Livermore Extension Project
 2025 Enhanced Bus + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	268	1053	466	41	568	164	233	377	18	255	323	188
Future Volume (vph)	268	1053	466	41	568	164	233	377	18	255	323	188
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.9	4.9	4.0	4.9	4.9	4.9	4.9		4.9	4.9	4.0
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.97	0.95		1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	3433	3515		1770	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	3433	3515		1770	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	291	1145	507	45	617	178	253	410	20	277	351	204
RTOR Reduction (vph)	0	0	296	0	0	69	0	4	0	0	0	154
Lane Group Flow (vph)	291	1145	211	45	617	109	253	426	0	277	351	50
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Prot	NA		Prot	NA	Perm
Protected Phases	7	4		3	8	1	5	2		1	6	
Permitted Phases			4			8						6
Actuated Green, G (s)	10.2	28.7	28.7	2.2	20.7	35.2	9.9	14.0		14.5	18.6	18.6
Effective Green, g (s)	10.2	27.8	27.8	2.2	19.8	33.4	9.0	13.1		13.6	17.7	18.6
Actuated g/C Ratio	0.14	0.37	0.37	0.03	0.26	0.44	0.12	0.17		0.18	0.23	0.25
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	464	1304	583	51	929	804	409	610		319	830	390
v/s Ratio Prot	c0.08	c0.32		0.03	0.17	0.02	0.07	c0.12		c0.16	c0.10	
v/s Ratio Perm			0.13			0.04						0.03
v/c Ratio	0.63	0.88	0.36	0.88	0.66	0.14	0.62	0.70		0.87	0.42	0.13
Uniform Delay, d1	30.8	22.2	17.3	36.5	24.8	12.4	31.6	29.3		30.0	24.5	22.1
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	2.6	7.0	0.4	83.2	1.8	0.1	2.8	3.5		21.3	0.3	0.2
Delay (s)	33.4	29.2	17.7	119.7	26.6	12.5	34.3	32.8		51.3	24.9	22.2
Level of Service	C	C	B	F	C	B	C	C		D	C	C
Approach Delay (s)		26.8			28.6			33.4			33.0	
Approach LOS		C			C			C			C	

Intersection Summary

HCM 2000 Control Delay	29.4	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.82		
Actuated Cycle Length (s)	75.4	Sum of lost time (s)	18.7
Intersection Capacity Utilization	73.1%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
37: Livermore Ave & I-580 WB Ramps

BART to Livermore Extension Project
2025 Enhanced Bus + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↖	↔		↗	↑			↕	
Traffic Volume (vph)	0	0	0	315	18	19	773	459	0	0	116	0
Future Volume (vph)	0	0	0	315	18	19	773	459	0	0	116	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)					4.0		4.0	4.0			4.0	
Lane Util. Factor					0.95		0.97	1.00			0.95	
Frt					0.99		1.00	1.00			1.00	
Flt Protected					0.96		0.95	1.00			1.00	
Satd. Flow (prot)					1680		3433	1863			3539	
Flt Permitted					0.96		0.95	1.00			1.00	
Satd. Flow (perm)					1680		3433	1863			3539	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	342	20	21	840	499	0	0	126	0
RTOR Reduction (vph)	0	0	0	0	4	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	0	379	0	840	499	0	0	126	0
Turn Type				Split	NA		Prot	NA			NA	
Protected Phases				8	8		5	2			6	
Permitted Phases												
Actuated Green, G (s)					16.4		18.2	33.9			12.2	
Effective Green, g (s)					16.4		17.7	35.6			13.9	
Actuated g/C Ratio					0.27		0.29	0.59			0.23	
Clearance Time (s)					4.0		3.5	5.7			5.7	
Vehicle Extension (s)					2.0		2.0	2.5			2.5	
Lane Grp Cap (vph)					459		1012	1105			819	
v/s Ratio Prot					c0.23		c0.24	c0.27			0.04	
v/s Ratio Perm												
v/c Ratio					0.83		0.83	0.45			0.15	
Uniform Delay, d1					20.5		19.7	6.8			18.4	
Progression Factor					1.00		0.53	0.19			1.00	
Incremental Delay, d2					11.1		0.5	0.1			0.4	
Delay (s)					31.5		11.0	1.4			18.8	
Level of Service					C		B	A			B	
Approach Delay (s)		0.0			31.5			7.4			18.8	
Approach LOS		A			C			A			B	

Intersection Summary

HCM 2000 Control Delay	13.2	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.73		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	102.6%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 38: Livermore Ave & I-580 EB Ramps

BART to Livermore Extension Project
 2025 Enhanced Bus + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕	↗					↕		↗	↕	
Traffic Volume (vph)	280	11	1254	0	0	0	0	1003	229	64	366	0
Future Volume (vph)	280	11	1254	0	0	0	0	1003	229	64	366	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0					4.0		4.0	4.0	
Lane Util. Factor		0.95	0.95					0.95		1.00	0.95	
Frt		0.90	0.85					0.97		1.00	1.00	
Flt Protected		0.98	1.00					1.00		0.95	1.00	
Satd. Flow (prot)		1565	1504					3440		1770	3539	
Flt Permitted		0.98	1.00					1.00		0.95	1.00	
Satd. Flow (perm)		1565	1504					3440		1770	3539	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	304	12	1363	0	0	0	0	1090	249	70	398	0
RTOR Reduction (vph)	0	127	278	0	0	0	0	30	0	0	0	0
Lane Group Flow (vph)	0	857	417	0	0	0	0	1309	0	70	398	0
Turn Type	Prot	NA	Perm					NA		Prot	NA	
Protected Phases	7	4						2		1	6	
Permitted Phases			4									
Actuated Green, G (s)		20.0	20.0					23.9		4.1	31.0	
Effective Green, g (s)		20.0	20.0					24.9		3.1	32.0	
Actuated g/C Ratio		0.33	0.33					0.41		0.05	0.53	
Clearance Time (s)		4.0	4.0					5.0		3.0	5.0	
Vehicle Extension (s)		2.0	2.0					2.5		2.0	2.5	
Lane Grp Cap (vph)		521	501					1427		91	1887	
v/s Ratio Prot								c0.38		c0.04	0.11	
v/s Ratio Perm		0.55	0.28									
v/c Ratio		1.65	0.83					0.92		0.77	0.21	
Uniform Delay, d1		20.0	18.5					16.6		28.1	7.4	
Progression Factor		1.00	1.00					1.00		1.16	0.11	
Incremental Delay, d2		299.1	10.8					10.8		24.3	0.2	
Delay (s)		319.1	29.3					27.4		56.8	1.0	
Level of Service		F	C					C		E	A	
Approach Delay (s)		199.1			0.0			27.4			9.3	
Approach LOS		F			A			C			A	

Intersection Summary		
HCM 2000 Control Delay	107.7	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	1.21	F
Actuated Cycle Length (s)	60.0	Sum of lost time (s)
Intersection Capacity Utilization	102.6%	12.0
Analysis Period (min)	15	ICU Level of Service
		G

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 39: Livermore Ave & Portola Ave

BART to Livermore Extension Project
 2025 Enhanced Bus + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	545	523	166	18	316	56	185	505	78	197	923	419
Future Volume (vph)	545	523	166	18	316	56	185	505	78	197	923	419
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	5.8		4.0	5.8	4.9
Lane Util. Factor	0.97	0.95		1.00	0.95		1.00	0.95		1.00	0.95	1.00
Frt	1.00	0.96		1.00	0.98		1.00	0.98		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3411		1770	3459		1770	3468		1770	3539	1583
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3411		1770	3459		1770	3468		1770	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	592	568	180	20	343	61	201	549	85	214	1003	455
RTOR Reduction (vph)	0	29	0	0	15	0	0	10	0	0	0	99
Lane Group Flow (vph)	592	719	0	20	389	0	201	624	0	214	1003	356
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	pm+ov
Protected Phases	3	8		7	4		1	6		5	2	3
Permitted Phases												2
Actuated Green, G (s)	19.8	34.2		1.9	16.3		12.0	33.8		12.0	33.8	53.6
Effective Green, g (s)	19.8	35.5		1.9	17.6		12.0	32.9		12.0	32.9	51.8
Actuated g/C Ratio	0.20	0.35		0.02	0.18		0.12	0.33		0.12	0.33	0.52
Clearance Time (s)	4.0	5.3		4.0	5.3		4.0	4.9		4.0	4.9	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	679	1209		33	608		212	1139		212	1163	819
v/s Ratio Prot	c0.17	0.21		0.01	c0.11		0.11	0.18		c0.12	c0.28	0.08
v/s Ratio Perm												0.14
v/c Ratio	0.87	0.59		0.61	0.64		0.95	0.55		1.01	0.86	0.43
Uniform Delay, d1	38.9	26.4		48.7	38.3		43.7	27.5		44.0	31.5	15.0
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	11.9	0.8		27.6	2.3		46.7	0.5		64.3	6.8	0.4
Delay (s)	50.8	27.2		76.3	40.6		90.5	28.1		108.3	38.3	15.4
Level of Service	D	C		E	D		F	C		F	D	B
Approach Delay (s)		37.6			42.3			43.1			41.0	
Approach LOS		D			D			D			D	

Intersection Summary		
HCM 2000 Control Delay	40.5	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.85	D
Actuated Cycle Length (s)	100.1	Sum of lost time (s)
Intersection Capacity Utilization	76.7%	18.7
Analysis Period (min)	15	ICU Level of Service
		D

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
40: First St/Springtown Blvd & I-580 WB Ramps

BART to Livermore Extension Project
2025 Enhanced Bus + Garage PM






















Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations			↗↘			↗	↗↘	↑			↗↘	↗
Traffic Volume (vph)	0	0	261	0	0	0	387	1508	0	0	422	206
Future Volume (vph)	0	0	261	0	0	0	387	1508	0	0	422	206
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)			4.0				4.0	4.0			5.0	5.0
Lane Util. Factor			0.88				0.97	1.00			0.95	1.00
Frt			0.85				1.00	1.00			1.00	0.85
Flt Protected			1.00				0.95	1.00			1.00	1.00
Satd. Flow (prot)			2787				3433	1863			3539	1583
Flt Permitted			1.00				0.95	1.00			1.00	1.00
Satd. Flow (perm)			2787				3433	1863			3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	284	0	0	0	421	1639	0	0	459	224
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	44
Lane Group Flow (vph)	0	0	284	0	0	0	421	1639	0	0	459	180
Turn Type			Over			Free	Prot	NA			NA	Perm
Protected Phases			5				5	2			6	
Permitted Phases						Free						6
Actuated Green, G (s)			25.8				25.8	60.0			26.2	26.2
Effective Green, g (s)			25.3				25.3	60.0			25.7	25.7
Actuated g/C Ratio			0.42				0.42	1.00			0.43	0.43
Clearance Time (s)			3.5				3.5	4.0			4.5	4.5
Vehicle Extension (s)			2.0				2.0	0.2			4.0	4.0
Lane Grp Cap (vph)			1175				1447	1863			1515	678
v/s Ratio Prot			0.10				0.12	c0.88			0.13	
v/s Ratio Perm												0.11
v/c Ratio			0.24				0.29	0.88			0.30	0.27
Uniform Delay, d1			11.2				11.4	0.0			11.3	11.1
Progression Factor			1.00				0.77	1.00			1.00	1.00
Incremental Delay, d2			0.0				0.0	0.6			0.2	0.3
Delay (s)			11.2				8.9	0.6			11.4	11.3
Level of Service			B				A	A			B	B
Approach Delay (s)		11.2			0.0			2.3			11.4	
Approach LOS		B			A			A			B	

Intersection Summary		
HCM 2000 Control Delay	5.2	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	1.04	A
Actuated Cycle Length (s)	60.0	Sum of lost time (s)
Intersection Capacity Utilization	82.7%	9.0
Analysis Period (min)	15	ICU Level of Service
		E

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 41: First St & I-580 EB Ramps

BART to Livermore Extension Project
 2025 Enhanced Bus + Garage PM

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations													
Traffic Volume (vph)	546	5	728	0	0	0	0	1338	453	90	885	0	
Future Volume (vph)	546	5	728	0	0	0	0	1338	453	90	885	0	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)		4.0	4.0					5.0	5.0	4.0	5.0		
Lane Util. Factor		1.00	0.88					0.95	1.00	1.00	0.95		
Frt		1.00	0.85					1.00	0.85	1.00	1.00		
Flt Protected		0.95	1.00					1.00	1.00	0.95	1.00		
Satd. Flow (prot)		1775	2787					3539	1583	1770	3539		
Flt Permitted		0.95	1.00					1.00	1.00	0.95	1.00		
Satd. Flow (perm)		1775	2787					3539	1583	1770	3539		
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	
Adj. Flow (vph)	593	5	791	0	0	0	0	1454	492	98	962	0	
RTOR Reduction (vph)	0	0	113	0	0	0	0	0	302	0	0	0	
Lane Group Flow (vph)	0	598	678	0	0	0	0	1454	190	98	962	0	
Turn Type	Perm	NA	Perm					NA	Perm	Prot	NA		
Protected Phases		4						2		1	6		
Permitted Phases	4		4						2				
Actuated Green, G (s)		21.3	21.3					23.7	23.7	4.0	30.7		
Effective Green, g (s)		20.8	20.8					23.2	23.2	3.0	30.2		
Actuated g/C Ratio		0.35	0.35					0.39	0.39	0.05	0.50		
Clearance Time (s)		3.5	3.5					4.5	4.5	3.0	4.5		
Vehicle Extension (s)		2.5	2.5					4.0	4.0	2.0	4.0		
Lane Grp Cap (vph)		615	966					1368	612	88	1781		
v/s Ratio Prot								c0.41		c0.06	0.27		
v/s Ratio Perm		0.34	0.24						0.12				
v/c Ratio		0.97	0.70					1.06	0.31	1.11	0.54		
Uniform Delay, d1		19.3	16.9					18.4	12.8	28.5	10.2		
Progression Factor		1.00	1.00					1.00	1.00	0.90	0.86		
Incremental Delay, d2		29.2	2.2					42.9	1.3	129.8	1.2		
Delay (s)		48.6	19.1					61.3	14.1	155.5	9.9		
Level of Service		D	B					E	B	F	A		
Approach Delay (s)		31.8			0.0			49.4			23.4		
Approach LOS		C			A			D			C		
Intersection Summary													
HCM 2000 Control Delay			37.6									HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio			1.03										
Actuated Cycle Length (s)			60.0									Sum of lost time (s)	13.0
Intersection Capacity Utilization			83.3%									ICU Level of Service	E
Analysis Period (min)			15										
c Critical Lane Group													

HCM Signalized Intersection Capacity Analysis
42: 1st St & Mines Rd

BART to Livermore Extension Project
2025 Enhanced Bus + Garage PM





















Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	68	240	58	419	279	379	73	1491	907	378	899	49
Future Volume (vph)	68	240	58	419	279	379	73	1491	907	378	899	49
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	0.97	1.00	1.00	1.00	0.91	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	1863	1583	3433	1863	1583	1770	5085	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	1863	1583	3433	1863	1583	1770	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	74	261	63	455	303	412	79	1621	986	411	977	53
RTOR Reduction (vph)	0	0	54	0	0	33	0	0	163	0	0	26
Lane Group Flow (vph)	74	261	9	455	303	379	79	1621	823	411	977	27
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8	1	5	2		1	NA	6
Permitted Phases			4			8			2			6
Actuated Green, G (s)	5.6	16.8	16.8	14.0	25.2	38.2	7.7	51.8	51.8	13.0	57.1	57.1
Effective Green, g (s)	5.6	16.8	16.8	14.0	25.2	38.2	7.7	51.8	51.8	13.0	57.1	57.1
Actuated g/C Ratio	0.05	0.15	0.15	0.13	0.23	0.34	0.07	0.46	0.46	0.12	0.51	0.51
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	88	280	238	430	420	598	122	2360	734	399	2601	809
v/s Ratio Prot	0.04	c0.14		c0.13	0.16	0.07	0.04	0.32		c0.12	0.19	
v/s Ratio Perm			0.01			0.17			c0.52			0.02
v/c Ratio	0.84	0.93	0.04	1.06	0.72	0.63	0.65	0.69	1.12	1.03	0.38	0.03
Uniform Delay, d1	52.6	46.8	40.5	48.8	40.0	30.8	50.6	23.5	29.9	49.3	16.5	13.5
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	48.1	36.0	0.1	59.6	6.0	2.2	11.2	0.8	71.9	53.0	0.1	0.0
Delay (s)	100.7	82.8	40.6	108.4	46.0	33.0	61.9	24.4	101.8	102.3	16.6	13.6
Level of Service	F	F	D	F	D	C	E	C	F	F	B	B
Approach Delay (s)		79.5			65.7			53.9			40.9	
Approach LOS		E			E			D			D	

Intersection Summary		
HCM 2000 Control Delay	54.8	HCM 2000 Level of Service D
HCM 2000 Volume to Capacity ratio	1.07	
Actuated Cycle Length (s)	111.6	Sum of lost time (s) 16.0
Intersection Capacity Utilization	89.6%	ICU Level of Service E
Analysis Period (min)	15	

c Critical Lane Group




















HCM Unsignalized Intersection Capacity Analysis
 43: Vasco Rd & I-580 WB Ramps

BART to Livermore Extension Project
 2025 Enhanced Bus + Garage PM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	0	0	121	0	1804	0	0	438	0
Future Volume (Veh/h)	0	0	0	0	0	121	0	1804	0	0	438	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	0	0	0	132	0	1961	0	0	476	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage (veh)												
Upstream signal (ft)											487	
pX, platoon unblocked												
vC, conflicting volume	1588	2437	476	2437	2437	980	476			1961		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1588	2437	476	2437	2437	980	476			1961		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	100	100	47	100			100		
cM capacity (veh/h)	34	31	535	16	31	249	1082			293		
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	SB 1	SB 2					
Volume Total	0	132	980	980	0	476	0					
Volume Left	0	0	0	0	0	0	0					
Volume Right	0	132	0	0	0	0	0					
cSH	1700	249	1700	1700	1700	1700	1700					
Volume to Capacity	0.00	0.53	0.58	0.58	0.00	0.28	0.00					
Queue Length 95th (ft)	0	71	0	0	0	0	0					
Control Delay (s)	0.0	34.7	0.0	0.0	0.0	0.0	0.0					
Lane LOS	A	D										
Approach Delay (s)	0.0	34.7	0.0			0.0						
Approach LOS	A	D										
Intersection Summary												
Average Delay			1.8									
Intersection Capacity Utilization			64.0%	ICU Level of Service	C							
Analysis Period (min)			15									

HCM Unsignalized Intersection Capacity Analysis
44: Vasco Rd & I-580 EB Ramps

BART to Livermore Extension Project
2025 Enhanced Bus + Garage PM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations								 			 	
Traffic Volume (veh/h)	0	0	0	0	0	0	0	2092	0	64	571	0
Future Volume (Veh/h)	0	0	0	0	0	0	0	2092	0	64	571	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	0	0	0	0	0	2274	0	70	621	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1898	3035	621	3035	3035	1137	621			2274		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1898	3035	621	3035	3035	1137	621			2274		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	100	100	100	100			68		
cM capacity (veh/h)	32	9	430	4	9	196	956			221		
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2						
Volume Total	0	0	1516	758	70	621						
Volume Left	0	0	0	0	70	0						
Volume Right	0	0	0	0	0	0						
cSH	1700	1700	1700	1700	221	1700						
Volume to Capacity	0.00	0.00	0.89	0.45	0.32	0.37						
Queue Length 95th (ft)	0	0	0	0	33	0						
Control Delay (s)	0.0	0.0	0.0	0.0	28.7	0.0						
Lane LOS	A	A			D							
Approach Delay (s)	0.0	0.0	0.0		2.9							
Approach LOS	A	A										
Intersection Summary												
Average Delay			0.7									
Intersection Capacity Utilization			61.2%	ICU Level of Service	B							
Analysis Period (min)			15									

HCM Signalized Intersection Capacity Analysis
45: Vasco Rd & East Ave

BART to Livermore Extension Project
2025 Enhanced Bus + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗		↖	↗		↖	↗		↖	↗	↖
Traffic Volume (vph)	468	26	94	142	355	240	99	342	12	12	351	354
Future Volume (vph)	468	26	94	142	355	240	99	342	12	12	351	354
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	0.95		0.97	1.00	1.00
Frt	1.00	0.88		1.00	0.94		1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	3123		1770	3325		1770	3521		3433	1863	1583
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1770	3123		1770	3325		1770	3521		3433	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	509	28	102	154	386	261	108	372	13	13	382	385
RTOR Reduction (vph)	0	65	0	0	149	0	0	3	0	0	0	284
Lane Group Flow (vph)	509	65	0	154	498	0	108	382	0	13	382	101
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												6
Actuated Green, G (s)	23.7	30.1		9.4	15.8		5.0	25.6		0.8	21.4	21.4
Effective Green, g (s)	23.7	30.1		9.4	15.8		5.0	25.6		0.8	21.4	21.4
Actuated g/C Ratio	0.29	0.37		0.11	0.19		0.06	0.31		0.01	0.26	0.26
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	512	1147		203	641		108	1100		33	486	413
v/s Ratio Prot	c0.29	0.02		0.09	c0.15		c0.06	0.11		0.00	c0.21	
v/s Ratio Perm												0.06
v/c Ratio	0.99	0.06		0.76	0.78		1.00	0.35		0.39	0.79	0.24
Uniform Delay, d1	29.0	16.7		35.1	31.4		38.5	21.7		40.3	28.1	23.9
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	38.0	0.0		14.9	5.9		86.6	0.2		7.6	8.2	0.3
Delay (s)	67.1	16.8		50.1	37.3		125.1	21.9		47.9	36.3	24.2
Level of Service	E	B		D	D		F	C		D	D	C
Approach Delay (s)		56.8			39.8			44.5			30.5	
Approach LOS		E			D			D			C	

Intersection Summary

HCM 2000 Control Delay	42.0	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.87		
Actuated Cycle Length (s)	81.9	Sum of lost time (s)	16.0
Intersection Capacity Utilization	80.7%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Unsignalized Intersection Capacity Analysis
 46: I-580 WB Ramps & Northfront Rd/Northfront Road



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↻			↻	↻	↻
Traffic Volume (veh/h)	625	39	253	134	3	133
Future Volume (Veh/h)	625	39	253	134	3	133
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	679	42	275	146	3	145
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume			679	1396		700
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			679	1396		700
tC, single (s)			4.1	6.4	6.2	
tC, 2 stage (s)						
tF (s)			2.2	3.5	3.3	
p0 queue free %			70	97	67	
cM capacity (veh/h)			913	109	439	
Direction, Lane #	EB 1	WB 1	NB 1	NB 2		
Volume Total	721	421	3	145		
Volume Left	0	275	3	0		
Volume Right	42	0	0	145		
cSH	1700	913	109	439		
Volume to Capacity	0.42	0.30	0.03	0.33		
Queue Length 95th (ft)	0	32	2	36		
Control Delay (s)	0.0	8.2	39.1	17.2		
Lane LOS	A		E	C		
Approach Delay (s)	0.0	8.2	17.6			
Approach LOS			C			
Intersection Summary						
Average Delay			4.7			
Intersection Capacity Utilization			69.6%	ICU Level of Service		C
Analysis Period (min)			15			

Intersection	
Intersection Delay, s/veh	14.6
Intersection LOS	B

Movement	EBU	EBL	EBT	WBU	WBT	WBR	SBU	SBL	SBR
Lane Configurations		↘	↕↕		↕	↘		↘↘	↘
Traffic Vol, veh/h	0	303	253	0	84	288	0	195	7
Future Vol, veh/h	0	303	253	0	84	288	0	195	7
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	329	275	0	91	313	0	212	8
Number of Lanes	0	1	2	0	1	1	0	2	1

Approach	EB	WB	SB
Opposing Approach	WB	EB	
Opposing Lanes	2	3	0
Conflicting Approach Left	SB		WB
Conflicting Lanes Left	3	0	2
Conflicting Approach Right		SB	EB
Conflicting Lanes Right	0	3	3
HCM Control Delay	15.7	14.3	12.1
HCM LOS	C	B	B

Lane	EBLn1	EBLn2	EBLn3	WBLn1	WBLn2	SBLn1	SBLn2	SBLn3
Vol Left, %	100%	0%	0%	0%	0%	100%	100%	0%
Vol Thru, %	0%	100%	100%	100%	0%	0%	0%	0%
Vol Right, %	0%	0%	0%	0%	100%	0%	0%	100%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	303	127	127	84	288	98	98	7
LT Vol	303	0	0	0	0	98	98	0
Through Vol	0	127	127	84	0	0	0	0
RT Vol	0	0	0	0	288	0	0	7
Lane Flow Rate	329	138	138	91	313	106	106	8
Geometry Grp	8	8	8	8	8	7	7	7
Degree of Util (X)	0.628	0.243	0.176	0.171	0.523	0.22	0.22	0.01
Departure Headway (Hd)	6.864	6.359	4.605	6.725	6.017	7.467	7.467	4.498
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cap	524	562	774	531	598	479	479	789
Service Time	4.626	4.12	2.365	4.492	3.783	5.232	5.232	2.261
HCM Lane V/C Ratio	0.628	0.246	0.178	0.171	0.523	0.221	0.221	0.01
HCM Control Delay	20.6	11.2	8.4	10.9	15.3	12.3	12.3	7.3
HCM Lane LOS	C	B	A	B	C	B	B	A
HCM 95th-tile Q	4.3	0.9	0.6	0.6	3	0.8	0.8	0

HCM Signalized Intersection Capacity Analysis
 48: Greenville Rd & Northfront Road/Altamont Pass Road

BART to Livermore Extension Project
 2025 Enhanced Bus + Garage PM



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↗	↖	↑	↘	↗
Traffic Volume (vph)	606	147	1	51	351	1038
Future Volume (vph)	606	147	1	51	351	1038
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	1863	1583	1770	1863	1770	1583
Flt Permitted	1.00	1.00	0.10	1.00	0.95	1.00
Satd. Flow (perm)	1863	1583	191	1863	1770	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	659	160	1	55	382	1128
RTOR Reduction (vph)	0	65	0	0	0	29
Lane Group Flow (vph)	659	95	1	55	382	1099
Turn Type	NA	Perm	Perm	NA	Prot	Perm
Protected Phases	4			8	2	
Permitted Phases		4	8			2
Actuated Green, G (s)	39.0	39.0	39.0	39.0	73.0	73.0
Effective Green, g (s)	39.0	39.0	39.0	39.0	73.0	73.0
Actuated g/C Ratio	0.32	0.32	0.32	0.32	0.61	0.61
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	605	514	62	605	1076	962
v/s Ratio Prot	c0.35			0.03	0.22	
v/s Ratio Perm		0.06	0.01			c0.69
v/c Ratio	1.09	0.18	0.02	0.09	0.36	1.14
Uniform Delay, d1	40.5	29.1	27.5	28.2	11.7	23.5
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	63.2	0.2	0.1	0.1	0.2	76.8
Delay (s)	103.7	29.2	27.6	28.2	11.9	100.3
Level of Service	F	C	C	C	B	F
Approach Delay (s)	89.2			28.2	78.0	
Approach LOS	F			C	E	

Intersection Summary

HCM 2000 Control Delay	80.6	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.12		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	102.8%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
49: Greenville Rd & Southfront Rd

BART to Livermore Extension Project
2025 Enhanced Bus + Garage PM



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	415	117	266	987	66	83
Future Volume (vph)	415	117	266	987	66	83
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.2	5.2	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.88	0.97	0.95	0.95	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	3433	2787	3433	3539	3539	1583
Flt Permitted	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (perm)	3433	2787	3433	3539	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	451	127	289	1073	72	90
RTOR Reduction (vph)	0	109	0	0	0	59
Lane Group Flow (vph)	451	18	289	1073	72	31
Turn Type	Prot	Perm	Prot	NA	NA	Perm
Protected Phases	8		1	6	2	
Permitted Phases		8				2
Actuated Green, G (s)	5.5	5.5	4.0	18.0	10.0	10.0
Effective Green, g (s)	4.9	4.9	4.0	19.7	11.7	11.7
Actuated g/C Ratio	0.14	0.14	0.12	0.58	0.35	0.35
Clearance Time (s)	4.6	4.6	4.0	5.7	5.7	5.7
Vehicle Extension (s)	5.0	5.0	6.0	2.5	2.5	2.5
Lane Grp Cap (vph)	497	404	406	2062	1225	547
v/s Ratio Prot	c0.13		0.08	c0.30	0.02	
v/s Ratio Perm		0.01				0.02
v/c Ratio	0.91	0.05	0.71	0.52	0.06	0.06
Uniform Delay, d1	14.2	12.4	14.3	4.2	7.4	7.4
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	21.2	0.1	8.3	0.2	0.0	0.0
Delay (s)	35.4	12.5	22.6	4.4	7.4	7.4
Level of Service	D	B	C	A	A	A
Approach Delay (s)	30.4			8.3	7.4	
Approach LOS	C			A	A	

Intersection Summary

HCM 2000 Control Delay	14.3	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.71		
Actuated Cycle Length (s)	33.8	Sum of lost time (s)	13.2
Intersection Capacity Utilization	46.8%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

50: Greenville Rd & Patterson Pass Rd

BART to Livermore Extension Project

2025 Enhanced Bus + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	38	563	62	5	13	7	75	405	325	425	202	48
Future Volume (vph)	38	563	62	5	13	7	75	405	325	425	202	48
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.99		1.00	0.95		1.00	0.93		1.00	0.97	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1835		1770	1761		1770	1738		1770	1809	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	1835		1770	1761		1770	1738		1770	1809	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	41	612	67	5	14	8	82	440	353	462	220	52
RTOR Reduction (vph)	0	4	0	0	6	0	0	24	0	0	7	0
Lane Group Flow (vph)	41	675	0	5	16	0	82	769	0	462	265	0
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												
Actuated Green, G (s)	9.6	34.0		0.8	25.2		8.6	43.8		23.0	58.2	
Effective Green, g (s)	9.6	34.0		0.8	25.2		8.6	43.8		23.0	58.2	
Actuated g/C Ratio	0.08	0.29		0.01	0.21		0.07	0.37		0.20	0.49	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	144	530		12	377		129	647		346	895	
v/s Ratio Prot	c0.02	c0.37		0.00	0.01		0.05	c0.44		c0.26	0.15	
v/s Ratio Perm												
v/c Ratio	0.28	1.27		0.42	0.04		0.64	1.19		1.34	0.30	
Uniform Delay, d1	50.8	41.8		58.2	36.6		53.0	36.9		47.3	17.6	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	1.1	137.6		21.8	0.0		9.8	99.9		169.3	0.8	
Delay (s)	51.9	179.4		79.9	36.7		62.8	136.8		216.6	18.4	
Level of Service	D	F		E	D		E	F		F	B	
Approach Delay (s)		172.2			44.7			129.8			143.2	
Approach LOS		F			D			F			F	

Intersection Summary

HCM 2000 Control Delay	146.0	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.25		
Actuated Cycle Length (s)	117.6	Sum of lost time (s)	16.0
Intersection Capacity Utilization	108.1%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
1: Dougherty Rd & Amador Valley Rd



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	99	767	465	820	2140	132
Future Volume (vph)	99	767	465	820	2140	132
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00	0.97	0.91	0.91	
Frt	1.00	0.85	1.00	1.00	0.99	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1770	1583	3433	5085	5041	
Flt Permitted	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	1770	1583	3433	5085	5041	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	108	834	505	891	2326	143
RTOR Reduction (vph)	0	161	0	0	6	0
Lane Group Flow (vph)	108	673	505	891	2463	0
Turn Type	Perm	Perm	Prot	NA	NA	
Protected Phases			5	2	6	
Permitted Phases	4	4				
Actuated Green, G (s)	41.0	41.0	15.0	71.0	52.0	
Effective Green, g (s)	41.0	41.0	15.0	71.0	52.0	
Actuated g/C Ratio	0.34	0.34	0.12	0.59	0.43	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	604	540	429	3008	2184	
v/s Ratio Prot			c0.15	0.18	c0.49	
v/s Ratio Perm	0.06	c0.42				
v/c Ratio	0.18	1.25	1.18	0.30	1.13	
Uniform Delay, d1	27.7	39.5	52.5	12.1	34.0	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.1	125.5	101.6	0.1	64.1	
Delay (s)	27.8	165.0	154.1	12.2	98.1	
Level of Service	C	F	F	B	F	
Approach Delay (s)	149.3			63.5	98.1	
Approach LOS	F			E	F	

Intersection Summary

HCM 2000 Control Delay	98.1	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.18		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	98.4%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
2: Hopyard Road/Dougherty Rd & Dublin Blvd

BART to Livermore Extension Project
2040 No Project AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↑↑↑	↖↗	↖↗↗	↑↑↑	↖	↖↗↗	↑↑↑	↖↗	↖↗	↑↑↑	↖↗
Traffic Volume (vph)	53	506	534	343	908	477	752	1064	133	922	2170	109
Future Volume (vph)	53	506	534	343	908	477	752	1064	133	922	2170	109
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	6.0	5.0	5.0	5.5	5.0	5.0	5.5	5.0	5.0	5.5	
Lane Util. Factor	0.97	0.91	0.88	0.94	0.91	1.00	0.94	0.91	0.88	0.97	0.86	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	3433	5085	2787	4990	5085	1583	4990	5085	2787	3433	6362	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	3433	5085	2787	4990	5085	1583	4990	5085	2787	3433	6362	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	58	550	580	373	987	518	817	1157	145	1002	2359	118
RTOR Reduction (vph)	0	0	63	0	0	82	0	0	60	0	5	0
Lane Group Flow (vph)	58	550	517	373	987	436	817	1157	85	1002	2472	0
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	
Protected Phases	5	2	3	1	6	7	3	8	1	7	4	
Permitted Phases			2			6			8			
Actuated Green, G (s)	12.0	32.3	49.3	15.4	36.2	62.0	17.0	45.0	60.4	25.8	53.8	
Effective Green, g (s)	12.0	32.3	49.3	15.4	36.2	62.0	17.0	45.0	60.4	25.8	53.8	
Actuated g/C Ratio	0.09	0.23	0.35	0.11	0.26	0.44	0.12	0.32	0.43	0.18	0.38	
Clearance Time (s)	5.0	6.0	5.0	5.0	5.5	5.0	5.0	5.5	5.0	5.0	5.5	
Vehicle Extension (s)	2.0	4.5	2.0	2.0	4.5	2.0	2.0	4.5	2.0	2.0	4.5	
Lane Grp Cap (vph)	294	1173	981	548	1314	701	605	1634	1202	632	2444	
v/s Ratio Prot	0.02	0.11	c0.06	0.07	c0.19	0.11	c0.16	0.23	0.01	c0.29	c0.39	
v/s Ratio Perm			0.12			0.16			0.02			
v/c Ratio	0.20	0.47	0.53	0.68	0.75	0.62	1.35	0.71	0.07	1.59	1.01	
Uniform Delay, d1	59.5	46.5	36.1	59.9	47.8	30.0	61.5	41.7	23.3	57.1	43.1	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.11	1.13	0.98	1.00	1.00	
Incremental Delay, d2	0.1	1.3	0.2	2.8	4.0	1.2	166.3	1.3	0.0	270.9	21.1	
Delay (s)	59.6	47.8	36.3	62.7	51.7	31.2	234.6	48.5	22.8	328.0	64.2	
Level of Service	E	D	D	E	D	C	F	D	C	F	E	
Approach Delay (s)		42.8			48.3			118.5			140.2	
Approach LOS		D			D			F			F	

Intersection Summary

HCM 2000 Control Delay	101.6	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.05		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	21.5
Intersection Capacity Utilization	95.1%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
3: Dougherty Rd/Hopyard Road & I-580 WB Ramps



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↔↔		↔↔		↑↑↑			↑↑↑	↔
Traffic Volume (vph)	0	0	0	391	0	637	0	1724	0	0	2188	0
Future Volume (vph)	0	0	0	391	0	637	0	1724	0	0	2188	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0		4.0		4.0			4.0	
Lane Util. Factor				0.97		0.88		0.91			0.86	
Frt				1.00		0.85		1.00			1.00	
Flt Protected				0.95		1.00		1.00			1.00	
Satd. Flow (prot)				3433		2787		5085			4806	
Flt Permitted				0.95		1.00		1.00			1.00	
Satd. Flow (perm)				3433		2787		5085			4806	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	425	0	692	0	1874	0	0	2378	0
RTOR Reduction (vph)	0	0	0	0	0	22	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	425	0	670	0	1874	0	0	2378	0
Turn Type				Prot		Prot		NA			NA	Perm
Protected Phases				4		4		2			6	
Permitted Phases												6
Actuated Green, G (s)				39.1		39.1		90.1			90.1	
Effective Green, g (s)				40.5		40.5		91.5			91.5	
Actuated g/C Ratio				0.29		0.29		0.65			0.65	
Clearance Time (s)				5.4		5.4		5.4			5.4	
Vehicle Extension (s)				3.0		3.0		3.0			3.0	
Lane Grp Cap (vph)				993		806		3323			3141	
v/s Ratio Prot				0.12		c0.24		0.37			c0.49	
v/s Ratio Perm												
v/c Ratio				0.43		0.83		0.56			0.76	
Uniform Delay, d1				40.4		46.6		13.3			16.6	
Progression Factor				1.00		1.00		0.88			0.44	
Incremental Delay, d2				0.3		7.3		0.6			0.8	
Delay (s)				40.7		53.9		12.4			8.1	
Level of Service				D		D		B			A	
Approach Delay (s)		0.0			48.8			12.4			8.1	
Approach LOS		A			D			B			A	

Intersection Summary

HCM 2000 Control Delay	18.1	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.78		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	62.3%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
4: Hopyard Rd/Dougherty Rd & I-580 EB Ramps

BART to Livermore Extension Project
2040 No Project AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗		↖↗					↑↑↑	↖		↑↑↑	↖
Traffic Volume (vph)	896	0	1413	0	0	0	0	932	0	0	1786	0
Future Volume (vph)	896	0	1413	0	0	0	0	932	0	0	1786	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0					4.0			4.0	
Lane Util. Factor	0.97		0.88					0.91			0.86	
Frt	1.00		0.85					1.00			1.00	
Flt Protected	0.95		1.00					1.00			1.00	
Satd. Flow (prot)	3433		2787					5085			4806	
Flt Permitted	0.95		1.00					1.00			1.00	
Satd. Flow (perm)	3433		2787					5085			4806	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	974	0	1536	0	0	0	0	1013	0	0	1941	0
RTOR Reduction (vph)	0	0	9	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	974	0	1527	0	0	0	0	1013	0	0	1941	0
Turn Type	Prot		Prot					NA	Free		NA	Perm
Protected Phases	4		4					2			6	
Permitted Phases									Free			6
Actuated Green, G (s)	71.6		71.6					57.6			57.6	
Effective Green, g (s)	73.0		73.0					59.0			59.0	
Actuated g/C Ratio	0.52		0.52					0.42			0.42	
Clearance Time (s)	5.4		5.4					5.4			5.4	
Vehicle Extension (s)	3.0		3.0					3.0			3.0	
Lane Grp Cap (vph)	1790		1453					2142			2025	
v/s Ratio Prot	0.28		c0.55					0.20			c0.40	
v/s Ratio Perm												
v/c Ratio	0.54		1.05					0.47			0.96	
Uniform Delay, d1	22.4		33.5					29.3			39.3	
Progression Factor	1.00		1.00					1.00			0.67	
Incremental Delay, d2	0.3		38.2					0.8			9.5	
Delay (s)	22.7		71.7					30.0			35.7	
Level of Service	C		E					C			D	
Approach Delay (s)		52.7			0.0			30.0			35.7	
Approach LOS		D			A			C			D	

Intersection Summary

HCM 2000 Control Delay	42.5	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	1.01		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	90.6%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
5: Hopyard Rd & Owens Rd

BART to Livermore Extension Project
2040 No Project AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↔↗		↖	↗	↗	↖	↑↑↑	↗	↖↗	↑↑↗	
Traffic Volume (vph)	215	86	48	122	128	245	134	831	144	898	1787	565
Future Volume (vph)	215	86	48	122	128	245	134	831	144	898	1787	565
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	2.7	2.7		2.7	2.7	2.7	4.0	2.3	2.3	4.0	2.3	
Lane Util. Factor	0.91	0.91		1.00	0.95	0.95	1.00	0.91	1.00	0.97	0.91	
Frt	1.00	0.97		1.00	0.94	0.85	1.00	1.00	0.85	1.00	0.96	
Flt Protected	0.95	0.98		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1610	3217		1770	1671	1504	1770	5085	1583	3433	4902	
Flt Permitted	0.95	0.98		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1610	3217		1770	1671	1504	1770	5085	1583	3433	4902	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	234	93	52	133	139	266	146	903	157	976	1942	614
RTOR Reduction (vph)	0	25	0	0	24	31	0	0	111	0	63	0
Lane Group Flow (vph)	129	225	0	133	197	153	146	903	46	976	2493	0
Turn Type	Split	NA		Split	NA	pm+ov	Prot	NA	Perm	Prot	NA	
Protected Phases	8	8		4	4	1	5	2		1	6	
Permitted Phases						4			2			
Actuated Green, G (s)	7.0	7.0		10.0	10.0	42.2	9.0	24.8	24.8	32.2	48.0	
Effective Green, g (s)	8.3	8.3		11.3	11.3	44.8	9.0	26.5	26.5	32.2	49.7	
Actuated g/C Ratio	0.09	0.09		0.13	0.13	0.50	0.10	0.29	0.29	0.36	0.55	
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	148	296		222	209	793	177	1497	466	1228	2706	
v/s Ratio Prot	c0.08	0.07		0.08	c0.12	0.07	0.08	0.18		c0.28	c0.51	
v/s Ratio Perm						0.03			0.03			
v/c Ratio	0.87	0.76		0.60	0.94	0.19	0.82	0.60	0.10	0.79	0.92	
Uniform Delay, d1	40.3	39.9		37.2	39.0	12.6	39.7	27.2	23.1	25.9	18.4	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	39.0	11.0		4.3	46.4	0.1	25.7	1.8	0.4	3.6	6.6	
Delay (s)	79.4	50.9		41.5	85.4	12.7	65.4	29.0	23.5	29.6	24.9	
Level of Service	E	D		D	F	B	E	C	C	C	C	
Approach Delay (s)		60.6			49.7			32.7			26.2	
Approach LOS		E			D			C			C	

Intersection Summary

HCM 2000 Control Delay	32.1	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.93		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	11.7
Intersection Capacity Utilization	86.4%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
6: Hopyard Rd & Stoneridge Dr

BART to Livermore Extension Project
2040 No Project AM



































Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	203	788	468	71	998	129	629	786	73	296	1022	284
Future Volume (vph)	203	788	468	71	998	129	629	786	73	296	1022	284
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.91	1.00	0.97	0.91	1.00	0.94	0.95	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5085	1583	3433	5085	1583	4990	3539	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5085	1583	3433	5085	1583	4990	3539	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	221	857	509	77	1085	140	684	854	79	322	1111	309
RTOR Reduction (vph)	0	0	220	0	0	100	0	0	57	0	0	121
Lane Group Flow (vph)	221	857	289	77	1085	40	684	854	22	322	1111	188
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	NA	6
Permitted Phases			4			8			2			6
Actuated Green, G (s)	4.0	19.2	19.2	2.4	17.6	17.6	8.0	17.0	17.0	7.0	16.0	16.0
Effective Green, g (s)	4.0	19.2	19.2	2.4	17.6	17.6	8.0	17.0	17.0	7.0	16.0	16.0
Actuated g/C Ratio	0.06	0.31	0.31	0.04	0.29	0.29	0.13	0.28	0.28	0.11	0.26	0.26
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	222	1584	493	133	1452	452	648	976	436	390	1320	411
v/s Ratio Prot	c0.06	0.17		0.02	c0.21		c0.14	c0.24		0.09	0.22	
v/s Ratio Perm			0.18			0.03			0.01			0.12
v/c Ratio	1.00	0.54	0.59	0.58	0.75	0.09	1.06	0.88	0.05	0.83	0.84	0.46
Uniform Delay, d1	28.8	17.6	17.9	29.1	20.0	16.1	26.8	21.3	16.4	26.7	21.6	19.1
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	58.8	0.4	1.8	6.0	2.1	0.1	50.9	8.8	0.0	13.3	5.0	0.8
Delay (s)	87.6	17.9	19.6	35.1	22.1	16.2	77.7	30.1	16.4	40.0	26.6	20.0
Level of Service	F	B	B	D	C	B	E	C	B	D	C	B
Approach Delay (s)		28.2			22.3			49.6			27.9	
Approach LOS		C			C			D			C	

Intersection Summary		
HCM 2000 Control Delay	32.4	HCM 2000 Level of Service C
HCM 2000 Volume to Capacity ratio	0.88	
Actuated Cycle Length (s)	61.6	Sum of lost time (s) 16.0
Intersection Capacity Utilization	70.1%	ICU Level of Service C
Analysis Period (min)	15	

c Critical Lane Group


































HCM Signalized Intersection Capacity Analysis
7: Hopyard Rd & Las Positas Blvd

BART to Livermore Extension Project
2040 No Project AM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 	 		 	 		 	  		 	  	
Traffic Volume (vph)	149	487	409	353	455	51	469	1161	395	113	1074	96
Future Volume (vph)	149	487	409	353	455	51	469	1161	395	113	1074	96
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.95	1.00	0.97	0.95	1.00	0.97	0.91	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	3433	3539	1583	3433	5085	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	3433	3539	1583	3433	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	162	529	445	384	495	55	510	1262	429	123	1167	104
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	74
Lane Group Flow (vph)	162	529	445	384	495	55	510	1262	429	123	1167	30
Turn Type	Prot	NA	Free	Prot	NA	Free	Prot	NA	Free	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1		6
Permitted Phases			Free			Free			Free			6
Actuated Green, G (s)	6.9	14.5	69.3	8.0	15.6	69.3	11.0	27.6	69.3	3.2	19.8	19.8
Effective Green, g (s)	6.9	14.5	69.3	8.0	15.6	69.3	11.0	27.6	69.3	3.2	19.8	19.8
Actuated g/C Ratio	0.10	0.21	1.00	0.12	0.23	1.00	0.16	0.40	1.00	0.05	0.29	0.29
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	341	740	1583	396	796	1583	544	2025	1583	158	1452	452
v/s Ratio Prot	0.05	c0.15		c0.11	0.14		c0.15	0.25		0.04	c0.23	
v/s Ratio Perm			c0.28			0.03			0.27			0.02
v/c Ratio	0.48	0.71	0.28	0.97	0.62	0.03	0.94	0.62	0.27	0.78	0.80	0.07
Uniform Delay, d1	29.5	25.5	0.0	30.5	24.2	0.0	28.8	16.7	0.0	32.7	22.9	18.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.0	3.3	0.4	36.8	1.5	0.0	23.8	0.6	0.4	21.1	3.3	0.1
Delay (s)	30.5	28.8	0.4	67.3	25.7	0.0	52.7	17.3	0.4	53.8	26.3	18.1
Level of Service	C	C	A	E	C	A	D	B	A	D	C	B
Approach Delay (s)		17.9			41.3			22.2			28.1	
Approach LOS		B			D			C			C	
Intersection Summary												
HCM 2000 Control Delay			25.9				HCM 2000 Level of Service			C		
HCM 2000 Volume to Capacity ratio			0.84									
Actuated Cycle Length (s)			69.3				Sum of lost time (s)			16.0		
Intersection Capacity Utilization			71.0%				ICU Level of Service			C		
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis
8: Willow Rd & Owens Rd

BART to Livermore Extension Project
2040 No Project AM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 	  		 	  			 		 	 	 
Traffic Volume (vph)	103	483	219	121	342	80	118	99	0	140	96	88
Future Volume (vph)	103	483	219	121	342	80	118	99	0	140	96	88
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	5.3	4.0		5.3	4.0	4.0
Lane Util. Factor	0.97	0.91		0.97	0.91	1.00	1.00	0.95		1.00	1.00	1.00
Frt	1.00	0.95		1.00	1.00	0.85	1.00	1.00		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	4847		3433	5085	1583	1770	3539		1770	1863	1583
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.69	1.00		0.68	1.00	1.00
Satd. Flow (perm)	3433	4847		3433	5085	1583	1285	3539		1274	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	112	525	238	132	372	87	128	108	0	152	104	96
RTOR Reduction (vph)	0	110	0	0	0	50	0	0	0	0	0	74
Lane Group Flow (vph)	112	653	0	132	372	37	128	108	0	152	104	22
Turn Type	Prot	NA		Prot	NA	Perm	Perm	NA	Perm	Perm	NA	Perm
Protected Phases	1	6		5	2			4				8
Permitted Phases						2	4		4	8		8
Actuated Green, G (s)	3.7	17.2		4.4	17.9	17.9	9.2	9.2		9.2	9.2	9.2
Effective Green, g (s)	3.7	18.9		4.4	19.6	19.6	9.2	10.5		9.2	10.5	10.5
Actuated g/C Ratio	0.08	0.41		0.10	0.43	0.43	0.20	0.23		0.20	0.23	0.23
Clearance Time (s)	4.0	5.7		4.0	5.7	5.7	5.3	5.3		5.3	5.3	5.3
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	277	2000		329	2176	677	258	811		255	427	362
v/s Ratio Prot	0.03	c0.13		c0.04	0.07			0.03				0.06
v/s Ratio Perm						0.02	0.10			c0.12		0.01
v/c Ratio	0.40	0.33		0.40	0.17	0.05	0.50	0.13		0.60	0.24	0.06
Uniform Delay, d1	20.0	9.1		19.5	8.1	7.7	16.2	14.0		16.6	14.4	13.8
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	1.0	0.1		0.8	0.0	0.0	1.5	0.1		3.7	0.3	0.1
Delay (s)	21.0	9.2		20.3	8.1	7.7	17.7	14.1		20.3	14.7	13.9
Level of Service	C	A		C	A	A	B	B		C	B	B
Approach Delay (s)		10.7			10.8			16.1			16.9	
Approach LOS		B			B			B			B	
Intersection Summary												
HCM 2000 Control Delay			12.4	HCM 2000 Level of Service				B				
HCM 2000 Volume to Capacity ratio			0.40									
Actuated Cycle Length (s)			45.8	Sum of lost time (s)				12.0				
Intersection Capacity Utilization			42.1%	ICU Level of Service				A				
Analysis Period (min)			15									

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
9: Hacienda Dr & Dublin Blvd

BART to Livermore Extension Project
2040 No Project AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↖	↗↗↗	↘↘	↖↖	↗↗↗		↖↖↖	↗↗	↘↘	↖↖	↗↗↗	↘↘
Traffic Volume (vph)	86	385	117	291	811	81	188	707	124	11	391	135
Future Volume (vph)	86	385	117	291	811	81	188	707	124	11	391	135
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	6.0	5.0	4.5	6.0		5.0	6.0	6.0	4.5	5.5	5.5
Lane Util. Factor	0.97	0.91	0.88	0.97	0.91		0.94	0.95	0.88	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5085	2787	3433	5016		4990	3539	2787	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5085	2787	3433	5016		4990	3539	2787	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	93	418	127	316	882	88	204	768	135	12	425	147
RTOR Reduction (vph)	0	0	52	0	8	0	0	0	98	0	0	128
Lane Group Flow (vph)	93	418	75	316	962	0	204	768	37	12	425	19
Turn Type	Prot	NA	pm+ov	Prot	NA		Prot	NA	Perm	Prot	NA	Perm
Protected Phases	5	2	3	1	6		3	8		7	4	
Permitted Phases			2						8			4
Actuated Green, G (s)	9.2	59.5	82.5	18.1	68.4		23.0	38.8	38.8	2.6	18.4	18.4
Effective Green, g (s)	9.2	59.5	82.5	18.1	68.4		23.0	38.8	38.8	2.6	18.4	18.4
Actuated g/C Ratio	0.07	0.42	0.59	0.13	0.49		0.16	0.28	0.28	0.02	0.13	0.13
Clearance Time (s)	4.5	6.0	5.0	4.5	6.0		5.0	6.0	6.0	4.5	5.5	5.5
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	225	2161	1642	443	2450		819	980	772	63	668	208
v/s Ratio Prot	0.03	0.08	0.01	c0.09	c0.19		0.04	c0.22		0.00	c0.08	
v/s Ratio Perm			0.02						0.01			0.01
v/c Ratio	0.41	0.19	0.05	0.71	0.39		0.25	0.78	0.05	0.19	0.64	0.09
Uniform Delay, d1	62.8	25.2	12.1	58.5	22.7		51.0	46.7	37.1	67.7	57.6	53.5
Progression Factor	1.00	1.00	1.00	1.00	1.00		0.77	0.76	0.40	1.00	1.00	1.00
Incremental Delay, d2	1.2	0.2	0.0	5.4	0.5		0.2	4.1	0.0	1.5	2.0	0.2
Delay (s)	64.0	25.4	12.1	63.8	23.1		39.4	39.3	14.8	69.1	59.6	53.7
Level of Service	E	C	B	E	C		D	D	B	E	E	D
Approach Delay (s)		28.4			33.1			36.4			58.3	
Approach LOS		C			C			D			E	

Intersection Summary

HCM 2000 Control Delay	37.4	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.59		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	21.0
Intersection Capacity Utilization	61.2%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 10: Hacienda Dr & Martinelli Blvd/Hacienda Crossings



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗	↖↗	↖↗	↗		↖↗↘	↖↗↘	↗	↖↗	↖↗↘	
Traffic Volume (vph)	16	11	225	107	13	9	256	976	109	18	737	56
Future Volume (vph)	16	11	225	107	13	9	256	976	109	18	737	56
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	2.0	2.0	4.5	2.0		3.0	2.0	2.0	4.5	2.5	
Lane Util. Factor	1.00	0.91	0.91	0.97	1.00		0.94	0.91	1.00	0.97	0.86	
Frt	1.00	0.90	0.85	1.00	0.94		1.00	1.00	0.85	1.00	0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1770	1523	2882	3433	1746		4990	5085	1583	3433	6340	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1770	1523	2882	3433	1746		4990	5085	1583	3433	6340	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	17	12	245	116	14	10	278	1061	118	20	801	61
RTOR Reduction (vph)	0	23	198	0	9	0	0	0	26	0	5	0
Lane Group Flow (vph)	17	15	22	116	15	0	278	1061	92	20	857	0
Turn Type	Prot	NA	Perm	Prot	NA		Prot	NA	pm+ov	Prot	NA	
Protected Phases	5	2		1	6		3	8	1	7	4	
Permitted Phases			2						8			
Actuated Green, G (s)	4.8	12.0	12.0	11.5	18.7		13.1	93.1	104.6	7.4	87.4	
Effective Green, g (s)	4.3	14.0	14.0	11.0	20.7		14.1	95.1	108.6	6.9	88.9	
Actuated g/C Ratio	0.03	0.10	0.10	0.08	0.15		0.10	0.68	0.78	0.05	0.64	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	4.0	4.0	2.0	4.0		3.0	4.0	2.0	3.0	4.0	
Lane Grp Cap (vph)	54	152	288	269	258		502	3454	1250	169	4025	
v/s Ratio Prot	0.01	c0.01		c0.03	0.01		c0.06	c0.21	0.01	0.01	c0.14	
v/s Ratio Perm			0.01						0.05			
v/c Ratio	0.31	0.10	0.08	0.43	0.06		0.55	0.31	0.07	0.12	0.21	
Uniform Delay, d1	66.4	57.2	57.1	61.5	51.3		60.0	9.1	3.7	63.6	10.8	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.02	1.07	2.14	0.79	0.15	
Incremental Delay, d2	3.3	0.4	0.2	0.4	0.1		1.2	0.2	0.0	0.3	0.1	
Delay (s)	69.7	57.6	57.3	61.9	51.4		62.1	9.9	8.0	50.7	1.8	
Level of Service	E	E	E	E	D		E	A	A	D	A	
Approach Delay (s)		58.1			60.1			19.7			2.9	
Approach LOS		E			E			B			A	

Intersection Summary		
HCM 2000 Control Delay	20.2	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.32	C
Actuated Cycle Length (s)	140.0	Sum of lost time (s)
Intersection Capacity Utilization	44.3%	13.0
Analysis Period (min)	15	ICU Level of Service
		A

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 11: Hacienda Dr & I-580 WB Ramps

BART to Livermore Extension Project
 2040 No Project AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↔↔		↔↔		↑↑↑			↑↑↑	↔
Traffic Volume (vph)	0	0	0	272	0	451	0	1250	291	0	730	416
Future Volume (vph)	0	0	0	272	0	451	0	1250	291	0	730	416
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				2.6		2.6		2.1			2.1	2.1
Lane Util. Factor				0.97		0.88		0.91			0.86	0.86
Frt				1.00		0.85		0.97			0.97	0.85
Flt Protected				0.95		1.00		1.00			1.00	1.00
Satd. Flow (prot)				3433		2787		4941			4646	1362
Flt Permitted				0.95		1.00		1.00			1.00	1.00
Satd. Flow (perm)				3433		2787		4941			4646	1362
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	296	0	490	0	1359	316	0	793	452
RTOR Reduction (vph)	0	0	0	0	0	68	0	43	0	0	54	72
Lane Group Flow (vph)	0	0	0	296	0	422	0	1632	0	0	965	154
Turn Type				Prot		Prot		NA			NA	Perm
Protected Phases				4		4		2			6	
Permitted Phases												6
Actuated Green, G (s)				16.1		16.1		45.9			45.9	45.9
Effective Green, g (s)				17.5		17.5		47.8			47.8	47.8
Actuated g/C Ratio				0.25		0.25		0.68			0.68	0.68
Clearance Time (s)				4.0		4.0		4.0			4.0	4.0
Vehicle Extension (s)				3.0		3.0		3.0			3.0	3.0
Lane Grp Cap (vph)				858		696		3373			3172	930
v/s Ratio Prot				0.09		c0.15		c0.33			0.21	
v/s Ratio Perm												0.11
v/c Ratio				0.34		0.61		0.48			0.30	0.17
Uniform Delay, d1				21.5		23.2		5.3			4.4	4.0
Progression Factor				1.00		1.00		0.70			0.47	0.80
Incremental Delay, d2				0.2		1.5		0.4			0.2	0.4
Delay (s)				21.8		24.7		4.1			2.3	3.6
Level of Service				C		C		A			A	A
Approach Delay (s)		0.0			23.6			4.1			2.6	
Approach LOS		A			C			A			A	

Intersection Summary			
HCM 2000 Control Delay	7.7	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.51		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	4.7
Intersection Capacity Utilization	53.1%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 12: Hacienda Dr & I-580 EB Ramps



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔↔		↔↔					↑↑↑	↔		↑↑↑	
Traffic Volume (vph)	819	0	1168	0	0	0	0	686	276	0	1058	199
Future Volume (vph)	819	0	1168	0	0	0	0	686	276	0	1058	199
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0					4.0	4.0		4.0	
Lane Util. Factor	0.97		0.88					0.86	0.86		0.91	
Frt	1.00		0.85					0.98	0.85		0.98	
Flt Protected	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (prot)	3433		2787					4726	1362		4965	
Flt Permitted	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (perm)	3433		2787					4726	1362		4965	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	890	0	1270	0	0	0	0	746	300	0	1150	216
RTOR Reduction (vph)	0	0	23	0	0	0	0	21	123	0	40	0
Lane Group Flow (vph)	890	0	1247	0	0	0	0	818	84	0	1326	0
Turn Type	Prot		Prot					NA	Perm		NA	
Protected Phases	4		4					2			6	
Permitted Phases									2			
Actuated Green, G (s)	32.3		32.3					26.4	26.4		26.4	
Effective Green, g (s)	33.7		33.7					28.3	28.3		28.3	
Actuated g/C Ratio	0.48		0.48					0.40	0.40		0.40	
Clearance Time (s)	5.4		5.4					5.9	5.9		5.9	
Vehicle Extension (s)	2.0		2.0					2.0	2.0		2.0	
Lane Grp Cap (vph)	1652		1341					1910	550		2007	
v/s Ratio Prot	0.26		c0.45					0.17			c0.27	
v/s Ratio Perm									0.06			
v/c Ratio	0.54		0.93					0.43	0.15		0.66	
Uniform Delay, d1	12.7		17.0					15.0	13.2		16.9	
Progression Factor	1.00		1.00					1.00	1.00		0.89	
Incremental Delay, d2	0.2		11.2					0.7	0.6		1.7	
Delay (s)	12.9		28.2					15.7	13.8		16.8	
Level of Service	B		C					B	B		B	
Approach Delay (s)		21.9			0.0			15.3			16.8	
Approach LOS		C			A			B			B	

Intersection Summary

HCM 2000 Control Delay	18.9	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.81		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	72.4%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
13: Hacienda Dr & Owens Rd

BART to Livermore Extension Project
2040 No Project AM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	179	271	25	134	419	456	26	322	126	659	915	623
Future Volume (vph)	179	271	25	134	419	456	26	322	126	659	915	623
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	2.3	4.0	4.0	2.3	4.0	4.0	2.7	4.0	4.0	2.7
Lane Util. Factor	0.97	0.91	1.00	0.97	0.91	1.00	0.97	0.91	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5085	1583	3433	5085	1583	3433	5085	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5085	1583	3433	5085	1583	3433	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	195	295	27	146	455	496	28	350	137	716	995	677
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	195	295	27	146	455	496	28	350	137	716	995	677
Turn Type	Prot	NA	Free	Prot	NA	Free	Prot	NA	Free	Prot	NA	Free
Protected Phases	1	6		5	2		7	4		3	8	
Permitted Phases			Free			Free			Free			Free
Actuated Green, G (s)	14.1	18.6	115.0	11.5	16.0	115.0	4.2	31.9	115.0	34.0	61.7	115.0
Effective Green, g (s)	14.1	20.3	115.0	11.5	17.7	115.0	4.2	33.2	115.0	34.0	63.0	115.0
Actuated g/C Ratio	0.12	0.18	1.00	0.10	0.15	1.00	0.04	0.29	1.00	0.30	0.55	1.00
Clearance Time (s)	4.0	5.7		4.0	5.7		4.0	5.3		4.0	5.3	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	420	897	1583	343	782	1583	125	1468	1583	1014	2785	1583
v/s Ratio Prot	0.06	0.06		0.04	c0.09		0.01	0.07		c0.21	0.20	
v/s Ratio Perm			0.02			0.31			0.09			c0.43
v/c Ratio	0.46	0.33	0.02	0.43	0.58	0.31	0.22	0.24	0.09	0.71	0.36	0.43
Uniform Delay, d1	46.9	41.4	0.0	48.6	45.2	0.0	53.8	31.2	0.0	36.1	14.6	0.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.8	0.2	0.0	0.9	1.1	0.5	0.9	0.4	0.1	2.3	0.4	0.8
Delay (s)	47.8	41.6	0.0	49.5	46.3	0.5	54.7	31.6	0.1	38.3	15.0	0.8
Level of Service	D	D	A	D	D	A	D	C	A	D	B	A
Approach Delay (s)		41.8			26.0			24.5			18.0	
Approach LOS		D			C			C			B	

Intersection Summary

HCM 2000 Control Delay	23.4	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.59		
Actuated Cycle Length (s)	115.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	51.6%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 14: Tassajara Rd & Dublin Blvd

BART to Livermore Extension Project
 2040 No Project AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	101	202	141	650	1290	67	271	485	171	35	1143	333
Future Volume (vph)	101	202	141	650	1290	67	271	485	171	35	1143	333
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	6.0	6.0	5.0	6.0		5.0	6.0	6.0	5.0	5.7	5.7
Lane Util. Factor	0.97	0.86	0.88	0.94	0.91		0.94	0.86	1.00	0.97	0.86	0.88
Frt	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	6408	2787	4990	5048		4990	6408	1583	3433	6408	2787
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	6408	2787	4990	5048		4990	6408	1583	3433	6408	2787
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	110	220	153	707	1402	73	295	527	186	38	1242	362
RTOR Reduction (vph)	0	0	112	0	4	0	0	0	139	0	0	259
Lane Group Flow (vph)	110	220	41	707	1471	0	295	527	47	38	1242	103
Turn Type	Prot	NA	Perm	Prot	NA		Prot	NA	Perm	Prot	NA	Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases			2						8			4
Actuated Green, G (s)	16.1	39.6	39.6	24.9	48.4		18.2	36.9	36.9	22.8	41.8	41.8
Effective Green, g (s)	16.1	39.6	39.6	24.9	48.4		18.2	36.9	36.9	22.8	41.8	41.8
Actuated g/C Ratio	0.11	0.27	0.27	0.17	0.33		0.12	0.25	0.25	0.16	0.29	0.29
Clearance Time (s)	5.0	6.0	6.0	5.0	6.0		5.0	6.0	6.0	5.0	5.7	5.7
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	378	1735	754	849	1671		621	1617	399	535	1832	796
v/s Ratio Prot	0.03	0.03		c0.14	c0.29		c0.06	0.08		c0.01	c0.19	
v/s Ratio Perm			0.01						0.03			0.04
v/c Ratio	0.29	0.13	0.05	0.83	0.88		0.48	0.33	0.12	0.07	0.68	0.13
Uniform Delay, d1	59.8	40.2	39.5	58.6	46.2		59.6	44.5	42.1	52.7	46.2	38.7
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.4	0.0	0.0	7.0	5.8		0.6	0.1	0.1	0.1	1.0	0.1
Delay (s)	60.2	40.3	39.5	65.7	51.9		60.1	44.6	42.2	52.7	47.2	38.8
Level of Service	E	D	D	E	D		E	D	D	D	D	D
Approach Delay (s)		44.6			56.4			48.7			45.5	
Approach LOS		D			E			D			D	

Intersection Summary

HCM 2000 Control Delay	50.5	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.76		
Actuated Cycle Length (s)	146.2	Sum of lost time (s)	22.0
Intersection Capacity Utilization	87.7%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 15: Tassajara Rd & I-580 WB Ramps

BART to Livermore Extension Project
 2040 No Project AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↔		↔		↑↑	↔		↑↑↑	↔
Traffic Volume (vph)	0	0	0	598	0	296	0	1192	472	0	1037	935
Future Volume (vph)	0	0	0	598	0	296	0	1192	472	0	1037	935
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0		4.0		4.0	4.0		4.0	4.0
Lane Util. Factor				0.97		0.88		0.95	1.00		0.86	0.86
Frt				1.00		0.85		1.00	0.85		0.95	0.85
Flt Protected				0.95		1.00		1.00	1.00		1.00	1.00
Satd. Flow (prot)				3433		2787		3539	1583		4582	1362
Flt Permitted				0.95		1.00		1.00	1.00		1.00	1.00
Satd. Flow (perm)				3433		2787		3539	1583		4582	1362
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	650	0	322	0	1296	513	0	1127	1016
RTOR Reduction (vph)	0	0	0	0	0	67	0	0	196	0	103	194
Lane Group Flow (vph)	0	0	0	650	0	255	0	1296	317	0	1532	314
Turn Type				Perm		Perm		NA	Perm		NA	Perm
Protected Phases								2			6	
Permitted Phases				8		8			2			6
Actuated Green, G (s)				18.7		18.7		43.3	43.3		43.3	43.3
Effective Green, g (s)				18.7		18.7		43.3	43.3		43.3	43.3
Actuated g/C Ratio				0.27		0.27		0.62	0.62		0.62	0.62
Clearance Time (s)				4.0		4.0		4.0	4.0		4.0	4.0
Vehicle Extension (s)				3.0		3.0		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)				917		744		2189	979		2834	842
v/s Ratio Prot								c0.37			0.33	
v/s Ratio Perm				c0.19		0.09			0.20			0.23
v/c Ratio				0.71		0.34		0.59	0.32		0.54	0.37
Uniform Delay, d1				23.2		20.7		8.0	6.4		7.6	6.6
Progression Factor				1.00		1.00		1.00	1.00		1.00	1.00
Incremental Delay, d2				2.5		0.3		1.2	0.9		0.7	1.3
Delay (s)				25.7		21.0		9.2	7.2		8.4	7.9
Level of Service				C		C		A	A		A	A
Approach Delay (s)		0.0			24.1			8.7			8.3	
Approach LOS		A			C			A			A	

Intersection Summary			
HCM 2000 Control Delay	11.5	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.63		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	56.7%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 16: Santa Rita Rd & I-580 EB Ramps/Pimilco Dr

BART to Livermore Extension Project
 2040 No Project AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	567	116	745	186	0	188	0	883	118	183	1355	0
Future Volume (vph)	567	116	745	186	0	188	0	883	118	183	1355	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0		4.0		4.0		4.0	4.0	
Lane Util. Factor	0.97	1.00	1.00	0.97		0.88		0.86		1.00	0.95	
Frt	1.00	1.00	0.85	1.00		0.85		0.98		1.00	1.00	
Flt Protected	0.95	1.00	1.00	0.95		1.00		1.00		0.95	1.00	
Satd. Flow (prot)	3433	1863	1583	3433		2787		6295		1770	3539	
Flt Permitted	0.95	1.00	1.00	0.95		1.00		1.00		0.95	1.00	
Satd. Flow (perm)	3433	1863	1583	3433		2787		6295		1770	3539	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	616	126	810	202	0	204	0	960	128	199	1473	0
RTOR Reduction (vph)	0	0	0	0	0	72	0	40	0	0	0	0
Lane Group Flow (vph)	616	126	810	202	0	132	0	1048	0	199	1473	0
Turn Type	Perm	NA	Free	Prot		pm+ov		NA		Prot	NA	Perm
Protected Phases		4		3		1		2		1	6	
Permitted Phases	4		Free			3						6
Actuated Green, G (s)	14.9	14.9	60.0	4.4		12.8		16.3		8.4	28.7	
Effective Green, g (s)	14.9	14.9	60.0	4.4		12.8		16.3		8.4	28.7	
Actuated g/C Ratio	0.25	0.25	1.00	0.07		0.21		0.27		0.14	0.48	
Clearance Time (s)	4.0	4.0		4.0		4.0		4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0		3.0		3.0		3.0	3.0	
Lane Grp Cap (vph)	852	462	1583	251		594		1710		247	1692	
v/s Ratio Prot		0.07		0.06		0.03		0.17		0.11	c0.42	
v/s Ratio Perm	c0.18		c0.51			0.02						
v/c Ratio	0.72	0.27	0.51	0.80		0.22		0.61		0.81	0.87	
Uniform Delay, d1	20.7	18.2	0.0	27.4		19.5		19.1		25.0	14.0	
Progression Factor	1.00	1.00	1.00	1.00		1.00		1.00		1.00	1.00	
Incremental Delay, d2	3.1	0.3	1.2	16.9		0.2		1.7		17.2	6.4	
Delay (s)	23.7	18.5	1.2	44.2		19.7		20.7		42.2	20.4	
Level of Service	C	B	A	D		B		C		D	C	
Approach Delay (s)		11.5			31.9			20.7			23.0	
Approach LOS		B			C			C			C	

Intersection Summary

HCM 2000 Control Delay	19.5	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.91		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	60.3%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
17: Santa Rita Rd & Valley Ave

BART to Livermore Extension Project
2040 No Project AM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	215	250	82	194	426	981	115	541	80	595	895	180
Future Volume (vph)	215	250	82	194	426	981	115	541	80	595	895	180
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.97	0.95		0.97	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.98		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	3433	3471		3433	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	3433	3471		3433	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	234	272	89	211	463	1066	125	588	87	647	973	196
RTOR Reduction (vph)	0	0	73	0	0	0	0	16	0	0	0	115
Lane Group Flow (vph)	234	272	16	211	463	1066	125	659	0	647	973	81
Turn Type	Prot	NA	Perm	Prot	NA	Free	Prot	NA		Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			Free						6
Actuated Green, G (s)	8.6	12.8	12.8	10.1	14.3	71.7	3.1	17.7		15.1	29.7	29.7
Effective Green, g (s)	8.6	12.8	12.8	10.1	14.3	71.7	3.1	17.7		15.1	29.7	29.7
Actuated g/C Ratio	0.12	0.18	0.18	0.14	0.20	1.00	0.04	0.25		0.21	0.41	0.41
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	411	631	282	249	705	1583	148	856		722	1465	655
v/s Ratio Prot	0.07	0.08		c0.12	0.13		0.04	0.19		c0.19	0.27	
v/s Ratio Perm			0.01			c0.67						0.05
v/c Ratio	0.57	0.43	0.06	0.85	0.66	0.67	0.84	0.77		0.90	0.66	0.12
Uniform Delay, d1	29.8	26.2	24.4	30.0	26.4	0.0	34.1	25.1		27.5	17.0	13.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	1.8	0.5	0.1	22.5	2.2	2.3	33.3	4.3		13.7	1.1	0.1
Delay (s)	31.6	26.7	24.5	52.5	28.7	2.3	67.4	29.4		41.2	18.1	13.1
Level of Service	C	C	C	D	C	A	E	C		D	B	B
Approach Delay (s)		28.3			15.4			35.4			25.8	
Approach LOS		C			B			D			C	
Intersection Summary												
HCM 2000 Control Delay			24.0			HCM 2000 Level of Service				C		
HCM 2000 Volume to Capacity ratio			0.89									
Actuated Cycle Length (s)			71.7			Sum of lost time (s)			16.0			
Intersection Capacity Utilization			65.7%			ICU Level of Service				C		
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis
18: Bernal Ave/Valley Ave & Stanley Blvd

BART to Livermore Extension Project
2040 No Project AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↕	↖	↖↗	↕	↖	↖	↕	↖	↖↗	↕	↖↗
Traffic Volume (vph)	218	204	55	247	897	955	174	480	101	141	362	124
Future Volume (vph)	218	204	55	247	897	955	174	480	101	141	362	124
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.95	1.00	0.97	0.91	0.91	1.00	0.95	1.00	0.97	0.95	0.95
Frt	1.00	1.00	0.85	1.00	0.96	0.85	1.00	1.00	0.85	1.00	0.96	0.96
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	3433	3238	1441	1770	3539	1583	3433	3403	3403
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	3433	3238	1441	1770	3539	1583	3433	3403	3403
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	237	222	60	268	975	1038	189	522	110	153	393	135
RTOR Reduction (vph)	0	0	30	0	47	28	0	0	87	0	38	0
Lane Group Flow (vph)	237	222	30	268	1343	595	189	522	23	153	490	0
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	NA
Protected Phases	7	4	5	3	8	1	5	2		1	6	
Permitted Phases			4			8			2			
Actuated Green, G (s)	7.0	33.0	44.6	11.0	37.0	46.9	11.6	18.1	18.1	9.9	16.4	16.4
Effective Green, g (s)	7.0	33.0	44.6	11.0	37.0	46.9	11.6	18.1	18.1	9.9	16.4	16.4
Actuated g/C Ratio	0.08	0.38	0.51	0.12	0.42	0.53	0.13	0.21	0.21	0.11	0.19	0.19
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	273	1327	874	429	1361	833	233	727	325	386	634	634
v/s Ratio Prot	c0.07	0.06	0.00	0.08	c0.41	0.08	c0.11	c0.15		0.04	0.14	0.14
v/s Ratio Perm			0.01			0.33			0.01			
v/c Ratio	0.87	0.17	0.03	0.62	0.99	0.71	0.81	0.72	0.07	0.40	0.77	0.77
Uniform Delay, d1	40.0	18.3	10.9	36.5	25.3	15.5	37.1	32.6	28.2	36.3	34.0	34.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	24.0	0.1	0.0	2.8	21.1	2.9	18.9	3.4	0.1	0.7	5.8	5.8
Delay (s)	64.0	18.4	10.9	39.4	46.3	18.4	56.0	36.0	28.3	36.9	39.8	39.8
Level of Service	E	B	B	D	D	B	E	D	C	D	D	D
Approach Delay (s)		38.4			37.9			39.6			39.2	
Approach LOS		D			D			D			D	










































Intersection Summary

HCM 2000 Control Delay	38.5	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.90		
Actuated Cycle Length (s)	88.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	78.1%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
19: Fallon Rd & Dublin Blvd/Croak Rd

BART to Livermore Extension Project
2040 No Project AM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 	  	 	  	  		  	  	 	  	  	
Traffic Volume (vph)	48	79	92	355	1309	421	830	275	43	80	711	326
Future Volume (vph)	48	79	92	355	1309	421	830	275	43	80	711	326
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.91	0.88	0.94	0.91	1.00	0.94	0.91	0.88	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5085	2787	4990	5085	1583	4990	5085	2787	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5085	2787	4990	5085	1583	4990	5085	2787	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	52	86	100	386	1423	458	902	299	47	87	773	354
RTOR Reduction (vph)	0	0	42	0	0	229	0	0	32	0	0	133
Lane Group Flow (vph)	52	86	58	386	1423	229	902	299	15	87	773	221
Turn Type	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4	5	3	8		5	2		1	6	
Permitted Phases			4			8			2			6
Actuated Green, G (s)	2.4	9.6	28.3	31.3	38.5	38.5	18.7	28.7	28.7	4.4	14.4	14.4
Effective Green, g (s)	2.4	9.6	28.3	31.3	38.5	38.5	18.7	28.7	28.7	4.4	14.4	14.4
Actuated g/C Ratio	0.03	0.11	0.31	0.35	0.43	0.43	0.21	0.32	0.32	0.05	0.16	0.16
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	91	542	876	1735	2175	677	1036	1621	888	167	813	253
v/s Ratio Prot	c0.02	0.02	0.01	0.08	c0.28		c0.18	0.06		0.03	c0.15	
v/s Ratio Perm			0.01			0.14			0.01			0.14
v/c Ratio	0.57	0.16	0.07	0.22	0.65	0.34	0.87	0.18	0.02	0.52	0.95	0.87
Uniform Delay, d1	43.3	36.5	21.6	20.7	20.5	17.2	34.5	22.2	21.0	41.8	37.4	36.9
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	8.4	0.1	0.0	0.1	0.7	0.3	8.1	0.3	0.0	2.9	21.6	31.8
Delay (s)	51.7	36.7	21.6	20.8	21.2	17.5	42.6	22.4	21.0	44.7	59.1	68.7
Level of Service	D	D	C	C	C	B	D	C	C	D	E	E
Approach Delay (s)		33.6			20.4			37.0			60.9	
Approach LOS		C			C			D			E	
Intersection Summary												
HCM 2000 Control Delay			35.1	HCM 2000 Level of Service				D				
HCM 2000 Volume to Capacity ratio			0.76									
Actuated Cycle Length (s)			90.0	Sum of lost time (s)				16.0				
Intersection Capacity Utilization			71.3%	ICU Level of Service				C				
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis
20: El Charro Rd/Fallon Rd & I-580 WB Ramps



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↙	↖	↗		↑↑↑	↗		↑↑↑	↗
Traffic Volume (vph)	0	0	0	171	0	613	0	869	478	0	650	399
Future Volume (vph)	0	0	0	171	0	613	0	869	478	0	650	399
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0	4.0	4.0		4.0	4.0		4.0	4.0
Lane Util. Factor				0.95	0.95	0.88		0.91	1.00		0.91	1.00
Frt				1.00	1.00	0.85		1.00	0.85		1.00	0.85
Flt Protected				0.95	0.95	1.00		1.00	1.00		1.00	1.00
Satd. Flow (prot)				1681	1681	2787		5085	1583		5085	1583
Flt Permitted				0.95	0.95	1.00		1.00	1.00		1.00	1.00
Satd. Flow (perm)				1681	1681	2787		5085	1583		5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	186	0	666	0	945	520	0	707	434
RTOR Reduction (vph)	0	0	0	0	0	115	0	0	195	0	0	162
Lane Group Flow (vph)	0	0	0	95	91	551	0	945	325	0	707	272
Turn Type				Perm	NA	Perm		NA	Perm		NA	Perm
Protected Phases					8			2			6	
Permitted Phases				8		8			2			6
Actuated Green, G (s)				18.7	18.7	18.7		43.8	43.8		43.8	43.8
Effective Green, g (s)				18.2	18.2	18.2		43.8	43.8		43.8	43.8
Actuated g/C Ratio				0.26	0.26	0.26		0.63	0.63		0.63	0.63
Clearance Time (s)				3.5	3.5	3.5		4.0	4.0		4.0	4.0
Vehicle Extension (s)				2.0	2.0	2.0		2.0	2.0		2.0	2.0
Lane Grp Cap (vph)				437	437	724		3181	990		3181	990
v/s Ratio Prot								0.19			0.14	
v/s Ratio Perm				0.06	0.05	c0.20			c0.21			0.17
v/c Ratio				0.22	0.21	0.76		0.30	0.33		0.22	0.27
Uniform Delay, d1				20.3	20.3	23.9		6.0	6.2		5.7	5.9
Progression Factor				1.00	1.00	1.00		0.80	0.78		1.00	1.00
Incremental Delay, d2				0.1	0.1	4.3		0.2	0.7		0.2	0.7
Delay (s)				20.4	20.3	28.1		5.0	5.6		5.9	6.6
Level of Service				C	C	C		A	A		A	A
Approach Delay (s)		0.0			26.4			5.2			6.1	
Approach LOS		A			C			A			A	

Intersection Summary

HCM 2000 Control Delay	10.8	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.46		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	44.9%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 21: El Charro Rd & I-580 EB Ramps

BART to Livermore Extension Project
 2040 No Project AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔↔		↔↔					↕↕	↔		↕↕	↔
Traffic Volume (vph)	279	0	618	0	0	0	0	1340	425	0	471	0
Future Volume (vph)	279	0	618	0	0	0	0	1340	425	0	471	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0					4.0	4.0		4.0	
Lane Util. Factor	0.97		0.88					0.91	0.91		0.91	
Frt	1.00		0.85					0.99	0.85		1.00	
Flt Protected	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (prot)	3433		2787					3372	1441		3390	
Flt Permitted	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (perm)	3433		2787					3372	1441		3390	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	303	0	672	0	0	0	0	1457	462	0	512	0
RTOR Reduction (vph)	0	0	571	0	0	0	0	3	108	0	0	0
Lane Group Flow (vph)	303	0	101	0	0	0	0	1509	299	0	512	0
Turn Type	Prot		Perm					NA	Perm		NA	Perm
Protected Phases	4							2			6	
Permitted Phases			4						2			6
Actuated Green, G (s)	10.5		10.5					51.5	51.5		51.5	
Effective Green, g (s)	10.5		10.5					51.5	51.5		51.5	
Actuated g/C Ratio	0.15		0.15					0.74	0.74		0.74	
Clearance Time (s)	4.0		4.0					4.0	4.0		4.0	
Vehicle Extension (s)	2.0		2.0					3.0	3.0		3.0	
Lane Grp Cap (vph)	514		418					2480	1060		2494	
v/s Ratio Prot	c0.09							c0.45			0.15	
v/s Ratio Perm			0.04						0.21			
v/c Ratio	0.59		0.24					0.61	0.28		0.21	
Uniform Delay, d1	27.7		26.2					4.4	3.1		2.9	
Progression Factor	1.00		1.00					1.00	1.00		1.29	
Incremental Delay, d2	1.1		0.1					1.1	0.7		0.2	
Delay (s)	28.9		26.3					5.5	3.8		3.9	
Level of Service	C		C					A	A		A	
Approach Delay (s)		27.1			0.0			5.2			3.9	
Approach LOS		C			A			A			A	

Intersection Summary	
HCM 2000 Control Delay	11.3 HCM 2000 Level of Service B
HCM 2000 Volume to Capacity ratio	0.61
Actuated Cycle Length (s)	70.0 Sum of lost time (s) 8.0
Intersection Capacity Utilization	56.2% ICU Level of Service B
Analysis Period (min)	15

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 22: El Charro Rd & Stoneridge Dr/Jack London Blvd

BART to Livermore Extension Project
 2040 No Project AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔↔↔	↑↑	↗	↖	↑↑	↗↗	↖	↑↑		↖↖↖	↑	↗↗
Traffic Volume (vph)	93	131	16	65	631	797	31	539	28	324	212	108
Future Volume (vph)	93	131	16	65	631	797	31	539	28	324	212	108
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	0.94	0.95	1.00	1.00	0.95	0.88	1.00	0.95		0.94	1.00	0.88
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	4491	3185	1425	1593	3185	2508	1593	3162		4491	1676	2508
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	4491	3185	1425	1593	3185	2508	1593	3162		4491	1676	2508
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	101	142	17	71	686	866	34	586	30	352	230	117
RTOR Reduction (vph)	0	0	13	0	0	52	0	4	0	0	0	62
Lane Group Flow (vph)	101	142	4	71	686	814	34	612	0	352	230	55
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Prot	NA		Prot	NA	Perm
Protected Phases	7	4		3	8	1	5	2		1	6	
Permitted Phases			4			8						6
Actuated Green, G (s)	2.9	20.4	20.4	6.8	24.3	45.8	3.1	22.2		21.5	40.6	40.6
Effective Green, g (s)	2.9	20.4	20.4	6.8	24.3	45.8	3.1	22.2		21.5	40.6	40.6
Actuated g/C Ratio	0.03	0.23	0.23	0.08	0.28	0.53	0.04	0.26		0.25	0.47	0.47
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	149	747	334	124	890	1321	56	807		1111	783	1171
v/s Ratio Prot	0.02	0.04		c0.04	c0.22	c0.15	0.02	c0.19		0.08	0.14	
v/s Ratio Perm			0.00			0.17						0.02
v/c Ratio	0.68	0.19	0.01	0.57	0.77	0.62	0.61	0.76		0.32	0.29	0.05
Uniform Delay, d1	41.5	26.6	25.5	38.6	28.7	14.4	41.3	29.9		26.7	14.3	12.6
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	11.6	0.1	0.0	6.3	4.2	0.9	17.2	4.1		0.2	0.2	0.0
Delay (s)	53.1	26.8	25.5	44.9	32.9	15.3	58.5	34.0		26.9	14.5	12.6
Level of Service	D	C	C	D	C	B	E	C		C	B	B
Approach Delay (s)		36.9			24.0			35.3			20.4	
Approach LOS		D			C			D			C	

Intersection Summary

HCM 2000 Control Delay	26.5	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.72		
Actuated Cycle Length (s)	86.9	Sum of lost time (s)	16.0
Intersection Capacity Utilization	61.9%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 23: Stanley Blvd & El Charro Rd



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	395	459	2753	112	26	116
Future Volume (vph)	395	459	2753	112	26	116
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95	0.91	1.00	0.97	0.88
Frt	1.00	1.00	1.00	0.85	1.00	0.85
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1770	3539	5085	1583	3433	2787
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1770	3539	5085	1583	3433	2787
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	429	499	2992	122	28	126
RTOR Reduction (vph)	0	0	0	27	0	118
Lane Group Flow (vph)	429	499	2992	95	28	8
Turn Type	Prot	NA	NA	Perm	Prot	Perm
Protected Phases	7	4	8		6	
Permitted Phases				8		6
Actuated Green, G (s)	27.0	96.0	65.0	65.0	6.6	6.6
Effective Green, g (s)	27.0	96.0	65.0	65.0	6.6	6.6
Actuated g/C Ratio	0.24	0.87	0.59	0.59	0.06	0.06
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	432	3071	2988	930	204	166
v/s Ratio Prot	c0.24	0.14	c0.59		c0.01	
v/s Ratio Perm				0.06		0.00
v/c Ratio	0.99	0.16	1.00	0.10	0.14	0.05
Uniform Delay, d1	41.7	1.1	22.8	10.0	49.3	49.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	41.3	0.0	16.8	0.0	0.3	0.1
Delay (s)	83.0	1.1	39.6	10.0	49.6	49.1
Level of Service	F	A	D	B	D	D
Approach Delay (s)		39.0	38.4		49.2	
Approach LOS		D	D		D	

Intersection Summary

HCM 2000 Control Delay	38.9	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.94		
Actuated Cycle Length (s)	110.6	Sum of lost time (s)	12.0
Intersection Capacity Utilization	88.4%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 24: Airway Blvd/Driveway & N Canyons Pkwy



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑	↑	↑↑	↑	↑		↑	↑↑		↑	
Traffic Volume (vph)	0	91	50	718	1029	0	978	0	961	0	0	0
Future Volume (vph)	0	91	50	718	1029	0	978	0	961	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		2.0	2.0	2.0	2.0			4.2	2.0			
Lane Util. Factor		0.95	1.00	0.97	1.00			1.00	0.88			
Frt		1.00	0.85	1.00	1.00			1.00	0.85			
Flt Protected		1.00	1.00	0.95	1.00			0.95	1.00			
Satd. Flow (prot)		3539	1583	3433	1863			1770	2787			
Flt Permitted		1.00	1.00	0.95	1.00			0.95	1.00			
Satd. Flow (perm)		3539	1583	3433	1863			1770	2787			
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	99	54	780	1118	0	1063	0	1045	0	0	0
RTOR Reduction (vph)	0	0	49	0	0	0	0	0	73	0	0	0
Lane Group Flow (vph)	0	99	5	780	1118	0	0	1063	972	0	0	0
Turn Type		NA	Perm	Prot	NA	Perm	Split	NA	pm+ov			
Protected Phases		2		1	6		8	8	1	4	4	
Permitted Phases			2			6			8			
Actuated Green, G (s)		10.2	10.2	34.8	49.0			63.0	97.8			
Effective Green, g (s)		12.2	12.2	36.8	51.0			62.8	101.8			
Actuated g/C Ratio		0.10	0.10	0.31	0.42			0.52	0.85			
Clearance Time (s)		4.0	4.0	4.0	4.0			4.0	4.0			
Vehicle Extension (s)		3.0	3.0	3.0	3.0			3.0	3.0			
Lane Grp Cap (vph)		359	160	1052	791			926	2410			
v/s Ratio Prot		0.03		0.23	c0.60			c0.60	0.12			
v/s Ratio Perm			0.00						0.23			
v/c Ratio		0.28	0.03	0.74	1.41			1.15	0.40			
Uniform Delay, d1		49.8	48.6	37.3	34.5			28.6	2.1			
Progression Factor		1.00	1.00	1.00	1.00			1.00	1.00			
Incremental Delay, d2		1.9	0.4	2.9	193.5			79.2	0.1			
Delay (s)		51.7	49.0	40.2	228.0			107.8	2.2			
Level of Service		D	D	D	F			F	A			
Approach Delay (s)		50.8			150.8			55.5			0.0	
Approach LOS		D			F			E			A	

Intersection Summary			
HCM 2000 Control Delay	98.8	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.33		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	12.2
Intersection Capacity Utilization	115.2%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
25: Airway Blvd & I-580 WB Ramps

BART to Livermore Extension Project
2040 No Project AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↶	↷	↶↷		↶↷	↶		↶↷↶	
Traffic Volume (vph)	0	0	0	67	43	813	0	1234	343	0	293	553
Future Volume (vph)	0	0	0	67	43	813	0	1234	343	0	293	553
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0	4.0	4.0		4.0	4.0		4.0	
Lane Util. Factor				0.95	0.95	0.88		0.95	1.00		0.91	
Frt				1.00	1.00	0.85		1.00	0.85		0.90	
Flt Protected				0.95	0.98	1.00		1.00	1.00		1.00	
Satd. Flow (prot)				1681	1733	2787		3539	1583		4586	
Flt Permitted				0.95	0.98	1.00		1.00	1.00		1.00	
Satd. Flow (perm)				1681	1733	2787		3539	1583		4586	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	73	47	884	0	1341	373	0	318	601
RTOR Reduction (vph)	0	0	0	0	0	38	0	0	160	0	258	0
Lane Group Flow (vph)	0	0	0	39	81	846	0	1341	213	0	661	0
Turn Type				Split	NA	Perm		NA	Perm		NA	
Protected Phases				8	8			2			6	
Permitted Phases						8			2			
Actuated Green, G (s)				35.0	35.0	35.0		55.7	55.7		55.7	
Effective Green, g (s)				35.0	35.0	35.0		57.0	57.0		57.0	
Actuated g/C Ratio				0.35	0.35	0.35		0.57	0.57		0.57	
Clearance Time (s)				4.0	4.0	4.0		5.3	5.3		5.3	
Vehicle Extension (s)				2.0	2.0	2.0		4.0	4.0		4.0	
Lane Grp Cap (vph)				588	606	975		2017	902		2614	
v/s Ratio Prot				0.02	0.05			c0.38			0.14	
v/s Ratio Perm						c0.30			0.13			
v/c Ratio				0.07	0.13	0.87		0.66	0.24		0.25	
Uniform Delay, d1				21.6	22.2	30.3		14.9	10.7		10.8	
Progression Factor				1.00	1.00	1.00		0.51	0.11		1.00	
Incremental Delay, d2				0.0	0.0	8.0		1.6	0.5		0.2	
Delay (s)				21.6	22.2	38.3		9.1	1.7		11.0	
Level of Service				C	C	D		A	A		B	
Approach Delay (s)		0.0			36.4			7.5			11.0	
Approach LOS		A			D			A			B	

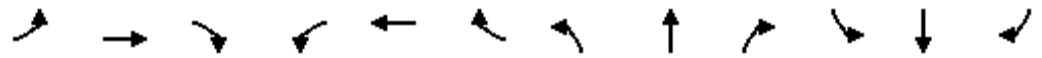
Intersection Summary

HCM 2000 Control Delay	16.4	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.74		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	69.2%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 26: Airway Blvd & I-580 EB Ramps/Kitty Hawk Rd

BART to Livermore Extension Project
 2040 No Project AM































Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	645	196	232	28	37	91	32	515	164	73	144	161
Future Volume (vph)	645	196	232	28	37	91	32	515	164	73	144	161
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.4	4.4	4.4	4.5	2.7		4.0	2.7	
Lane Util. Factor	0.97	1.00	1.00	1.00	1.00	1.00	1.00	0.95		1.00	0.95	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.96		1.00	0.92	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	3433	1863	1583	1770	1863	1583	1770	3411		1770	3259	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	3433	1863	1583	1770	1863	1583	1770	3411		1770	3259	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	701	213	252	30	40	99	35	560	178	79	157	175
RTOR Reduction (vph)	0	0	188	0	0	78	0	29	0	0	96	0
Lane Group Flow (vph)	701	213	64	30	40	21	35	709	0	79	236	0
Turn Type	Split	NA	Perm	Split	NA	pm+ov	Prot	NA		Prot	NA	
Protected Phases	7	7		8	8	1	5	2		1	6	
Permitted Phases			7			8						
Actuated Green, G (s)	25.2	25.2	25.2	11.2	11.2	21.1	3.8	37.7		9.9	43.8	
Effective Green, g (s)	25.2	25.2	25.2	10.8	10.8	20.3	3.3	39.0		9.9	45.1	
Actuated g/C Ratio	0.25	0.25	0.25	0.11	0.11	0.20	0.03	0.39		0.10	0.45	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Vehicle Extension (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	3.5		2.0	4.0	
Lane Grp Cap (vph)	865	469	398	191	201	391	58	1330		175	1469	
v/s Ratio Prot	c0.20	0.11		0.02	c0.02	0.01	0.02	c0.21		c0.04	0.07	
v/s Ratio Perm			0.04			0.01						
v/c Ratio	0.81	0.45	0.16	0.16	0.20	0.05	0.60	0.53		0.45	0.16	
Uniform Delay, d1	35.2	31.6	29.1	40.5	40.7	32.1	47.7	23.5		42.5	16.2	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		0.99	0.90	
Incremental Delay, d2	5.5	0.3	0.1	0.1	0.2	0.0	11.5	1.5		0.7	0.2	
Delay (s)	40.7	31.8	29.2	40.6	40.8	32.1	59.2	25.0		42.9	14.9	
Level of Service	D	C	C	D	D	C	E	C		D	B	
Approach Delay (s)		36.6			35.7			26.6			20.3	
Approach LOS		D			D			C			C	

Intersection Summary		
HCM 2000 Control Delay	30.8	HCM 2000 Level of Service C
HCM 2000 Volume to Capacity ratio	0.57	
Actuated Cycle Length (s)	100.0	Sum of lost time (s) 15.6
Intersection Capacity Utilization	58.6%	ICU Level of Service B
Analysis Period (min)	15	

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 27: Collier Canyon Rd & N Canyons Pkwy/Portola Ave

BART to Livermore Extension Project
 2040 No Project AM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 	 			 			 			 	
Traffic Volume (vph)	264	187	99	150	907	57	81	8	102	58	14	214
Future Volume (vph)	264	187	99	150	907	57	81	8	102	58	14	214
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	2.7	2.7	4.0	2.7	2.7	4.0	3.0		4.0	4.6	4.6
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.86		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	1770	1604		1770	1863	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	1770	1604		1770	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	287	203	108	163	986	62	88	9	111	63	15	233
RTOR Reduction (vph)	0	0	69	0	0	36	0	86	0	0	0	188
Lane Group Flow (vph)	287	203	39	163	986	26	88	34	0	63	15	45
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA		Prot	NA	Perm
Protected Phases	1	6		5	2		3	8		7		4
Permitted Phases			6			2						4
Actuated Green, G (s)	7.0	22.7	22.7	10.1	25.8	25.8	4.0	13.9		3.1	13.0	13.0
Effective Green, g (s)	7.0	24.0	24.0	10.1	27.1	27.1	4.0	14.9		3.1	12.4	12.4
Actuated g/C Ratio	0.11	0.36	0.36	0.15	0.41	0.41	0.06	0.23		0.05	0.19	0.19
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	365	1290	577	271	1457	651	107	363		83	351	298
v/s Ratio Prot	c0.08	0.06		0.09	c0.28		c0.05	0.02		0.04	0.01	
v/s Ratio Perm			0.02			0.02						c0.03
v/c Ratio	0.79	0.16	0.07	0.60	0.68	0.04	0.82	0.09		0.76	0.04	0.15
Uniform Delay, d1	28.7	14.1	13.6	26.0	15.8	11.6	30.5	20.1		31.0	21.8	22.3
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	10.7	0.1	0.1	3.7	1.3	0.0	37.7	0.1		32.1	0.1	0.2
Delay (s)	39.3	14.1	13.7	29.7	17.0	11.6	68.2	20.2		63.1	21.9	22.5
Level of Service	D	B	B	C	B	B	E	C		E	C	C
Approach Delay (s)		26.1			18.5			40.5			30.7	
Approach LOS		C			B			D			C	
Intersection Summary												
HCM 2000 Control Delay			24.0	HCM 2000 Level of Service				C				
HCM 2000 Volume to Capacity ratio			0.57									
Actuated Cycle Length (s)			65.8	Sum of lost time (s)				15.3				
Intersection Capacity Utilization			53.8%	ICU Level of Service				A				
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis
28: Isabel Ave/Campus Hill Dr & Portola Ave

BART to Livermore Extension Project
2040 No Project AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↘	↑↑	↗↗	↘↘↘	↑↑		↘↘	↑↑	↗	↘	↑↑	↗
Traffic Volume (vph)	1	197	225	516	607	145	501	302	82	66	202	2
Future Volume (vph)	1	197	225	516	607	145	501	302	82	66	202	2
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	5.8	5.8
Lane Util. Factor	1.00	0.95	0.88	0.94	0.95		0.97	0.95	1.00	1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	0.97		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3539	2787	4990	3437		3433	3539	1583	1770	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	3539	2787	4990	3437		3433	3539	1583	1770	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	1	214	245	561	660	158	545	328	89	72	220	2
RTOR Reduction (vph)	0	0	190	0	14	0	0	0	60	0	0	2
Lane Group Flow (vph)	1	214	55	561	804	0	545	328	29	72	220	0
Turn Type	Prot	NA	Perm	Prot	NA		Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4						2			6
Actuated Green, G (s)	1.5	18.2	18.2	15.4	32.1		20.9	26.4	26.4	7.7	13.6	13.6
Effective Green, g (s)	1.5	19.5	19.5	15.4	33.4		20.9	27.7	27.7	7.7	12.7	12.7
Actuated g/C Ratio	0.02	0.23	0.23	0.18	0.39		0.24	0.32	0.32	0.09	0.15	0.15
Clearance Time (s)	4.0	5.3	5.3	4.0	5.3		4.0	5.3	5.3	4.0	4.9	4.9
Vehicle Extension (s)	2.0	3.0	3.0	2.0	3.0		2.0	3.0	3.0	2.0	3.0	3.0
Lane Grp Cap (vph)	30	799	629	890	1330		831	1135	508	157	520	232
v/s Ratio Prot	0.00	0.06		c0.11	c0.23		c0.16	0.09		0.04	c0.06	
v/s Ratio Perm			0.02						0.02			0.00
v/c Ratio	0.03	0.27	0.09	0.63	0.60		0.66	0.29	0.06	0.46	0.42	0.00
Uniform Delay, d1	41.7	27.5	26.4	32.8	21.2		29.5	21.9	20.3	37.3	33.5	31.4
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.2	0.2	0.1	1.1	0.8		1.4	0.1	0.0	0.8	0.6	0.0
Delay (s)	41.9	27.7	26.4	33.9	21.9		30.9	22.1	20.3	38.1	34.0	31.4
Level of Service	D	C	C	C	C		C	C	C	D	C	C
Approach Delay (s)		27.1			26.8			26.9			35.0	
Approach LOS		C			C			C			D	

Intersection Summary

HCM 2000 Control Delay	27.7	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.61		
Actuated Cycle Length (s)	86.3	Sum of lost time (s)	17.8
Intersection Capacity Utilization	68.0%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 29: Isabel Ave & I-580 WB Ramps

BART to Livermore Extension Project
 2040 No Project AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↖↗		↖		↖↖↗	↖		↖↖↗	↖
Traffic Volume (vph)	0	0	0	653	0	472	0	511	0	0	676	438
Future Volume (vph)	0	0	0	653	0	472	0	511	0	0	676	438
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0		4.0		4.8			4.8	4.8
Lane Util. Factor				0.97		1.00		0.91			0.91	1.00
Frt				1.00		0.85		1.00			1.00	0.85
Flt Protected				0.95		1.00		1.00			1.00	1.00
Satd. Flow (prot)				3433		1583		5085			5085	1583
Flt Permitted				0.95		1.00		1.00			1.00	1.00
Satd. Flow (perm)				3433		1583		5085			5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	710	0	513	0	555	0	0	735	476
RTOR Reduction (vph)	0	0	0	0	0	96	0	0	0	0	0	247
Lane Group Flow (vph)	0	0	0	710	0	417	0	555	0	0	735	229
Turn Type				Prot		Prot		NA	Free		NA	Prot
Protected Phases				8		8		2			6	6
Permitted Phases									Free			
Actuated Green, G (s)				17.1		17.1		24.9			24.9	24.9
Effective Green, g (s)				17.1		17.1		24.1			24.1	24.1
Actuated g/C Ratio				0.34		0.34		0.48			0.48	0.48
Clearance Time (s)				4.0		4.0		4.0			4.0	4.0
Vehicle Extension (s)				2.0		2.0		4.0			4.0	4.0
Lane Grp Cap (vph)				1174		541		2450			2450	763
v/s Ratio Prot				0.21		c0.26		0.11			0.14	c0.14
v/s Ratio Perm												
v/c Ratio				0.60		0.77		0.23			0.30	0.30
Uniform Delay, d1				13.6		14.7		7.5			7.8	7.8
Progression Factor				1.00		1.00		0.79			1.00	1.00
Incremental Delay, d2				0.6		6.1		0.2			0.3	1.0
Delay (s)				14.3		20.8		6.1			8.2	8.9
Level of Service				B		C		A			A	A
Approach Delay (s)		0.0			17.0			6.1			8.4	
Approach LOS		A			B			A			A	

Intersection Summary		
HCM 2000 Control Delay	11.5	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.50	B
Actuated Cycle Length (s)	50.0	Sum of lost time (s)
Intersection Capacity Utilization	46.4%	8.8
Analysis Period (min)	15	ICU Level of Service
		A

c Critical Lane Group

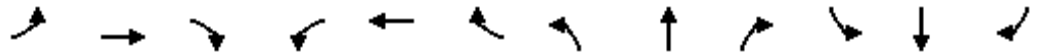
HCM Signalized Intersection Capacity Analysis
 30: Isabel Ave & I-580 EB Ramps

BART to Livermore Extension Project
 2040 No Project AM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations													
Traffic Volume (vph)	239	0	486	0	0	0	0	721	494	0	1013	365	
Future Volume (vph)	239	0	486	0	0	0	0	721	494	0	1013	365	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)	4.0		4.0					4.0	4.0		4.0	4.0	
Lane Util. Factor	0.97		0.88					0.91	1.00		0.91	1.00	
Frt	1.00		0.85					1.00	0.85		1.00	0.85	
Flt Protected	0.95		1.00					1.00	1.00		1.00	1.00	
Satd. Flow (prot)	3433		2787					5085	1583		5085	1583	
Flt Permitted	0.95		1.00					1.00	1.00		1.00	1.00	
Satd. Flow (perm)	3433		2787					5085	1583		5085	1583	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	
Adj. Flow (vph)	260	0	528	0	0	0	0	784	537	0	1101	397	
RTOR Reduction (vph)	0	0	145	0	0	0	0	0	0	0	0	0	
Lane Group Flow (vph)	260	0	383	0	0	0	0	784	537	0	1101	397	
Turn Type	Prot		Perm					NA	Free		NA	Free	
Protected Phases	4							2			6		
Permitted Phases			4						Free			Free	
Actuated Green, G (s)	10.4		10.4					30.6	50.0		30.6	50.0	
Effective Green, g (s)	10.4		10.4					31.6	50.0		31.6	50.0	
Actuated g/C Ratio	0.21		0.21					0.63	1.00		0.63	1.00	
Clearance Time (s)	4.0		4.0					5.0			5.0		
Vehicle Extension (s)	2.0		2.0					4.0			4.0		
Lane Grp Cap (vph)	714		579					3213	1583		3213	1583	
v/s Ratio Prot	0.08							0.15			0.22		
v/s Ratio Perm			c0.14						c0.34			0.25	
v/c Ratio	0.36		0.66					0.24	0.34		0.34	0.25	
Uniform Delay, d1	17.0		18.2					4.0	0.0		4.3	0.0	
Progression Factor	1.00		1.00					1.00	1.00		0.57	1.00	
Incremental Delay, d2	0.1		2.2					0.2	0.6		0.3	0.4	
Delay (s)	17.1		20.4					4.2	0.6		2.7	0.4	
Level of Service	B		C					A	A		A	A	
Approach Delay (s)		19.3			0.0			2.7			2.1		
Approach LOS		B			A			A			A		
Intersection Summary													
HCM 2000 Control Delay			6.1									HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio			0.45										
Actuated Cycle Length (s)			50.0									Sum of lost time (s)	8.0
Intersection Capacity Utilization			43.2%									ICU Level of Service	A
Analysis Period (min)			15										
c Critical Lane Group													

HCM Signalized Intersection Capacity Analysis
31: Isabel Ave & Airway Blvd

BART to Livermore Extension Project
2040 No Project AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	74	279	214	312	107	318	1075	24	254	1412	22
Future Volume (vph)	0	74	279	214	312	107	318	1075	24	254	1412	22
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.2	5.6	5.2	5.2	5.6	4.0	4.0	4.0	4.0	4.0	5.0
Lane Util. Factor		1.00	1.00	1.00	1.00	1.00	1.00	0.91	1.00	0.97	0.91	1.00
Frt		1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1863	1583	1770	1863	1583	1770	5085	1583	3433	5085	1583
Flt Permitted		1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)		1863	1583	1770	1863	1583	1770	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	80	303	233	339	116	346	1168	26	276	1535	24
RTOR Reduction (vph)	0	0	110	0	0	71	0	0	15	0	0	15
Lane Group Flow (vph)	0	80	193	233	339	45	346	1168	11	276	1535	9
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4	5	3	8	1	5	2		1	6	
Permitted Phases			4			8			2			6
Actuated Green, G (s)		7.6	22.7	11.9	24.1	34.7	15.1	37.0	37.0	10.6	32.5	32.5
Effective Green, g (s)		7.0	21.5	11.3	23.5	33.5	16.1	38.0	38.0	11.6	33.5	32.5
Actuated g/C Ratio		0.08	0.25	0.13	0.27	0.39	0.19	0.44	0.44	0.13	0.39	0.38
Clearance Time (s)		4.6	5.0	4.6	4.6	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Extension (s)		3.0	3.0	3.0	3.0	3.0	3.0	5.0	5.0	3.0	5.0	5.0
Lane Grp Cap (vph)		151	394	231	507	614	330	2239	697	461	1973	596
v/s Ratio Prot		0.04	0.08	c0.13	c0.18	0.01	c0.20	0.23		0.08	c0.30	
v/s Ratio Perm			0.04			0.02			0.01			0.01
v/c Ratio		0.53	0.49	1.01	0.67	0.07	1.05	0.52	0.02	0.60	0.78	0.02
Uniform Delay, d1		38.1	27.7	37.5	27.9	16.6	35.1	17.5	13.6	35.2	23.1	16.9
Progression Factor		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2		3.3	1.0	61.5	3.3	0.1	62.8	0.4	0.0	2.1	2.3	0.0
Delay (s)		41.4	28.7	99.0	31.3	16.7	97.9	18.0	13.6	37.3	25.5	16.9
Level of Service		D	C	F	C	B	F	B	B	D	C	B
Approach Delay (s)		31.3			51.7			35.9			27.1	
Approach LOS		C			D			D			C	

Intersection Summary		
HCM 2000 Control Delay	34.3	HCM 2000 Level of Service C
HCM 2000 Volume to Capacity ratio	0.91	
Actuated Cycle Length (s)	86.3	Sum of lost time (s) 20.0
Intersection Capacity Utilization	74.4%	ICU Level of Service D
Analysis Period (min)	15	

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 32: Isabel Ave & Jack London Blvd

BART to Livermore Extension Project
 2040 No Project AM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	23	55	62	331	1038	363	404	852	115	169	1387	296
Future Volume (vph)	23	55	62	331	1038	363	404	852	115	169	1387	296
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.97	0.91	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	3433	5085	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	3433	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	25	60	67	360	1128	395	439	926	125	184	1508	322
RTOR Reduction (vph)	0	0	55	0	0	54	0	0	81	0	0	98
Lane Group Flow (vph)	25	60	12	360	1128	341	439	926	44	184	1508	224
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8	1	5	2		1	NA	6
Permitted Phases			4			8			2			6
Actuated Green, G (s)	3.9	23.0	23.0	28.0	47.1	59.2	17.9	46.6	46.6	12.1	40.8	40.8
Effective Green, g (s)	3.9	23.0	23.0	28.0	47.1	59.2	17.9	46.6	46.6	12.1	40.8	40.8
Actuated g/C Ratio	0.03	0.18	0.18	0.21	0.36	0.45	0.14	0.36	0.36	0.09	0.31	0.31
Clearance Time (s)	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	102	621	278	378	1273	780	469	1810	563	317	1584	493
v/s Ratio Prot	0.01	0.02		c0.20	c0.32	0.04	c0.13	0.18		0.05	c0.30	
v/s Ratio Perm			0.01			0.17			0.03			0.14
v/c Ratio	0.25	0.10	0.04	0.95	0.89	0.44	0.94	0.51	0.08	0.58	0.95	0.45
Uniform Delay, d1	62.1	45.2	44.8	50.8	39.4	24.5	55.9	33.2	27.9	57.0	44.1	36.1
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.3	0.1	0.1	33.9	7.7	0.4	26.1	0.2	0.1	2.7	13.0	0.7
Delay (s)	63.3	45.3	44.9	84.7	47.1	24.9	82.1	33.4	28.0	59.7	57.1	36.8
Level of Service	E	D	D	F	D	C	F	C	C	E	E	D
Approach Delay (s)		48.1			49.6			47.3			54.1	
Approach LOS		D			D			D			D	

Intersection Summary

HCM 2000 Control Delay	50.6	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.96		
Actuated Cycle Length (s)	130.9	Sum of lost time (s)	21.2
Intersection Capacity Utilization	80.3%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
33: Isabel Ave Connector & Stanley Blvd



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑	↑	↔	↑↑	↔	↔
Traffic Volume (vph)	330	150	796	2474	588	655
Future Volume (vph)	330	150	796	2474	588	655
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	2.3	2.3	4.0	2.3	2.5	2.5
Lane Util. Factor	0.95	1.00	0.97	0.95	0.97	0.88
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	3539	1583	3433	3539	3433	2787
Flt Permitted	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (perm)	3539	1583	3433	3539	3433	2787
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	359	163	865	2689	639	712
RTOR Reduction (vph)	0	2	0	0	0	140
Lane Group Flow (vph)	359	161	865	2689	639	572
Turn Type	NA	pm+ov	Prot	NA	Prot	pm+ov
Protected Phases	2	8	1	6	8	1
Permitted Phases		2				8
Actuated Green, G (s)	13.6	34.6	43.6	61.2	21.0	64.6
Effective Green, g (s)	15.3	38.0	43.6	62.9	22.5	67.6
Actuated g/C Ratio	0.17	0.42	0.48	0.70	0.25	0.75
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Grp Cap (vph)	600	707	1659	2467	856	2165
v/s Ratio Prot	0.10	0.06	0.25	c0.76	c0.19	0.13
v/s Ratio Perm		0.04				0.07
v/c Ratio	0.60	0.23	0.52	1.09	0.75	0.26
Uniform Delay, d1	34.6	16.7	16.1	13.7	31.2	3.5
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.1	0.1	0.1	48.0	3.1	0.0
Delay (s)	35.7	16.8	16.2	61.6	34.4	3.6
Level of Service	D	B	B	E	C	A
Approach Delay (s)	29.8			50.6	18.1	
Approach LOS	C			D	B	

Intersection Summary

HCM 2000 Control Delay	40.5	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	1.05		
Actuated Cycle Length (s)	90.2	Sum of lost time (s)	8.8
Intersection Capacity Utilization	91.8%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 34: Murrieta Blvd/Driveway & Portola Ave

BART to Livermore Extension Project
 2040 No Project AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗		↖	↗		↖	↗	↗		↗	
Traffic Volume (vph)	0	438	103	267	1225	1	187	6	149	1	3	0
Future Volume (vph)	0	438	103	267	1225	1	187	6	149	1	3	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.8		4.0	5.8		5.2	5.2	5.2		4.0	
Lane Util. Factor		0.95		1.00	0.95		0.95	0.95	1.00		1.00	
Frt		0.97		1.00	1.00		1.00	1.00	0.85		1.00	
Flt Protected		1.00		0.95	1.00		0.95	0.96	1.00		0.99	
Satd. Flow (prot)		3438		1770	3539		1681	1691	1583		1840	
Flt Permitted		1.00		0.95	1.00		0.95	0.96	1.00		0.99	
Satd. Flow (perm)		3438		1770	3539		1681	1691	1583		1840	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	476	112	290	1332	1	203	7	162	1	3	0
RTOR Reduction (vph)	0	25	0	0	0	0	0	0	139	0	0	0
Lane Group Flow (vph)	0	563	0	290	1333	0	106	104	23	0	4	0
Turn Type	Prot	NA		Prot	NA		Split	NA	Perm		Split	NA
Protected Phases	5	2		1	6		8	8		4	4	
Permitted Phases									8			
Actuated Green, G (s)		13.5		14.5	32.0		8.2	8.2	8.2		0.6	
Effective Green, g (s)		12.6		14.5	31.1		7.6	7.6	7.6		0.6	
Actuated g/C Ratio		0.23		0.27	0.57		0.14	0.14	0.14		0.01	
Clearance Time (s)		4.9		4.0	4.9		4.6	4.6	4.6		4.0	
Vehicle Extension (s)		2.0		2.0	2.0		2.0	2.0	2.0		2.0	
Lane Grp Cap (vph)		797		472	2026		235	236	221		20	
v/s Ratio Prot		0.16		0.16	c0.38		c0.06	0.06			c0.00	
v/s Ratio Perm									0.01			
v/c Ratio		0.71		0.61	0.66		0.45	0.44	0.10		0.20	
Uniform Delay, d1		19.1		17.4	8.0		21.4	21.4	20.4		26.6	
Progression Factor		1.00		1.00	1.00		1.00	1.00	1.00		1.00	
Incremental Delay, d2		2.3		1.7	0.6		0.5	0.5	0.1		1.8	
Delay (s)		21.5		19.1	8.5		21.9	21.9	20.4		28.4	
Level of Service		C		B	A		C	C	C		C	
Approach Delay (s)		21.5			10.4			21.3			28.4	
Approach LOS		C			B			C			C	

Intersection Summary		
HCM 2000 Control Delay	14.5	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.68	B
Actuated Cycle Length (s)	54.3	Sum of lost time (s)
Intersection Capacity Utilization	61.7%	19.0
Analysis Period (min)	15	ICU Level of Service
		B

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
35: Murrieta Blvd & Jack London Blvd
































Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	68	294	875	215	244	176
Future Volume (vph)	68	294	875	215	244	176
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00	1.00	0.95	0.91	
Frt	1.00	0.85	1.00	1.00	0.94	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1770	1583	1770	3539	4766	
Flt Permitted	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	1770	1583	1770	3539	4766	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	74	320	951	234	265	191
RTOR Reduction (vph)	0	283	0	0	152	0
Lane Group Flow (vph)	74	37	951	234	304	0
Turn Type	Prot	Perm	Prot	NA	NA	
Protected Phases	4		5	2	6	
Permitted Phases		4				
Actuated Green, G (s)	9.1	9.1	46.3	60.7	10.4	
Effective Green, g (s)	9.1	9.1	46.3	60.7	10.4	
Actuated g/C Ratio	0.12	0.12	0.60	0.78	0.13	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	207	185	1053	2761	637	
v/s Ratio Prot	c0.04		c0.54	0.07	c0.06	
v/s Ratio Perm		0.02				
v/c Ratio	0.36	0.20	0.90	0.08	0.48	
Uniform Delay, d1	31.7	31.1	13.8	2.0	31.2	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	1.1	0.5	10.7	0.0	0.6	
Delay (s)	32.7	31.6	24.5	2.0	31.8	
Level of Service	C	C	C	A	C	
Approach Delay (s)	31.8			20.1	31.8	
Approach LOS	C			C	C	

Intersection Summary

HCM 2000 Control Delay	25.0	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.76		
Actuated Cycle Length (s)	77.8	Sum of lost time (s)	12.0
Intersection Capacity Utilization	70.9%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 36: Murrieta Blvd & Stanley Blvd

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 	 			 		 	 			 	
Traffic Volume (vph)	216	787	260	24	1411	138	691	380	17	198	187	462
Future Volume (vph)	216	787	260	24	1411	138	691	380	17	198	187	462
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	5.8	5.8	4.0	5.8	4.9	4.9	5.8		4.9	5.8	4.9
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.97	0.95		1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	3433	3517		1770	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	3433	3517		1770	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	235	855	283	26	1534	150	751	413	18	215	203	502
RTOR Reduction (vph)	0	0	127	0	0	32	0	2	0	0	0	61
Lane Group Flow (vph)	235	855	156	26	1534	118	751	429	0	215	203	441
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Prot	NA		Prot	NA	Perm
Protected Phases	1	6		5	2	3	7	4		3	8	
Permitted Phases			6			2						8
Actuated Green, G (s)	7.0	62.1	62.1	3.6	58.7	80.4	25.0	36.4		21.7	33.1	33.1
Effective Green, g (s)	7.0	61.2	61.2	3.6	57.8	78.6	24.1	35.5		20.8	32.2	33.1
Actuated g/C Ratio	0.05	0.43	0.43	0.03	0.41	0.56	0.17	0.25		0.15	0.23	0.23
Clearance Time (s)	4.0	4.9	4.9	4.0	4.9	4.0	4.0	4.9		4.0	4.9	4.9
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	169	1529	684	45	1444	878	584	881		260	804	370
v/s Ratio Prot	c0.07	c0.24		0.01	c0.43	0.02	c0.22	c0.12		0.12	0.06	
v/s Ratio Perm			0.10			0.05						c0.28
v/c Ratio	1.39	0.56	0.23	0.58	1.06	0.13	1.29	0.49		0.83	0.25	1.19
Uniform Delay, d1	67.3	30.1	25.3	68.2	41.9	15.1	58.8	45.3		58.7	44.8	54.2
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	207.8	0.4	0.2	16.7	42.2	0.1	141.3	0.4		18.9	0.2	110.5
Delay (s)	275.1	30.5	25.5	85.0	84.1	15.2	200.1	45.7		77.6	45.0	164.8
Level of Service	F	C	C	F	F	B	F	D		E	D	F
Approach Delay (s)		71.4			78.0			143.8			118.0	
Approach LOS		E			E			F			F	

Intersection Summary

HCM 2000 Control Delay	98.3	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.14		
Actuated Cycle Length (s)	141.6	Sum of lost time (s)	20.5
Intersection Capacity Utilization	100.3%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
37: Livermore Ave & I-580 WB Ramps



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↶	↷		↶	↷			↶	↷
Traffic Volume (vph)	0	0	0	344	90	28	472	81	0	0	151	0
Future Volume (vph)	0	0	0	344	90	28	472	81	0	0	151	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)					4.0		4.0	4.0			4.0	
Lane Util. Factor					0.95		0.97	1.00			0.95	
Frt					0.99		1.00	1.00			1.00	
Flt Protected					0.96		0.95	1.00			1.00	
Satd. Flow (prot)					1691		3433	1863			3539	
Flt Permitted					0.96		0.95	1.00			1.00	
Satd. Flow (perm)					1691		3433	1863			3539	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	374	98	30	513	88	0	0	164	0
RTOR Reduction (vph)	0	0	0	0	5	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	0	497	0	513	88	0	0	164	0
Turn Type				Split	NA		Prot	NA			NA	
Protected Phases				8	8		5	2			6	
Permitted Phases												
Actuated Green, G (s)					19.2		11.4	26.1			11.2	
Effective Green, g (s)					19.2		10.9	27.8			12.9	
Actuated g/C Ratio					0.35		0.20	0.51			0.23	
Clearance Time (s)					4.0		3.5	5.7			5.7	
Vehicle Extension (s)					2.0		2.0	2.5			2.5	
Lane Grp Cap (vph)					590		680	941			830	
v/s Ratio Prot					c0.29		c0.15	0.05			c0.05	
v/s Ratio Perm												
v/c Ratio					0.84		0.75	0.09			0.20	
Uniform Delay, d1					16.5		20.8	7.1			16.9	
Progression Factor					1.00		1.00	1.00			1.00	
Incremental Delay, d2					10.2		4.2	0.2			0.5	
Delay (s)					26.7		25.0	7.3			17.4	
Level of Service					C		C	A			B	
Approach Delay (s)		0.0			26.7			22.4			17.4	
Approach LOS		A			C			C			B	

Intersection Summary

HCM 2000 Control Delay	23.5	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.63		
Actuated Cycle Length (s)	55.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	56.2%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 38: Livermore Ave & I-580 EB Ramps































Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕	↗					↕		↘	↕	
Traffic Volume (vph)	14	2	693	0	0	0	0	534	378	23	477	0
Future Volume (vph)	14	2	693	0	0	0	0	534	378	23	477	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0					3.0		5.0	3.0	
Lane Util. Factor		0.95	0.95					0.95		1.00	0.95	
Frt		0.86	0.85					0.94		1.00	1.00	
Flt Protected		1.00	1.00					1.00		0.95	1.00	
Satd. Flow (prot)		1513	1504					3319		1770	3539	
Flt Permitted		1.00	1.00					1.00		0.95	1.00	
Satd. Flow (perm)		1513	1504					3319		1770	3539	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	15	2	753	0	0	0	0	580	411	25	518	0
RTOR Reduction (vph)	0	222	222	0	0	0	0	197	0	0	0	0
Lane Group Flow (vph)	0	164	162	0	0	0	0	794	0	25	518	0
Turn Type	Prot	NA	Perm					NA		Prot	NA	
Protected Phases	7	4						2		1	6	
Permitted Phases			4									
Actuated Green, G (s)		12.9	12.9					24.3		0.8	29.1	
Effective Green, g (s)		12.9	12.9					25.3		0.0	30.1	
Actuated g/C Ratio		0.26	0.26					0.51		0.00	0.60	
Clearance Time (s)		4.0	4.0					4.0		4.0	4.0	
Vehicle Extension (s)		2.0	2.0					2.5		2.0	2.5	
Lane Grp Cap (vph)		390	388					1679		0	2130	
v/s Ratio Prot								c0.24			c0.15	
v/s Ratio Perm		0.11	0.11									
v/c Ratio		0.42	0.42					0.47		no cap	0.24	
Uniform Delay, d1		15.4	15.4					8.0		Error	4.6	
Progression Factor		1.00	1.00					1.00			1.00	
Incremental Delay, d2		0.3	0.3					1.0		Error	0.3	
Delay (s)		15.7	15.7					9.0		Error	4.9	
Level of Service		B	B					A		F	A	
Approach Delay (s)		15.7			0.0			9.0			Error	
Approach LOS		B			A			A			F	

Intersection Summary		
HCM 2000 Control Delay	Error	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.47	F
Actuated Cycle Length (s)	50.0	Sum of lost time (s)
Intersection Capacity Utilization	56.2%	12.0
Analysis Period (min)	15	ICU Level of Service
		B

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 39: Livermore Ave & Portola Ave

BART to Livermore Extension Project
 2040 No Project AM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 	 			 			 			 	
Traffic Volume (vph)	288	247	89	30	718	94	250	499	69	138	736	448
Future Volume (vph)	288	247	89	30	718	94	250	499	69	138	736	448
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	2.7	4.0	4.0	2.7	4.0	4.0	4.9		4.0	4.9	4.9
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	1.00	0.95		1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.98		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	1770	3475		1770	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	1770	3475		1770	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	313	268	97	33	780	102	272	542	75	150	800	487
RTOR Reduction (vph)	0	0	74	0	0	74	0	9	0	0	0	50
Lane Group Flow (vph)	313	268	23	33	780	28	272	608	0	150	800	437
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA		Prot	NA	pm+ov
Protected Phases	3	8		7	4		1	6		5	2	3
Permitted Phases			8			4						2
Actuated Green, G (s)	14.9	28.1	28.1	19.9	33.1	33.1	21.0	41.2		14.8	35.0	49.9
Effective Green, g (s)	14.9	29.4	28.1	19.9	34.4	33.1	21.0	40.3		14.8	34.1	48.1
Actuated g/C Ratio	0.12	0.24	0.23	0.17	0.29	0.28	0.18	0.34		0.12	0.28	0.40
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	426	867	370	293	1014	436	309	1167		218	1005	634
v/s Ratio Prot	c0.09	0.08		0.02	c0.22		c0.15	0.18		0.08	c0.23	0.08
v/s Ratio Perm			0.01			0.02						0.20
v/c Ratio	0.73	0.31	0.06	0.11	0.77	0.06	0.88	0.52		0.69	0.80	0.69
Uniform Delay, d1	50.6	37.0	35.7	42.5	39.2	32.0	48.3	32.1		50.4	39.7	29.8
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	6.5	0.2	0.1	0.2	3.6	0.1	24.0	1.7		8.7	6.5	3.1
Delay (s)	57.1	37.2	35.8	42.7	42.7	32.1	72.2	33.8		59.1	46.3	32.9
Level of Service	E	D	D	D	D	C	E	C		E	D	C
Approach Delay (s)		46.2			41.6			45.5			43.1	
Approach LOS		D			D			D			D	
Intersection Summary												
HCM 2000 Control Delay			43.8	HCM 2000 Level of Service				D				
HCM 2000 Volume to Capacity ratio			0.80									
Actuated Cycle Length (s)			120.0	Sum of lost time (s)				16.5				
Intersection Capacity Utilization			76.3%	ICU Level of Service				D				
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis
40: First St/Springtown Blvd & I-580 WB Ramps

BART to Livermore Extension Project
2040 No Project AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations			↗↘			↗	↗↘	↑			↗↘	↗
Traffic Volume (vph)	0	0	443	0	0	0	341	375	0	0	875	521
Future Volume (vph)	0	0	443	0	0	0	341	375	0	0	875	521
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)			4.5				4.5	4.0			4.5	4.5
Lane Util. Factor			0.88				0.97	1.00			0.95	1.00
Frt			0.85				1.00	1.00			1.00	0.85
Flt Protected			1.00				0.95	1.00			1.00	1.00
Satd. Flow (prot)			2787				3433	1863			3539	1583
Flt Permitted			1.00				0.95	1.00			1.00	1.00
Satd. Flow (perm)			2787				3433	1863			3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	482	0	0	0	371	408	0	0	951	566
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	71
Lane Group Flow (vph)	0	0	482	0	0	0	371	408	0	0	951	495
Turn Type			Over			Free	Prot	NA			NA	Perm
Protected Phases			5				5	2			6	
Permitted Phases						Free						6
Actuated Green, G (s)			21.8				21.8	100.0			70.2	70.2
Effective Green, g (s)			21.3				21.3	100.0			69.7	69.7
Actuated g/C Ratio			0.21				0.21	1.00			0.70	0.70
Clearance Time (s)			4.0				4.0	4.0			4.0	4.0
Vehicle Extension (s)			2.0				2.0	0.2			4.0	4.0
Lane Grp Cap (vph)			593				731	1863			2466	1103
v/s Ratio Prot			c0.17				0.11	0.22			0.27	
v/s Ratio Perm												c0.31
v/c Ratio			0.81				0.51	0.22			0.39	0.45
Uniform Delay, d1			37.5				34.7	0.0			6.3	6.7
Progression Factor			1.00				0.95	1.00			1.00	1.00
Incremental Delay, d2			7.9				0.2	0.3			0.5	1.3
Delay (s)			45.4				33.3	0.3			6.7	8.0
Level of Service			D				C	A			A	A
Approach Delay (s)		45.4			0.0			16.0			7.2	
Approach LOS		D			A			B			A	

Intersection Summary

HCM 2000 Control Delay	16.3	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.53		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	49.5%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
41: First St & I-580 EB Ramps



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕	↗↘					↕↕	↗	↘	↕↕	
Traffic Volume (vph)	73	2	379	0	0	0	0	928	906	90	1201	0
Future Volume (vph)	73	2	379	0	0	0	0	928	906	90	1201	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0					5.0	5.0	5.0	5.0	
Lane Util. Factor		1.00	0.88					0.95	1.00	1.00	0.95	
Frt		1.00	0.85					1.00	0.85	1.00	1.00	
Flt Protected		0.95	1.00					1.00	1.00	0.95	1.00	
Satd. Flow (prot)		1776	2787					3539	1583	1770	3539	
Flt Permitted		0.95	1.00					1.00	1.00	0.95	1.00	
Satd. Flow (perm)		1776	2787					3539	1583	1770	3539	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	79	2	412	0	0	0	0	1009	985	98	1305	0
RTOR Reduction (vph)	0	0	175	0	0	0	0	0	250	0	0	0
Lane Group Flow (vph)	0	81	237	0	0	0	0	1009	735	98	1305	0
Turn Type	Perm	NA	Perm					NA	Perm	Prot	NA	
Protected Phases		4						2		1	6	
Permitted Phases	4		4						2			
Actuated Green, G (s)		12.3	12.3					67.7	67.7	8.0	79.7	
Effective Green, g (s)		11.8	11.8					67.2	67.2	7.0	79.2	
Actuated g/C Ratio		0.12	0.12					0.67	0.67	0.07	0.79	
Clearance Time (s)		3.5	3.5					4.5	4.5	4.0	4.5	
Vehicle Extension (s)		2.5	2.5					4.0	4.0	2.0	4.0	
Lane Grp Cap (vph)		209	328					2378	1063	123	2802	
v/s Ratio Prot								0.29		c0.06	0.37	
v/s Ratio Perm		0.05	c0.09						c0.46			
v/c Ratio		0.39	0.72					0.42	0.69	0.80	0.47	
Uniform Delay, d1		40.8	42.5					7.5	10.0	45.8	3.4	
Progression Factor		1.00	1.00					1.00	1.00	0.83	0.90	
Incremental Delay, d2		0.9	7.2					0.6	3.7	25.4	0.5	
Delay (s)		41.6	49.8					8.1	13.7	63.5	3.6	
Level of Service		D	D					A	B	E	A	
Approach Delay (s)		48.4			0.0			10.9			7.8	
Approach LOS		D			A			B			A	

Intersection Summary

HCM 2000 Control Delay	14.5	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.70		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	14.0
Intersection Capacity Utilization	76.9%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
42: 1st St & Mines Rd

BART to Livermore Extension Project
2040 No Project AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	42	59	46	519	100	365	26	1414	342	170	1308	21
Future Volume (vph)	42	59	46	519	100	365	26	1414	342	170	1308	21
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		0.97	1.00	1.00	1.00	0.91		0.97	0.91	
Frt	1.00	0.93		1.00	1.00	0.85	1.00	0.97		1.00	1.00	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1740		3433	1863	1583	1770	4937		3433	5073	
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	1740		3433	1863	1583	1770	4937		3433	5073	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	46	64	50	564	109	397	28	1537	372	185	1422	23
RTOR Reduction (vph)	0	34	0	0	0	47	0	41	0	0	1	0
Lane Group Flow (vph)	46	80	0	564	109	350	28	1868	0	185	1444	0
Turn Type	Prot	NA		Prot	NA	pm+ov	Prot	NA		Prot	NA	
Protected Phases	7	4		3	8	1	5	2		1	6	
Permitted Phases						8						
Actuated Green, G (s)	3.4	8.6		15.7	20.9	26.9	1.9	38.9		6.0	43.0	
Effective Green, g (s)	3.4	8.6		15.7	20.9	26.9	1.9	38.9		6.0	43.0	
Actuated g/C Ratio	0.04	0.10		0.18	0.25	0.32	0.02	0.46		0.07	0.50	
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	70	175		632	457	574	39	2254		241	2560	
v/s Ratio Prot	0.03	0.05		c0.16	0.06	c0.04	0.02	c0.38		c0.05	0.28	
v/s Ratio Perm						0.18						
v/c Ratio	0.66	0.46		0.89	0.24	0.61	0.72	0.83		0.77	0.56	
Uniform Delay, d1	40.3	36.1		33.9	25.8	24.7	41.4	20.2		38.9	14.6	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	20.1	1.9		14.9	0.3	1.8	47.4	2.7		13.6	0.3	
Delay (s)	60.4	38.0		48.8	26.0	26.5	88.8	22.9		52.5	14.9	
Level of Service	E	D		D	C	C	F	C		D	B	
Approach Delay (s)		44.4			38.2			23.8			19.2	
Approach LOS		D			D			C			B	























Intersection Summary

HCM 2000 Control Delay	26.2	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.86		
Actuated Cycle Length (s)	85.2	Sum of lost time (s)	16.0
Intersection Capacity Utilization	71.3%	ICU Level of Service	C
Analysis Period (min)	15		




















c Critical Lane Group

HCM Unsignalized Intersection Capacity Analysis
43: Vasco Rd & I-580 WB Ramps

BART to Livermore Extension Project
2040 No Project AM


























												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations								  			  	
Traffic Volume (veh/h)	0	0	0	0	0	162	0	1042	0	0	1957	0
Future Volume (Veh/h)	0	0	0	0	0	162	0	1042	0	0	1957	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	0	0	0	176	0	1133	0	0	2127	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage (veh)												
Upstream signal (ft)											524	
pX, platoon unblocked												
vC, conflicting volume	2681	3260	709	1842	3260	378	2127			1133		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	2681	3260	709	1842	3260	378	2127			1133		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	100	100	72	100			100		
cM capacity (veh/h)	8	9	377	47	9	620	252			612		
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	NB 4	SB 1	SB 2	SB 3	SB 4		
Volume Total	0	176	378	378	378	0	709	709	709	0		
Volume Left	0	0	0	0	0	0	0	0	0	0		
Volume Right	0	176	0	0	0	0	0	0	0	0		
cSH	1700	620	1700	1700	1700	1700	1700	1700	1700	1700		
Volume to Capacity	0.00	0.28	0.22	0.22	0.22	0.00	0.42	0.42	0.42	0.00		
Queue Length 95th (ft)	0	29	0	0	0	0	0	0	0	0		
Control Delay (s)	0.0	13.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
Lane LOS	A	B										
Approach Delay (s)	0.0	13.1	0.0				0.0					
Approach LOS	A	B										
Intersection Summary												
Average Delay			0.7									
Intersection Capacity Utilization			41.1%		ICU Level of Service				A			
Analysis Period (min)			15									

HCM Unsignalized Intersection Capacity Analysis
 44: Vasco Rd & I-580 EB Ramps

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	0	0	0	0	1056	0	73	2087	0
Future Volume (Veh/h)	0	0	0	0	0	0	0	1056	0	73	2087	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	0	0	0	0	0	1148	0	79	2268	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	2809	3574	756	2062	3574	383	2268			1148		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	2809	3574	756	2062	3574	383	2268			1148		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	100	100	100	100			87		
cM capacity (veh/h)	8	5	351	29	5	615	222			604		
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	NB 4	SB 1	SB 2	SB 3	SB 4		
Volume Total	0	0	383	383	383	0	79	756	756	756		
Volume Left	0	0	0	0	0	0	79	0	0	0		
Volume Right	0	0	0	0	0	0	0	0	0	0		
cSH	1700	1700	1700	1700	1700	1700	604	1700	1700	1700		
Volume to Capacity	0.00	0.00	0.23	0.23	0.23	0.00	0.13	0.44	0.44	0.44		
Queue Length 95th (ft)	0	0	0	0	0	0	11	0	0	0		
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	11.9	0.0	0.0	0.0		
Lane LOS	A	A					B					
Approach Delay (s)	0.0	0.0	0.0				0.4					
Approach LOS	A	A										
Intersection Summary												
Average Delay			0.3									
Intersection Capacity Utilization			43.7%		ICU Level of Service				A			
Analysis Period (min)			15									

HCM Signalized Intersection Capacity Analysis
45: Vasco Rd & East Ave

BART to Livermore Extension Project
2040 No Project AM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		 			 			 		 		
Traffic Volume (vph)	298	369	53	10	26	19	67	255	197	260	294	305
Future Volume (vph)	298	369	53	10	26	19	67	255	197	260	294	305
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	0.95		0.97	1.00	1.00
Frt	1.00	0.98		1.00	0.94		1.00	0.93		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	3472		1770	3312		1770	3308		3433	1863	1583
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1770	3472		1770	3312		1770	3308		3433	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	324	401	58	11	28	21	73	277	214	283	320	332
RTOR Reduction (vph)	0	19	0	0	19	0	0	159	0	0	0	233
Lane Group Flow (vph)	324	440	0	11	30	0	73	332	0	283	320	99
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												6
Actuated Green, G (s)	12.5	17.0		0.7	5.2		3.1	13.5		5.2	15.6	15.6
Effective Green, g (s)	12.5	17.0		0.7	5.2		3.1	13.5		5.2	15.6	15.6
Actuated g/C Ratio	0.24	0.32		0.01	0.10		0.06	0.26		0.10	0.30	0.30
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	422	1126		23	328		104	852		340	554	471
v/s Ratio Prot	c0.18	c0.13		0.01	0.01		0.04	0.10		c0.08	c0.17	
v/s Ratio Perm												0.06
v/c Ratio	0.77	0.39		0.48	0.09		0.70	0.39		0.83	0.58	0.21
Uniform Delay, d1	18.6	13.7		25.7	21.5		24.2	16.1		23.2	15.6	13.8
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	8.2	0.2		14.8	0.1		19.2	0.3		15.8	1.5	0.2
Delay (s)	26.8	13.9		40.5	21.6		43.4	16.3		39.0	17.1	14.0
Level of Service	C	B		D	C		D	B		D	B	B
Approach Delay (s)		19.2			25.0			19.9			22.6	
Approach LOS		B			C			B			C	
Intersection Summary												
HCM 2000 Control Delay			20.9	HCM 2000 Level of Service				C				
HCM 2000 Volume to Capacity ratio			0.70									
Actuated Cycle Length (s)			52.4	Sum of lost time (s)				16.0				
Intersection Capacity Utilization			54.0%	ICU Level of Service				A				
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis
46: Greenville Rd & I-580 WB Ramps

BART to Livermore Extension Project
2040 No Project AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↔		↔		↕	↔		↕	↔
Traffic Volume (vph)	0	0	0	235	0	38	0	122	367	0	942	521
Future Volume (vph)	0	0	0	235	0	38	0	122	367	0	942	521
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0		4.0		4.0	4.0		4.0	
Lane Util. Factor				0.97		1.00		0.95	1.00		0.95	
Frt				1.00		0.85		1.00	0.85		0.95	
Flt Protected				0.95		1.00		1.00	1.00		1.00	
Satd. Flow (prot)				3433		1583		3539	1583		3350	
Flt Permitted				0.95		1.00		1.00	1.00		1.00	
Satd. Flow (perm)				3433		1583		3539	1583		3350	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	255	0	41	0	133	399	0	1024	566
RTOR Reduction (vph)	0	0	0	0	0	35	0	0	127	0	149	0
Lane Group Flow (vph)	0	0	0	255	0	6	0	133	272	0	1441	0
Turn Type				Prot		Prot		NA	Perm		NA	
Protected Phases				3		3		2			6	
Permitted Phases									2			
Actuated Green, G (s)				7.9		7.9		34.1	34.1		34.1	
Effective Green, g (s)				7.9		7.9		34.1	34.1		34.1	
Actuated g/C Ratio				0.16		0.16		0.68	0.68		0.68	
Clearance Time (s)				4.0		4.0		4.0	4.0		4.0	
Vehicle Extension (s)				3.0		3.0		3.0	3.0		3.0	
Lane Grp Cap (vph)				542		250		2413	1079		2284	
v/s Ratio Prot				c0.07		0.00		0.04			c0.43	
v/s Ratio Perm									0.17			
v/c Ratio				0.47		0.03		0.06	0.25		0.63	
Uniform Delay, d1				19.1		17.8		2.6	3.1		4.4	
Progression Factor				1.00		1.00		1.00	4.68		1.00	
Incremental Delay, d2				0.6		0.0		0.0	0.6		1.3	
Delay (s)				19.8		17.8		2.7	14.9		5.8	
Level of Service				B		B		A	B		A	
Approach Delay (s)		0.0			19.5			11.8			5.8	
Approach LOS		A			B			B			A	

Intersection Summary			
HCM 2000 Control Delay	8.8	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.60		
Actuated Cycle Length (s)	50.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	56.1%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
47: Greenville Rd & I-580 EB Ramps

BART to Livermore Extension Project
2040 No Project AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗		↖					↖↗	↖		↖↗	↖
Traffic Volume (vph)	37	0	142	0	0	0	0	462	74	0	892	30
Future Volume (vph)	37	0	142	0	0	0	0	462	74	0	892	30
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0					4.0	4.0		4.0	4.0
Lane Util. Factor	0.97		1.00					0.95	1.00		0.95	1.00
Frt	1.00		0.85					1.00	0.85		1.00	0.85
Flt Protected	0.95		1.00					1.00	1.00		1.00	1.00
Satd. Flow (prot)	3433		1583					3539	1583		3539	1583
Flt Permitted	0.95		1.00					1.00	1.00		1.00	1.00
Satd. Flow (perm)	3433		1583					3539	1583		3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	40	0	154	0	0	0	0	502	80	0	970	33
RTOR Reduction (vph)	0	0	105	0	0	0	0	0	23	0	0	9
Lane Group Flow (vph)	40	0	49	0	0	0	0	502	57	0	970	24
Turn Type	Prot		Prot					NA	Perm		NA	Perm
Protected Phases	7		7					2			6	
Permitted Phases									2			6
Actuated Green, G (s)	6.3		6.3					35.7	35.7		35.7	35.7
Effective Green, g (s)	6.3		6.3					35.7	35.7		35.7	35.7
Actuated g/C Ratio	0.13		0.13					0.71	0.71		0.71	0.71
Clearance Time (s)	4.0		4.0					4.0	4.0		4.0	4.0
Vehicle Extension (s)	3.0		3.0					3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	432		199					2526	1130		2526	1130
v/s Ratio Prot	0.01		c0.03					0.14			c0.27	
v/s Ratio Perm									0.04			0.01
v/c Ratio	0.09		0.25					0.20	0.05		0.38	0.02
Uniform Delay, d1	19.3		19.7					2.4	2.1		2.8	2.1
Progression Factor	1.00		1.00					0.75	0.44		0.75	0.62
Incremental Delay, d2	0.1		0.7					0.2	0.1		0.4	0.0
Delay (s)	19.4		20.4					2.0	1.0		2.5	1.3
Level of Service	B		C					A	A		A	A
Approach Delay (s)		20.2			0.0			1.8			2.4	
Approach LOS		C			A			A			A	

Intersection Summary

HCM 2000 Control Delay	4.2	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.36		
Actuated Cycle Length (s)	50.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	40.1%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
48: Greenville Rd & Northfront Road/Altamont Pass Road

BART to Livermore Extension Project
2040 No Project AM



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↑	↑	↑	↑	↑
Traffic Volume (vph)	7	651	643	507	91	60
Future Volume (vph)	7	651	643	507	91	60
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	1863	1583	1770	1863	1770	1583
Flt Permitted	1.00	1.00	0.75	1.00	0.95	1.00
Satd. Flow (perm)	1863	1583	1402	1863	1770	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	8	708	699	551	99	65
RTOR Reduction (vph)	0	252	0	0	0	53
Lane Group Flow (vph)	8	456	699	551	99	12
Turn Type	NA	Perm	Perm	NA	Prot	Perm
Protected Phases	4			8	2	
Permitted Phases		4	8			2
Actuated Green, G (s)	29.4	29.4	29.4	29.4	8.2	8.2
Effective Green, g (s)	29.4	29.4	29.4	29.4	8.2	8.2
Actuated g/C Ratio	0.64	0.64	0.64	0.64	0.18	0.18
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	1201	1020	903	1201	318	284
v/s Ratio Prot	0.00			0.30	c0.06	
v/s Ratio Perm		0.29	c0.50			0.01
v/c Ratio	0.01	0.45	0.77	0.46	0.31	0.04
Uniform Delay, d1	2.9	4.0	5.7	4.1	16.2	15.5
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.0	0.3	4.2	0.3	0.6	0.1
Delay (s)	2.9	4.4	9.9	4.4	16.8	15.5
Level of Service	A	A	A	A	B	B
Approach Delay (s)	4.3			7.5	16.3	
Approach LOS	A			A	B	

Intersection Summary

HCM 2000 Control Delay	7.1	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.67		
Actuated Cycle Length (s)	45.6	Sum of lost time (s)	8.0
Intersection Capacity Utilization	82.6%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
49: Greenville Rd & Southfront Rd



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	122	167	130	440	754	219
Future Volume (vph)	122	167	130	440	754	219
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.2	5.2	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.88	0.97	0.95	0.95	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	3433	2787	3433	3539	3539	1583
Flt Permitted	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (perm)	3433	2787	3433	3539	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	133	182	141	478	820	238
RTOR Reduction (vph)	0	163	0	0	0	86
Lane Group Flow (vph)	133	19	141	478	820	152
Turn Type	Prot	Perm	Prot	NA	NA	Perm
Protected Phases	8		1	6	2	
Permitted Phases		8				2
Actuated Green, G (s)	11.3	11.3	12.3	78.4	62.1	62.1
Effective Green, g (s)	10.7	10.7	12.3	80.1	63.8	63.8
Actuated g/C Ratio	0.11	0.11	0.12	0.80	0.64	0.64
Clearance Time (s)	4.6	4.6	4.0	5.7	5.7	5.7
Vehicle Extension (s)	5.0	5.0	6.0	2.5	2.5	2.5
Lane Grp Cap (vph)	367	298	422	2834	2257	1009
v/s Ratio Prot	c0.04		c0.04	0.14	c0.23	
v/s Ratio Perm		0.01				0.10
v/c Ratio	0.36	0.07	0.33	0.17	0.36	0.15
Uniform Delay, d1	41.5	40.2	40.1	2.3	8.5	7.2
Progression Factor	1.00	1.00	1.00	1.00	0.91	0.96
Incremental Delay, d2	1.3	0.2	1.3	0.1	0.4	0.3
Delay (s)	42.8	40.3	41.4	2.4	8.2	7.2
Level of Service	D	D	D	A	A	A
Approach Delay (s)	41.4			11.3	8.0	
Approach LOS	D			B	A	

Intersection Summary

HCM 2000 Control Delay	14.3	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.36		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	13.2
Intersection Capacity Utilization	39.0%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
50: Greenville Rd & Patterson Pass Rd

BART to Livermore Extension Project
2040 No Project AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	42	6	70	253	403	349	16	146	1	6	340	47
Future Volume (vph)	42	6	70	253	403	349	16	146	1	6	340	47
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.86		1.00	0.93		1.00	1.00		1.00	0.98	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1607		1770	1733		1770	1861		1770	1829	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	1607		1770	1733		1770	1861		1770	1829	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	46	7	76	275	438	379	17	159	1	7	370	51
RTOR Reduction (vph)	0	58	0	0	34	0	0	0	0	0	6	0
Lane Group Flow (vph)	46	25	0	275	783	0	17	160	0	7	415	0
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												
Actuated Green, G (s)	2.2	19.7		22.8	40.3		1.4	25.8		0.7	25.1	
Effective Green, g (s)	2.2	19.7		22.8	40.3		1.4	25.8		0.7	25.1	
Actuated g/C Ratio	0.03	0.23		0.27	0.47		0.02	0.30		0.01	0.30	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	45	372		474	821		29	564		14	540	
v/s Ratio Prot	c0.03	0.02		0.16	c0.45		c0.01	0.09		0.00	c0.23	
v/s Ratio Perm												
v/c Ratio	1.02	0.07		0.58	0.95		0.59	0.28		0.50	0.77	
Uniform Delay, d1	41.4	25.5		27.0	21.5		41.5	22.6		42.0	27.3	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	140.7	0.1		1.8	20.8		26.8	1.3		25.4	10.1	
Delay (s)	182.1	25.5		28.8	42.2		68.3	23.8		67.4	37.4	
Level of Service	F	C		C	D		E	C		E	D	
Approach Delay (s)		81.4			38.8			28.1			37.9	
Approach LOS		F			D			C			D	

Intersection Summary

HCM 2000 Control Delay	40.6	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.88		
Actuated Cycle Length (s)	85.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	70.0%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
1: Dougherty Rd & Amador Valley Rd



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	386	468	823	2086	1132	313
Future Volume (vph)	386	468	823	2086	1132	313
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00	0.97	0.91	0.91	
Frt	1.00	0.85	1.00	1.00	0.97	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1770	1583	3433	5085	4920	
Flt Permitted	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	1770	1583	3433	5085	4920	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	420	509	895	2267	1230	340
RTOR Reduction (vph)	0	367	0	0	41	0
Lane Group Flow (vph)	420	142	895	2267	1529	0
Turn Type	Perm	Perm	Prot	NA	NA	
Protected Phases			5	2	6	
Permitted Phases	4	4				
Actuated Green, G (s)	30.6	30.6	32.6	77.1	40.5	
Effective Green, g (s)	30.6	30.6	32.6	77.1	40.5	
Actuated g/C Ratio	0.26	0.26	0.28	0.67	0.35	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	468	418	967	3388	1722	
v/s Ratio Prot			c0.26	0.45	c0.31	
v/s Ratio Perm	c0.24	0.09				
v/c Ratio	0.90	0.34	0.93	0.67	0.89	
Uniform Delay, d1	41.0	34.4	40.4	11.6	35.5	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	19.5	0.5	14.2	0.5	6.0	
Delay (s)	60.5	34.9	54.5	12.1	41.4	
Level of Service	E	C	D	B	D	
Approach Delay (s)	46.5			24.1	41.4	
Approach LOS	D			C	D	

Intersection Summary

HCM 2000 Control Delay	32.6	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.90		
Actuated Cycle Length (s)	115.7	Sum of lost time (s)	12.0
Intersection Capacity Utilization	83.7%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
2: Hopyard Road/Dougherty Rd & Dublin Blvd



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↑↑↑	↖↗	↖↗↘	↑↑↑	↖	↖↗↘	↑↑↑	↖↗	↖↗	↑↑↑	↖↗
Traffic Volume (vph)	94	1148	902	625	1052	911	858	1998	321	698	1224	39
Future Volume (vph)	94	1148	902	625	1052	911	858	1998	321	698	1224	39
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	6.0	5.0	5.0	5.5	5.0	5.0	5.5	5.0	5.0	5.5	
Lane Util. Factor	0.97	0.91	0.88	0.94	0.91	1.00	0.94	0.91	0.88	0.97	0.86	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	3433	5085	2787	4990	5085	1583	4990	5085	2787	3433	6378	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	3433	5085	2787	4990	5085	1583	4990	5085	2787	3433	6378	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	102	1248	980	679	1143	990	933	2172	349	759	1330	42
RTOR Reduction (vph)	0	0	60	0	0	70	0	0	57	0	4	0
Lane Group Flow (vph)	102	1248	920	679	1143	920	933	2172	292	759	1368	0
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	
Protected Phases	5	2	3	1	6	7	3	8	1	7	4	
Permitted Phases			2			6			8			
Actuated Green, G (s)	17.3	35.5	55.2	19.0	37.7	51.7	19.7	45.0	64.0	14.0	39.3	
Effective Green, g (s)	17.3	35.5	55.2	19.0	37.7	51.7	19.7	45.0	64.0	14.0	39.3	
Actuated g/C Ratio	0.13	0.26	0.41	0.14	0.28	0.38	0.15	0.33	0.47	0.10	0.29	
Clearance Time (s)	5.0	6.0	5.0	5.0	5.5	5.0	5.0	5.5	5.0	5.0	5.5	
Vehicle Extension (s)	2.0	4.5	2.0	2.0	4.5	2.0	2.0	4.5	2.0	2.0	4.5	
Lane Grp Cap (vph)	439	1337	1139	702	1420	606	728	1695	1321	356	1856	
v/s Ratio Prot	0.03	c0.25	0.12	0.14	0.22	c0.16	0.19	c0.43	0.03	c0.22	0.21	
v/s Ratio Perm			0.21			0.42			0.07			
v/c Ratio	0.23	0.93	0.81	0.97	0.80	1.52	1.28	1.28	0.22	2.13	0.74	
Uniform Delay, d1	52.9	48.6	35.2	57.7	45.2	41.6	57.6	45.0	20.9	60.5	43.2	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.1	12.3	4.1	25.6	3.8	241.8	137.1	131.3	0.0	518.8	1.8	
Delay (s)	53.0	60.9	39.3	83.3	49.0	283.4	194.8	176.3	20.9	579.3	45.0	
Level of Service	D	E	D	F	D	F	F	F	C	F	D	
Approach Delay (s)		51.4			139.8			165.6			235.3	
Approach LOS		D			F			F			F	

Intersection Summary

HCM 2000 Control Delay	147.9	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.43		
Actuated Cycle Length (s)	135.0	Sum of lost time (s)	21.5
Intersection Capacity Utilization	120.4%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
3: Dougherty Rd/Hopyard Road & I-580 WB Ramps



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↔↔		↔↔		↑↑↑			↑↑↑	↔
Traffic Volume (vph)	0	0	0	325	0	671	0	2534	0	0	1653	0
Future Volume (vph)	0	0	0	325	0	671	0	2534	0	0	1653	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0		4.0		4.0			4.0	
Lane Util. Factor				0.97		0.88		0.91			0.86	
Frt				1.00		0.85		1.00			1.00	
Flt Protected				0.95		1.00		1.00			1.00	
Satd. Flow (prot)				3433		2787		5085			4806	
Flt Permitted				0.95		1.00		1.00			1.00	
Satd. Flow (perm)				3433		2787		5085			4806	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	353	0	729	0	2754	0	0	1797	0
RTOR Reduction (vph)	0	0	0	0	0	17	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	353	0	712	0	2754	0	0	1797	0
Turn Type				Prot		Prot		NA			NA	Perm
Protected Phases				4		4		2			6	
Permitted Phases												6
Actuated Green, G (s)				31.1		31.1		68.1			68.1	
Effective Green, g (s)				32.5		32.5		69.5			69.5	
Actuated g/C Ratio				0.30		0.30		0.63			0.63	
Clearance Time (s)				5.4		5.4		5.4			5.4	
Vehicle Extension (s)				3.0		3.0		3.0			3.0	
Lane Grp Cap (vph)				1014		823		3212			3036	
v/s Ratio Prot				0.10		c0.26		c0.54			0.37	
v/s Ratio Perm												
v/c Ratio				0.35		0.87		0.86			0.59	
Uniform Delay, d1				30.4		36.7		16.3			11.9	
Progression Factor				1.00		1.00		0.88			1.00	
Incremental Delay, d2				0.2		9.4		0.3			0.9	
Delay (s)				30.6		46.1		14.7			12.8	
Level of Service				C		D		B			B	
Approach Delay (s)		0.0			41.1			14.7			12.8	
Approach LOS		A			D			B			B	

Intersection Summary

HCM 2000 Control Delay	19.1	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.86		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	79.1%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 4: Hopyard Rd/Dougherty Rd & I-580 EB Ramps



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↗↘		↗↘					↑↑↑	↗		↑↑↑	↗
Traffic Volume (vph)	1155	0	980	0	0	0	0	2647	0	0	1310	0
Future Volume (vph)	1155	0	980	0	0	0	0	2647	0	0	1310	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0					4.0			4.0	
Lane Util. Factor	0.97		0.88					0.91			0.86	
Frt	1.00		0.85					1.00			1.00	
Flt Protected	0.95		1.00					1.00			1.00	
Satd. Flow (prot)	3433		2787					5085			4806	
Flt Permitted	0.95		1.00					1.00			1.00	
Satd. Flow (perm)	3433		2787					5085			4806	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	1255	0	1065	0	0	0	0	2877	0	0	1424	0
RTOR Reduction (vph)	0	0	41	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	1255	0	1024	0	0	0	0	2877	0	0	1424	0
Turn Type	Prot		Prot					NA	Free		NA	Perm
Protected Phases	4		4					2			6	
Permitted Phases									Free			6
Actuated Green, G (s)	38.6		38.6					60.6			60.6	
Effective Green, g (s)	40.0		40.0					62.0			62.0	
Actuated g/C Ratio	0.36		0.36					0.56			0.56	
Clearance Time (s)	5.4		5.4					5.4			5.4	
Vehicle Extension (s)	3.0		3.0					3.0			3.0	
Lane Grp Cap (vph)	1248		1013					2866			2708	
v/s Ratio Prot	0.37		c0.37					c0.57			0.30	
v/s Ratio Perm												
v/c Ratio	1.01		1.01					1.00			0.53	
Uniform Delay, d1	35.0		35.0					24.0			14.9	
Progression Factor	1.00		1.00					1.00			1.77	
Incremental Delay, d2	26.8		31.0					17.7			0.6	
Delay (s)	61.8		66.0					41.7			27.0	
Level of Service	E		E					D			C	
Approach Delay (s)		63.8			0.0			41.7			27.0	
Approach LOS		E			A			D			C	

Intersection Summary			
HCM 2000 Control Delay	46.3	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	1.01		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	90.8%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 5: Hopyard Rd & Owens Rd

BART to Livermore Extension Project
 2040 No Project PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	389	276	250	518	291	361	244	986	302	488	1582	267
Future Volume (vph)	389	276	250	518	291	361	244	986	302	488	1582	267
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	2.7	2.7		2.7	2.7	2.7	4.0	2.3	2.3	4.0	2.3	
Lane Util. Factor	0.91	0.91		1.00	0.95	0.95	1.00	0.91	1.00	0.97	0.91	
Frt	1.00	0.95		1.00	0.96	0.85	1.00	1.00	0.85	1.00	0.98	
Flt Protected	0.95	0.99		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1610	3169		1770	1696	1504	1770	5085	1583	3433	4975	
Flt Permitted	0.95	0.99		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1610	3169		1770	1696	1504	1770	5085	1583	3433	4975	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	423	300	272	563	316	392	265	1072	328	530	1720	290
RTOR Reduction (vph)	0	55	0	0	11	25	0	0	229	0	19	0
Lane Group Flow (vph)	233	707	0	563	427	245	265	1072	99	530	1991	0
Turn Type	Split	NA		Split	NA	pm+ov	Prot	NA	Perm	Prot	NA	
Protected Phases	8	8		4	4	1	5	2		1	6	
Permitted Phases						4			2			
Actuated Green, G (s)	18.0	18.0		28.0	28.0	51.6	15.0	34.4	34.4	23.6	43.0	
Effective Green, g (s)	19.3	19.3		29.3	29.3	54.2	15.0	36.1	36.1	23.6	44.7	
Actuated g/C Ratio	0.16	0.16		0.24	0.24	0.45	0.12	0.30	0.30	0.20	0.37	
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	258	509		432	414	713	221	1529	476	675	1853	
v/s Ratio Prot	0.14	c0.22		c0.32	0.25	0.07	c0.15	0.21		0.15	c0.40	
v/s Ratio Perm						0.09			0.06			
v/c Ratio	0.90	1.39		1.30	1.03	0.34	1.20	0.70	0.21	0.79	1.07	
Uniform Delay, d1	49.4	50.4		45.4	45.4	21.4	52.5	37.2	31.3	45.8	37.6	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	31.6	186.6		152.5	52.3	0.3	124.8	2.7	1.0	6.0	44.1	
Delay (s)	81.1	236.9		197.8	97.7	21.7	177.3	39.9	32.3	51.8	81.7	
Level of Service	F	F		F	F	C	F	D	C	D	F	
Approach Delay (s)		200.4			125.9			60.3			75.5	
Approach LOS		F			F			E			E	

Intersection Summary

HCM 2000 Control Delay	100.7	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.21		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	11.7
Intersection Capacity Utilization	110.0%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

6: Hopyard Rd & Stoneridge Dr



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	276	1181	698	120	1369	198	618	864	89	263	901	204
Future Volume (vph)	276	1181	698	120	1369	198	618	864	89	263	901	204
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.91	1.00	0.97	0.91	1.00	0.94	0.95	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5085	1583	3433	5085	1583	4990	3539	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5085	1583	3433	5085	1583	4990	3539	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	300	1284	759	130	1488	215	672	939	97	286	979	222
RTOR Reduction (vph)	0	0	174	0	0	143	0	0	68	0	0	156
Lane Group Flow (vph)	300	1284	585	130	1488	72	672	939	29	286	979	66
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8			2			6
Actuated Green, G (s)	9.0	35.0	35.0	4.0	30.0	30.0	13.0	26.6	26.6	8.0	21.6	21.6
Effective Green, g (s)	9.0	35.0	35.0	4.0	30.0	30.0	13.0	26.6	26.6	8.0	21.6	21.6
Actuated g/C Ratio	0.10	0.39	0.39	0.04	0.33	0.33	0.15	0.30	0.30	0.09	0.24	0.24
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	344	1986	618	153	1702	530	723	1050	469	306	1225	381
v/s Ratio Prot	c0.09	0.25		0.04	0.29		c0.13	c0.27		0.08	0.19	
v/s Ratio Perm			c0.37			0.05			0.02			0.04
v/c Ratio	0.87	0.65	0.95	0.85	0.87	0.14	0.93	0.89	0.06	0.93	0.80	0.17
Uniform Delay, d1	39.7	22.3	26.4	42.5	28.0	20.8	37.8	30.2	22.6	40.5	32.0	26.9
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	20.8	0.7	23.7	33.2	5.3	0.1	18.2	9.9	0.1	34.4	3.7	0.2
Delay (s)	60.5	23.0	50.1	75.7	33.3	20.9	56.0	40.0	22.6	75.0	35.7	27.1
Level of Service	E	C	D	E	C	C	E	D	C	E	D	C
Approach Delay (s)		36.6			34.9			45.3			42.0	
Approach LOS		D			C			D			D	

Intersection Summary

HCM 2000 Control Delay	39.3	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.98		
Actuated Cycle Length (s)	89.6	Sum of lost time (s)	16.0
Intersection Capacity Utilization	79.0%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

7: Hopyard Rd & Las Positas Blvd

BART to Livermore Extension Project

2040 No Project PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	103	261	492	601	419	50	381	999	265	71	1516	73
Future Volume (vph)	103	261	492	601	419	50	381	999	265	71	1516	73
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.95	1.00	0.97	0.95	1.00	0.97	0.91	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	3433	3539	1583	3433	5085	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	3433	3539	1583	3433	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	112	284	535	653	455	54	414	1086	288	77	1648	79
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	51
Lane Group Flow (vph)	112	284	535	653	455	54	414	1086	288	77	1648	28
Turn Type	Prot	NA	Free	Prot	NA	Free	Prot	NA	Free	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1		6
Permitted Phases			Free			Free			Free			6
Actuated Green, G (s)	4.8	13.0	87.9	17.0	25.2	87.9	11.0	37.9	87.9	4.0	30.9	30.9
Effective Green, g (s)	4.8	13.0	87.9	17.0	25.2	87.9	11.0	37.9	87.9	4.0	30.9	30.9
Actuated g/C Ratio	0.05	0.15	1.00	0.19	0.29	1.00	0.13	0.43	1.00	0.05	0.35	0.35
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	187	523	1583	663	1014	1583	429	2192	1583	156	1787	556
v/s Ratio Prot	0.03	c0.08		c0.19	0.13		c0.12	0.21		0.02	c0.32	
v/s Ratio Perm			0.34			0.03			0.18			0.02
v/c Ratio	0.60	0.54	0.34	0.98	0.45	0.03	0.97	0.50	0.18	0.49	0.92	0.05
Uniform Delay, d1	40.6	34.7	0.0	35.3	25.7	0.0	38.3	18.1	0.0	41.0	27.3	18.8
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	5.1	1.2	0.6	30.9	0.3	0.0	34.2	0.2	0.3	2.4	8.4	0.0
Delay (s)	45.7	35.9	0.6	66.2	26.0	0.0	72.4	18.3	0.3	43.4	35.7	18.8
Level of Service	D	D	A	E	C	A	E	B	A	D	D	B
Approach Delay (s)		16.8			47.4			27.9			35.3	
Approach LOS		B			D			C			D	

Intersection Summary

HCM 2000 Control Delay	32.4	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.87		
Actuated Cycle Length (s)	87.9	Sum of lost time (s)	16.0
Intersection Capacity Utilization	77.9%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
8: Willow Rd & Owens Rd

BART to Livermore Extension Project
2040 No Project PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↖↗↘		↖↗	↖↗↘	↖	↖	↖↗	↖	↖	↖	↖
Traffic Volume (vph)	76	843	188	134	674	76	187	76	0	181	60	99
Future Volume (vph)	76	843	188	134	674	76	187	76	0	181	60	99
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	5.3	4.0		5.3	4.0	4.0
Lane Util. Factor	0.97	0.91		0.97	0.91	1.00	1.00	0.95		1.00	1.00	1.00
Frt	1.00	0.97		1.00	1.00	0.85	1.00	1.00		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	4946		3433	5085	1583	1770	3539		1770	1863	1583
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.71	1.00		0.70	1.00	1.00
Satd. Flow (perm)	3433	4946		3433	5085	1583	1331	3539		1304	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	83	916	204	146	733	83	203	83	0	197	65	108
RTOR Reduction (vph)	0	23	0	0	0	32	0	0	0	0	0	85
Lane Group Flow (vph)	83	1097	0	146	733	51	203	83	0	197	65	23
Turn Type	Prot	NA		Prot	NA	Perm	Perm	NA	Perm	Perm	NA	Perm
Protected Phases	1	6		5	2			4			8	
Permitted Phases						2	4		4	8		8
Actuated Green, G (s)	6.8	61.8		10.8	65.8	65.8	22.4	22.4		22.4	22.4	22.4
Effective Green, g (s)	6.8	63.5		10.8	67.5	67.5	22.4	23.7		22.4	23.7	23.7
Actuated g/C Ratio	0.06	0.58		0.10	0.61	0.61	0.20	0.22		0.20	0.22	0.22
Clearance Time (s)	4.0	5.7		4.0	5.7	5.7	5.3	5.3		5.3	5.3	5.3
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	212	2855		337	3120	971	271	762		265	401	341
v/s Ratio Prot	0.02	c0.22		c0.04	0.14			0.02			0.03	
v/s Ratio Perm						0.03	c0.15			0.15		0.01
v/c Ratio	0.39	0.38		0.43	0.23	0.05	0.75	0.11		0.74	0.16	0.07
Uniform Delay, d1	49.6	12.6		46.7	9.6	8.5	41.2	34.7		41.1	35.1	34.4
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	1.2	0.4		0.9	0.2	0.1	10.8	0.1		10.7	0.2	0.1
Delay (s)	50.8	13.0		47.6	9.8	8.6	51.9	34.7		51.8	35.3	34.4
Level of Service	D	B		D	A	A	D	C		D	D	C
Approach Delay (s)		15.6			15.4			47.0			43.8	
Approach LOS		B			B			D			D	

Intersection Summary

HCM 2000 Control Delay	22.4	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.47		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	51.3%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
9: Hacienda Dr & Dublin Blvd

BART to Livermore Extension Project
2040 No Project PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↑↑↑	↖↗	↖↗	↑↑↑		↖↗	↑↑	↖↗	↖↗	↑↑↑	↖↗
Traffic Volume (vph)	50	1082	168	240	606	27	387	652	552	38	695	216
Future Volume (vph)	50	1082	168	240	606	27	387	652	552	38	695	216
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	6.0	5.0	4.5	6.0		5.0	6.0	6.0	4.5	5.5	5.5
Lane Util. Factor	0.97	0.91	0.88	0.97	0.91		0.94	0.95	0.88	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5085	2787	3433	5053		4990	3539	2787	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5085	2787	3433	5053		4990	3539	2787	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	54	1176	183	261	659	29	421	709	600	41	755	235
RTOR Reduction (vph)	0	0	62	0	4	0	0	0	198	0	0	159
Lane Group Flow (vph)	54	1176	121	261	684	0	421	709	402	41	755	76
Turn Type	Prot	NA	pm+ov	Prot	NA		Prot	NA	Perm	Prot	NA	Perm
Protected Phases	5	2	3	1	6		3	8		7		4
Permitted Phases			2						8			4
Actuated Green, G (s)	4.1	33.5	45.8	10.1	39.5		12.3	34.4	34.4	2.2	24.3	24.3
Effective Green, g (s)	4.1	33.5	45.8	10.1	39.5		12.3	34.4	34.4	2.2	24.3	24.3
Actuated g/C Ratio	0.04	0.33	0.45	0.10	0.39		0.12	0.34	0.34	0.02	0.24	0.24
Clearance Time (s)	4.5	6.0	5.0	4.5	6.0		5.0	6.0	6.0	4.5	5.5	5.5
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	139	1683	1399	342	1972		606	1202	947	74	1221	380
v/s Ratio Prot	0.02	c0.23	0.01	c0.08	0.14		c0.08	0.20		0.01	c0.15	
v/s Ratio Perm			0.03						0.14			0.05
v/c Ratio	0.39	0.70	0.09	0.76	0.35		0.69	0.59	0.42	0.55	0.62	0.20
Uniform Delay, d1	47.3	29.5	15.8	44.4	21.8		42.6	27.6	25.8	49.0	34.3	30.7
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.8	1.3	0.0	9.7	0.1		3.5	0.7	0.3	8.7	0.9	0.3
Delay (s)	49.1	30.7	15.8	54.1	21.9		46.1	28.3	26.1	57.7	35.3	31.0
Level of Service	D	C	B	D	C		D	C	C	E	D	C
Approach Delay (s)		29.5			30.7			31.9			35.2	
Approach LOS		C			C			C			D	

Intersection Summary		
HCM 2000 Control Delay	31.7	HCM 2000 Level of Service C
HCM 2000 Volume to Capacity ratio	0.68	
Actuated Cycle Length (s)	101.2	Sum of lost time (s) 21.0
Intersection Capacity Utilization	66.6%	ICU Level of Service C
Analysis Period (min)	15	

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 10: Hacienda Dr & Martinelli Blvd/Hacienda Crossings

BART to Livermore Extension Project
 2040 No Project PM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	31	54	494	286	40	22	534	1568	466	57	1015	87
Future Volume (vph)	31	54	494	286	40	22	534	1568	466	57	1015	87
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	2.0	2.0	4.5	2.0		3.0	2.0	2.0	4.5	2.5	
Lane Util. Factor	1.00	0.91	0.91	0.97	1.00		0.94	0.91	1.00	0.97	0.86	
Frt	1.00	0.93	0.85	1.00	0.95		1.00	1.00	0.85	1.00	0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1770	1574	2882	3433	1763		4990	5085	1583	3433	6332	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1770	1574	2882	3433	1763		4990	5085	1583	3433	6332	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	34	59	537	311	43	24	580	1704	507	62	1103	95
RTOR Reduction (vph)	0	38	265	0	18	0	0	0	163	0	10	0
Lane Group Flow (vph)	34	75	218	311	49	0	580	1704	344	62	1188	0
Turn Type	Prot	NA	Perm	Prot	NA		Prot	NA	pm+ov	Prot	NA	
Protected Phases	5	2		1	6		3	8	1	7	4	
Permitted Phases			2						8			
Actuated Green, G (s)	3.6	17.0	17.0	13.8	27.2		13.7	56.9	70.7	6.3	49.5	
Effective Green, g (s)	3.1	19.0	19.0	13.3	29.2		14.7	58.9	74.7	5.8	51.0	
Actuated g/C Ratio	0.03	0.17	0.17	0.12	0.27		0.13	0.54	0.68	0.05	0.46	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	4.0	4.0	2.0	4.0		3.0	4.0	2.0	3.0	4.0	
Lane Grp Cap (vph)	49	271	497	415	467		666	2722	1103	181	2935	
v/s Ratio Prot	0.02	0.05		c0.09	0.03		c0.12	c0.34	0.04	0.02	c0.19	
v/s Ratio Perm			c0.08						0.17			
v/c Ratio	0.69	0.28	0.44	0.75	0.11		0.87	0.63	0.31	0.34	0.40	
Uniform Delay, d1	53.0	39.5	40.7	46.7	30.5		46.7	17.9	7.2	50.3	19.5	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.02	1.05	1.89	1.00	1.00	
Incremental Delay, d2	34.8	0.8	0.8	6.4	0.1		8.2	0.7	0.0	1.1	0.4	
Delay (s)	87.8	40.3	41.6	53.1	30.7		56.0	19.4	13.6	51.4	19.9	
Level of Service	F	D	D	D	C		E	B	B	D	B	
Approach Delay (s)		43.8			49.1			26.0			21.4	
Approach LOS		D			D			C			C	
Intersection Summary												
HCM 2000 Control Delay			28.8				HCM 2000 Level of Service				C	
HCM 2000 Volume to Capacity ratio			0.61									
Actuated Cycle Length (s)			110.0				Sum of lost time (s)				13.0	
Intersection Capacity Utilization			67.6%				ICU Level of Service				C	
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis
 11: Hacienda Dr & I-580 WB Ramps

BART to Livermore Extension Project
 2040 No Project PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↔↔		↔↔		↑↑↑			↑↑↑	↔
Traffic Volume (vph)	0	0	0	419	0	537	0	1773	810	0	951	799
Future Volume (vph)	0	0	0	419	0	537	0	1773	810	0	951	799
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				2.6		2.6		2.1			2.1	2.1
Lane Util. Factor				0.97		0.88		0.91			0.86	0.86
Frt				1.00		0.85		0.95			0.96	0.85
Flt Protected				0.95		1.00		1.00			1.00	1.00
Satd. Flow (prot)				3433		2787		4846			4593	1362
Flt Permitted				0.95		1.00		1.00			1.00	1.00
Satd. Flow (perm)				3433		2787		4846			4593	1362
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	455	0	584	0	1927	880	0	1034	868
RTOR Reduction (vph)	0	0	0	0	0	25	0	147	0	0	136	148
Lane Group Flow (vph)	0	0	0	455	0	559	0	2660	0	0	1332	286
Turn Type				Prot		Prot		NA			NA	Perm
Protected Phases				4		4		2			6	
Permitted Phases												6
Actuated Green, G (s)				12.7		12.7		34.3			34.3	34.3
Effective Green, g (s)				14.1		14.1		36.2			36.2	36.2
Actuated g/C Ratio				0.26		0.26		0.66			0.66	0.66
Clearance Time (s)				4.0		4.0		4.0			4.0	4.0
Vehicle Extension (s)				3.0		3.0		3.0			3.0	3.0
Lane Grp Cap (vph)				880		714		3189			3023	896
v/s Ratio Prot				0.13		c0.20		c0.55			0.29	
v/s Ratio Perm												0.21
v/c Ratio				0.52		0.78		0.83			0.44	0.32
Uniform Delay, d1				17.5		19.0		7.1			4.5	4.1
Progression Factor				1.00		1.00		0.84			0.61	1.27
Incremental Delay, d2				0.5		5.6		1.7			0.4	0.9
Delay (s)				18.0		24.6		7.7			3.2	6.0
Level of Service				B		C		A			A	A
Approach Delay (s)		0.0			21.7			7.7			3.8	
Approach LOS		A			C			A			A	

Intersection Summary			
HCM 2000 Control Delay	8.9	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.81		
Actuated Cycle Length (s)	55.0	Sum of lost time (s)	4.7
Intersection Capacity Utilization	77.8%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 12: Hacienda Dr & I-580 EB Ramps



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	897	0	464	0	0	0	0	1843	582	0	950	313
Future Volume (vph)	897	0	464	0	0	0	0	1843	582	0	950	313
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0					4.0	4.0		4.0	
Lane Util. Factor	0.97		0.88					0.86	0.86		0.91	
Frt	1.00		0.85					0.99	0.85		0.96	
Flt Protected	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (prot)	3433		2787					4742	1362		4896	
Flt Permitted	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (perm)	3433		2787					4742	1362		4896	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	975	0	504	0	0	0	0	2003	633	0	1033	340
RTOR Reduction (vph)	0	0	107	0	0	0	0	9	180	0	50	0
Lane Group Flow (vph)	975	0	397	0	0	0	0	2190	257	0	1323	0
Turn Type	Prot		Prot					NA	Perm		NA	
Protected Phases	4		4					2			6	
Permitted Phases									2			
Actuated Green, G (s)	35.9		35.9					62.8	62.8		62.8	
Effective Green, g (s)	37.3		37.3					64.7	64.7		64.7	
Actuated g/C Ratio	0.34		0.34					0.59	0.59		0.59	
Clearance Time (s)	5.4		5.4					5.9	5.9		5.9	
Vehicle Extension (s)	2.0		2.0					2.0	2.0		2.0	
Lane Grp Cap (vph)	1164		945					2789	801		2879	
v/s Ratio Prot	c0.28		0.14					c0.46			0.27	
v/s Ratio Perm									0.19			
v/c Ratio	0.84		0.42					0.79	0.32		0.46	
Uniform Delay, d1	33.6		28.0					17.3	11.5		12.8	
Progression Factor	1.00		1.00					1.00	1.00		0.70	
Incremental Delay, d2	5.2		0.1					2.3	1.1		0.5	
Delay (s)	38.7		28.1					19.6	12.6		9.4	
Level of Service	D		C					B	B		A	
Approach Delay (s)		35.1			0.0			18.5			9.4	
Approach LOS		D			A			B			A	

Intersection Summary

HCM 2000 Control Delay	20.7	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.80		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	72.2%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 13: Hacienda Dr & Owens Rd

BART to Livermore Extension Project
 2040 No Project PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↖	↗↗↗	↘	↖↖	↗↗↗	↘	↖↖	↗↗↗	↘	↖↖	↗↗↗	↘
Traffic Volume (vph)	679	961	55	147	364	871	27	734	269	606	515	278
Future Volume (vph)	679	961	55	147	364	871	27	734	269	606	515	278
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	2.3	4.0	4.0	2.3	4.0	4.0	2.7	4.0	4.0	2.7
Lane Util. Factor	0.97	0.91	1.00	0.97	0.91	1.00	0.97	0.91	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5085	1583	3433	5085	1583	3433	5085	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5085	1583	3433	5085	1583	3433	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	738	1045	60	160	396	947	29	798	292	659	560	302
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	738	1045	60	160	396	947	29	798	292	659	560	302
Turn Type	Prot	NA	Free	Prot	NA	Free	Prot	NA	Free	Prot	NA	Free
Protected Phases	1	6		5	2		7	4		3	8	
Permitted Phases			Free			Free			Free			Free
Actuated Green, G (s)	33.5	38.6	115.0	9.4	14.5	115.0	2.4	24.1	115.0	23.9	45.6	115.0
Effective Green, g (s)	33.5	40.3	115.0	9.4	16.2	115.0	2.4	25.4	115.0	23.9	46.9	115.0
Actuated g/C Ratio	0.29	0.35	1.00	0.08	0.14	1.00	0.02	0.22	1.00	0.21	0.41	1.00
Clearance Time (s)	4.0	5.7		4.0	5.7		4.0	5.3		4.0	5.3	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	1000	1781	1583	280	716	1583	71	1123	1583	713	2073	1583
v/s Ratio Prot	c0.21	0.21		0.05	0.08		0.01	c0.16		c0.19	0.11	
v/s Ratio Perm			0.04			c0.60			0.18			0.19
v/c Ratio	0.74	0.59	0.04	0.57	0.55	0.60	0.41	0.71	0.18	0.92	0.27	0.19
Uniform Delay, d1	36.8	30.5	0.0	50.9	46.0	0.0	55.6	41.4	0.0	44.7	22.7	0.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	2.9	0.5	0.0	2.8	0.9	1.7	3.8	3.8	0.3	17.7	0.3	0.3
Delay (s)	39.7	31.0	0.0	53.7	47.0	1.7	59.4	45.2	0.3	62.3	23.0	0.3
Level of Service	D	C	A	D	D	A	E	D	A	E	C	A
Approach Delay (s)		33.5			19.1			33.9			35.5	
Approach LOS		C			B			C			D	

Intersection Summary

HCM 2000 Control Delay	30.5	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.79		
Actuated Cycle Length (s)	115.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	71.2%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
14: Tassajara Rd & Dublin Blvd

BART to Livermore Extension Project
2040 No Project PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	277	1100	461	287	365	25	397	926	649	41	803	150
Future Volume (vph)	277	1100	461	287	365	25	397	926	649	41	803	150
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	6.0	6.0	5.0	6.0		5.0	6.0	6.0	5.0	5.7	5.7
Lane Util. Factor	0.97	0.86	0.88	0.94	0.91		0.94	0.86	1.00	0.97	0.86	0.88
Frt	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	6408	2787	4990	5037		4990	6408	1583	3433	6408	2787
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	6408	2787	4990	5037		4990	6408	1583	3433	6408	2787
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	301	1196	501	312	397	27	432	1007	705	45	873	163
RTOR Reduction (vph)	0	0	281	0	5	0	0	0	227	0	0	130
Lane Group Flow (vph)	301	1196	220	312	419	0	432	1007	478	45	873	33
Turn Type	Prot	NA	Perm	Prot	NA		Prot	NA	Perm	Prot	NA	Perm
Protected Phases	5	2		1	6		3	8		7		4
Permitted Phases			2						8			4
Actuated Green, G (s)	16.4	41.2	41.2	16.4	41.2		31.7	48.9	48.9	11.2	28.7	28.7
Effective Green, g (s)	16.4	41.2	41.2	16.4	41.2		31.7	48.9	48.9	11.2	28.7	28.7
Actuated g/C Ratio	0.12	0.29	0.29	0.12	0.29		0.23	0.35	0.35	0.08	0.21	0.21
Clearance Time (s)	5.0	6.0	6.0	5.0	6.0		5.0	6.0	6.0	5.0	5.7	5.7
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	403	1889	821	585	1485		1132	2243	554	275	1316	572
v/s Ratio Prot	c0.09	c0.19		0.06	0.08		c0.09	0.16		0.01	0.14	
v/s Ratio Perm			0.08						c0.30			0.01
v/c Ratio	0.75	0.63	0.27	0.53	0.28		0.38	0.45	0.86	0.16	0.66	0.06
Uniform Delay, d1	59.6	42.7	37.7	58.0	37.9		45.7	35.0	42.3	59.9	51.1	44.6
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	7.4	0.7	0.2	0.9	0.1		0.2	0.1	13.1	0.3	1.3	0.0
Delay (s)	67.0	43.4	37.9	59.0	38.0		45.9	35.2	55.4	60.2	52.3	44.7
Level of Service	E	D	D	E	D		D	D	E	E	D	D
Approach Delay (s)		45.6			46.9			44.0			51.5	
Approach LOS		D			D			D			D	

Intersection Summary

HCM 2000 Control Delay	46.2	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.73		
Actuated Cycle Length (s)	139.7	Sum of lost time (s)	22.0
Intersection Capacity Utilization	82.8%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 15: Tassajara Rd & I-580 WB Ramps

BART to Livermore Extension Project
 2040 No Project PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↔↔		↔↔		↑↑	↔		↑↑↔	↔
Traffic Volume (vph)	0	0	0	574	0	227	0	1666	725	0	1306	639
Future Volume (vph)	0	0	0	574	0	227	0	1666	725	0	1306	639
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0		4.0		4.0	4.0		4.0	4.0
Lane Util. Factor				0.97		0.88		0.95	1.00		0.86	0.86
Frt				1.00		0.85		1.00	0.85		0.98	0.85
Flt Protected				0.95		1.00		1.00	1.00		1.00	1.00
Satd. Flow (prot)				3433		2787		3539	1583		4708	1362
Flt Permitted				0.95		1.00		1.00	1.00		1.00	1.00
Satd. Flow (perm)				3433		2787		3539	1583		4708	1362
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	624	0	247	0	1811	788	0	1420	695
RTOR Reduction (vph)	0	0	0	0	0	18	0	0	321	0	33	193
Lane Group Flow (vph)	0	0	0	624	0	229	0	1811	467	0	1609	280
Turn Type				Perm		Perm		NA	Perm		NA	Perm
Protected Phases								2			6	
Permitted Phases				8		8			2			6
Actuated Green, G (s)				14.4		14.4		32.6	32.6		32.6	32.6
Effective Green, g (s)				14.4		14.4		32.6	32.6		32.6	32.6
Actuated g/C Ratio				0.26		0.26		0.59	0.59		0.59	0.59
Clearance Time (s)				4.0		4.0		4.0	4.0		4.0	4.0
Vehicle Extension (s)				3.0		3.0		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)				898		729		2097	938		2790	807
v/s Ratio Prot								c0.51			0.34	
v/s Ratio Perm				c0.18		0.08			0.29			0.21
v/c Ratio				0.69		0.31		0.86	0.50		0.58	0.35
Uniform Delay, d1				18.3		16.3		9.3	6.5		6.9	5.7
Progression Factor				1.00		1.00		1.00	1.00		1.00	1.00
Incremental Delay, d2				2.4		0.2		5.0	1.9		0.9	1.2
Delay (s)				20.7		16.6		14.4	8.4		7.8	6.9
Level of Service				C		B		B	A		A	A
Approach Delay (s)		0.0			19.5			12.5			7.6	
Approach LOS		A			B			B			A	

Intersection Summary			
HCM 2000 Control Delay	11.8	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.81		
Actuated Cycle Length (s)	55.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	69.1%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 16: Santa Rita Rd & I-580 EB Ramps/Pimilco Dr

BART to Livermore Extension Project
 2040 No Project PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	441	82	258	140	0	318	0	1589	194	315	1133	0
Future Volume (vph)	441	82	258	140	0	318	0	1589	194	315	1133	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0		4.0		4.0		4.0	4.0	
Lane Util. Factor	0.97	1.00	1.00	0.97		0.88		0.86		1.00	0.95	
Frt	1.00	1.00	0.85	1.00		0.85		0.98		1.00	1.00	
Flt Protected	0.95	1.00	1.00	0.95		1.00		1.00		0.95	1.00	
Satd. Flow (prot)	3433	1863	1583	3433		2787		6303		1770	3539	
Flt Permitted	0.95	1.00	1.00	0.95		1.00		1.00		0.95	1.00	
Satd. Flow (perm)	3433	1863	1583	3433		2787		6303		1770	3539	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	479	89	280	152	0	346	0	1727	211	342	1232	0
RTOR Reduction (vph)	0	0	73	0	0	35	0	19	0	0	0	0
Lane Group Flow (vph)	479	89	207	152	0	311	0	1919	0	342	1232	0
Turn Type	Perm	NA	Perm	Prot		pm+ov		NA		Prot	NA	Perm
Protected Phases		4		3		1		2		1	6	
Permitted Phases	4		4			3						6
Actuated Green, G (s)	19.9	19.9	19.9	7.6		32.2		41.9		24.6	70.5	
Effective Green, g (s)	19.9	19.9	19.9	7.6		32.2		41.9		24.6	70.5	
Actuated g/C Ratio	0.18	0.18	0.18	0.07		0.29		0.38		0.22	0.64	
Clearance Time (s)	4.0	4.0	4.0	4.0		4.0		4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0		3.0		3.0		3.0	3.0	
Lane Grp Cap (vph)	621	337	286	237		815		2400		395	2268	
v/s Ratio Prot		0.05		c0.04		0.09		c0.30		c0.19	0.35	
v/s Ratio Perm	c0.14		0.13			0.03						
v/c Ratio	0.77	0.26	0.72	0.64		0.38		0.80		0.87	0.54	
Uniform Delay, d1	42.9	38.8	42.5	49.9		31.0		30.3		41.1	10.9	
Progression Factor	1.00	1.00	1.00	1.00		1.00		1.00		1.00	1.00	
Incremental Delay, d2	5.9	0.4	8.8	5.8		0.3		2.9		17.7	0.9	
Delay (s)	48.8	39.2	51.2	55.7		31.3		33.2		58.8	11.8	
Level of Service	D	D	D	E		C		C		E	B	
Approach Delay (s)		48.6			38.7			33.2			22.0	
Approach LOS		D			D			C			C	

Intersection Summary

HCM 2000 Control Delay	32.8	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.80		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	66.3%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 17: Santa Rita Rd & Valley Ave

BART to Livermore Extension Project
 2040 No Project PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	370	735	124	136	375	790	145	627	159	1400	1071	270
Future Volume (vph)	370	735	124	136	375	790	145	627	159	1400	1071	270
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.97	0.95		0.97	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.97		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	3433	3432		3433	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	3433	3432		3433	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	402	799	135	148	408	859	158	682	173	1522	1164	293
RTOR Reduction (vph)	0	0	95	0	0	0	0	18	0	0	0	128
Lane Group Flow (vph)	402	799	40	148	408	859	158	837	0	1522	1164	165
Turn Type	Prot	NA	Perm	Prot	NA	Free	Prot	NA		Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1		6
Permitted Phases			4			Free						6
Actuated Green, G (s)	15.0	23.0	23.0	8.0	16.0	120.0	9.5	28.0		45.0	63.5	63.5
Effective Green, g (s)	15.0	23.0	23.0	8.0	16.0	120.0	9.5	28.0		45.0	63.5	63.5
Actuated g/C Ratio	0.12	0.19	0.19	0.07	0.13	1.00	0.08	0.23		0.38	0.53	0.53
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	429	678	303	118	471	1583	271	800		1287	1872	837
v/s Ratio Prot	0.12	c0.23		c0.08	0.12		0.05	c0.24		c0.44	0.33	
v/s Ratio Perm			0.03			0.54						0.10
v/c Ratio	0.94	1.18	0.13	1.25	0.87	0.54	0.58	1.05		1.18	0.62	0.20
Uniform Delay, d1	52.0	48.5	40.2	56.0	51.0	0.0	53.3	46.0		37.5	19.8	14.8
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	27.9	95.1	0.2	166.2	15.3	1.3	3.2	44.4		90.4	0.6	0.1
Delay (s)	80.0	143.6	40.4	222.2	66.3	1.3	56.5	90.4		127.9	20.5	15.0
Level of Service	E	F	D	F	E	A	E	F		F	C	B
Approach Delay (s)		114.0			43.2			85.1			74.8	
Approach LOS		F			D			F			E	

Intersection Summary

HCM 2000 Control Delay	77.5	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.15		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	103.5%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
18: Bernal Ave/Valley Ave & Stanley Blvd

BART to Livermore Extension Project
2040 No Project PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↑↑	↖	↖↗	↑↑	↖	↖	↑↑	↖	↖↗	↑↑	↖↗
Traffic Volume (vph)	228	836	59	92	235	350	95	366	303	823	551	132
Future Volume (vph)	228	836	59	92	235	350	95	366	303	823	551	132
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.95	1.00	0.97	0.91	0.91	1.00	0.95	1.00	0.97	0.95	0.95
Frt	1.00	1.00	0.85	1.00	0.94	0.85	1.00	1.00	0.85	1.00	0.97	0.97
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	3433	3178	1441	1770	3539	1583	3433	3437	3437
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	3433	3178	1441	1770	3539	1583	3433	3437	3437
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	248	909	64	100	255	380	103	398	329	895	599	143
RTOR Reduction (vph)	0	0	39	0	126	53	0	0	169	0	22	0
Lane Group Flow (vph)	248	909	25	100	311	145	103	398	160	895	720	0
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	NA
Protected Phases	7	4	5	3	8	1	5	2		1	6	
Permitted Phases			4			8			2			
Actuated Green, G (s)	10.2	25.6	33.3	3.0	18.4	43.7	7.7	15.5	15.5	25.3	33.1	
Effective Green, g (s)	10.2	25.6	33.3	3.0	18.4	43.7	7.7	15.5	15.5	25.3	33.1	
Actuated g/C Ratio	0.12	0.30	0.39	0.04	0.22	0.51	0.09	0.18	0.18	0.30	0.39	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	410	1060	691	120	684	804	159	642	287	1017	1332	
v/s Ratio Prot	c0.07	c0.26	0.00	0.03	0.10	0.05	0.06	0.11		c0.26	c0.21	
v/s Ratio Perm			0.01			0.05			0.10			
v/c Ratio	0.60	0.86	0.04	0.83	0.45	0.18	0.65	0.62	0.56	0.88	0.54	
Uniform Delay, d1	35.7	28.2	16.1	41.0	29.1	11.2	37.5	32.2	31.8	28.6	20.3	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	2.5	7.0	0.0	36.7	0.5	0.1	8.8	1.8	2.4	9.0	0.5	
Delay (s)	38.2	35.2	16.1	77.6	29.6	11.3	46.3	34.0	34.2	37.6	20.7	
Level of Service	D	D	B	E	C	B	D	C	C	D	C	
Approach Delay (s)		34.8			31.2			35.6			29.9	
Approach LOS		C			C			D			C	

Intersection Summary		
HCM 2000 Control Delay	32.6	HCM 2000 Level of Service C
HCM 2000 Volume to Capacity ratio	0.82	
Actuated Cycle Length (s)	85.4	Sum of lost time (s) 16.0
Intersection Capacity Utilization	75.3%	ICU Level of Service D
Analysis Period (min)	15	

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 19: Fallon Rd & Dublin Blvd/Croak Rd

BART to Livermore Extension Project
 2040 No Project PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↖	↑↑↑	↗↗	↖↖↖	↑↑↑	↗	↖↖↖	↑↑↑	↗↗	↖↖	↑↑↑	↗
Traffic Volume (vph)	220	942	432	81	29	94	243	800	326	185	650	29
Future Volume (vph)	220	942	432	81	29	94	243	800	326	185	650	29
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.91	0.88	0.94	0.91	1.00	0.94	0.91	0.88	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5085	2787	4990	5085	1583	4990	5085	2787	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5085	2787	4990	5085	1583	4990	5085	2787	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	239	1024	470	88	32	102	264	870	354	201	707	32
RTOR Reduction (vph)	0	0	63	0	0	91	0	0	148	0	0	19
Lane Group Flow (vph)	239	1024	407	88	32	11	264	870	206	201	707	13
Turn Type	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4	5	3	8		5	2		1	6	
Permitted Phases			4			8			2			6
Actuated Green, G (s)	25.0	31.7	43.6	5.3	12.0	12.0	11.9	45.6	45.6	11.4	45.1	45.1
Effective Green, g (s)	25.0	31.7	43.6	5.3	12.0	12.0	11.9	45.6	45.6	11.4	45.1	45.1
Actuated g/C Ratio	0.23	0.29	0.40	0.05	0.11	0.11	0.11	0.41	0.41	0.10	0.41	0.41
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	780	1465	1206	240	554	172	539	2107	1155	355	2084	649
v/s Ratio Prot	0.07	c0.20	0.04	c0.02	0.01		c0.05	c0.17		c0.06	0.14	
v/s Ratio Perm			0.11			0.01			0.07			0.01
v/c Ratio	0.31	0.70	0.34	0.37	0.06	0.06	0.49	0.41	0.18	0.57	0.34	0.02
Uniform Delay, d1	35.3	34.9	23.1	50.7	43.9	44.0	46.2	22.7	20.4	46.9	22.2	19.3
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.03	0.93	0.90	1.00	1.00	1.00
Incremental Delay, d2	0.2	1.5	0.2	1.0	0.0	0.2	0.7	0.6	0.3	2.1	0.4	0.1
Delay (s)	35.5	36.4	23.3	51.7	44.0	44.1	48.2	21.6	18.6	49.0	22.7	19.4
Level of Service	D	D	C	D	D	D	D	C	B	D	C	B
Approach Delay (s)		32.7			47.1			25.6			28.2	
Approach LOS		C			D			C			C	

Intersection Summary		
HCM 2000 Control Delay	30.1	HCM 2000 Level of Service C
HCM 2000 Volume to Capacity ratio	0.53	
Actuated Cycle Length (s)	110.0	Sum of lost time (s) 16.0
Intersection Capacity Utilization	53.8%	ICU Level of Service A
Analysis Period (min)	15	

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
20: El Charro Rd/Fallon Rd & I-580 WB Ramps

BART to Livermore Extension Project
2040 No Project PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↙	↖	↗		↑↑↑	↗		↑↑↑	↗
Traffic Volume (vph)	0	0	0	621	0	538	0	919	245	0	853	405
Future Volume (vph)	0	0	0	621	0	538	0	919	245	0	853	405
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0	4.0	4.0		4.0	4.0		4.0	4.0
Lane Util. Factor				0.95	0.95	0.88		0.91	1.00		0.91	1.00
Frt				1.00	1.00	0.85		1.00	0.85		1.00	0.85
Flt Protected				0.95	0.95	1.00		1.00	1.00		1.00	1.00
Satd. Flow (prot)				1681	1681	2787		5085	1583		5085	1583
Flt Permitted				0.95	0.95	1.00		1.00	1.00		1.00	1.00
Satd. Flow (perm)				1681	1681	2787		5085	1583		5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	675	0	585	0	999	266	0	927	440
RTOR Reduction (vph)	0	0	0	0	0	70	0	0	121	0	0	200
Lane Group Flow (vph)	0	0	0	344	331	515	0	999	145	0	927	240
Turn Type				Perm	NA	Perm		NA	Perm		NA	Perm
Protected Phases					8			2			6	
Permitted Phases				8		8			2			6
Actuated Green, G (s)				17.5	17.5	17.5		30.0	30.0		30.0	30.0
Effective Green, g (s)				17.0	17.0	17.0		30.0	30.0		30.0	30.0
Actuated g/C Ratio				0.31	0.31	0.31		0.55	0.55		0.55	0.55
Clearance Time (s)				3.5	3.5	3.5		4.0	4.0		4.0	4.0
Vehicle Extension (s)				2.0	2.0	2.0		2.0	2.0		2.0	2.0
Lane Grp Cap (vph)				519	519	861		2773	863		2773	863
v/s Ratio Prot								c0.20			0.18	
v/s Ratio Perm				c0.20	0.20	0.18			0.09			0.15
v/c Ratio				0.66	0.64	0.60		0.36	0.17		0.33	0.28
Uniform Delay, d1				16.5	16.4	16.1		7.1	6.3		6.9	6.7
Progression Factor				1.00	1.00	1.00		0.70	0.38		0.65	1.30
Incremental Delay, d2				2.5	1.9	0.8		0.2	0.3		0.3	0.8
Delay (s)				19.0	18.2	16.9		5.2	2.7		4.8	9.5
Level of Service				B	B	B		A	A		A	A
Approach Delay (s)		0.0			17.8			4.7			6.3	
Approach LOS		A			B			A			A	

Intersection Summary

HCM 2000 Control Delay	9.5	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.47		
Actuated Cycle Length (s)	55.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	48.9%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 21: El Charro Rd & I-580 EB Ramps

BART to Livermore Extension Project
 2040 No Project PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↗↘		↗↘					↕↔	↗		↕↔	↗
Traffic Volume (vph)	333	0	436	0	0	0	0	1538	281	0	1513	0
Future Volume (vph)	333	0	436	0	0	0	0	1538	281	0	1513	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0					4.0	4.0		4.0	
Lane Util. Factor	0.97		0.88					0.91	0.91		0.91	
Frt	1.00		0.85					1.00	0.85		1.00	
Flt Protected	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (prot)	3433		2787					3379	1441		3390	
Flt Permitted	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (perm)	3433		2787					3379	1441		3390	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	362	0	474	0	0	0	0	1672	305	0	1645	0
RTOR Reduction (vph)	0	0	47	0	0	0	0	2	93	0	0	0
Lane Group Flow (vph)	362	0	427	0	0	0	0	1707	175	0	1645	0
Turn Type	Prot		Perm					NA	Perm		NA	Perm
Protected Phases	4							2			6	
Permitted Phases			4						2			6
Actuated Green, G (s)	11.1		11.1					35.9	35.9		35.9	
Effective Green, g (s)	11.1		11.1					35.9	35.9		35.9	
Actuated g/C Ratio	0.20		0.20					0.65	0.65		0.65	
Clearance Time (s)	4.0		4.0					4.0	4.0		4.0	
Vehicle Extension (s)	2.0		2.0					3.0	3.0		3.0	
Lane Grp Cap (vph)	692		562					2205	940		2212	
v/s Ratio Prot	0.11							c0.51			0.49	
v/s Ratio Perm			c0.15						0.12			
v/c Ratio	0.52		0.76					0.77	0.19		0.74	
Uniform Delay, d1	19.6		20.7					6.7	3.8		6.4	
Progression Factor	1.00		1.00					1.00	1.00		1.24	
Incremental Delay, d2	0.3		5.2					2.7	0.4		2.2	
Delay (s)	19.9		25.9					9.4	4.2		10.2	
Level of Service	B		C					A	A		B	
Approach Delay (s)		23.3			0.0			8.7			10.2	
Approach LOS		C			A			A			B	

Intersection Summary

HCM 2000 Control Delay	12.0	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.77		
Actuated Cycle Length (s)	55.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	63.7%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 22: El Charro Rd & Stoneridge Dr/Jack London Blvd

BART to Livermore Extension Project
 2040 No Project PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔↔↔	↑↑	↗	↖	↑↑	↗↗	↖	↑↑		↖↖↖	↑	↗↗
Traffic Volume (vph)	185	589	59	98	322	648	16	443	51	780	420	73
Future Volume (vph)	185	589	59	98	322	648	16	443	51	780	420	73
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	0.94	0.95	1.00	1.00	0.95	0.88	1.00	0.95		0.94	1.00	0.88
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.98		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	4491	3185	1425	1593	3185	2508	1593	3136		4491	1676	2508
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	4491	3185	1425	1593	3185	2508	1593	3136		4491	1676	2508
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	201	640	64	107	350	704	17	482	55	848	457	79
RTOR Reduction (vph)	0	0	49	0	0	74	0	13	0	0	0	42
Lane Group Flow (vph)	201	640	15	107	350	630	17	524	0	848	457	37
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Prot	NA		Prot	NA	Perm
Protected Phases	7	4		3	8	1	5	2		1	6	
Permitted Phases			4			8						6
Actuated Green, G (s)	6.0	16.7	16.7	4.6	15.3	33.7	0.8	15.3		18.4	32.9	32.9
Effective Green, g (s)	6.0	16.7	16.7	4.6	15.3	33.7	0.8	15.3		18.4	32.9	32.9
Actuated g/C Ratio	0.08	0.24	0.24	0.06	0.22	0.47	0.01	0.22		0.26	0.46	0.46
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	379	749	335	103	686	1190	17	675		1163	776	1162
v/s Ratio Prot	0.04	c0.20		c0.07	0.11	0.14	0.01	c0.17		c0.19	0.27	
v/s Ratio Perm			0.01			0.11						0.01
v/c Ratio	0.53	0.85	0.04	1.04	0.51	0.53	1.00	0.78		0.73	0.59	0.03
Uniform Delay, d1	31.1	26.0	21.0	33.2	24.5	13.1	35.1	26.2		24.0	14.1	10.4
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	1.4	9.4	0.1	99.5	0.6	0.4	218.3	5.6		2.3	1.1	0.0
Delay (s)	32.6	35.4	21.0	132.7	25.2	13.5	253.4	31.9		26.3	15.2	10.4
Level of Service	C	D	C	F	C	B	F	C		C	B	B
Approach Delay (s)		33.7			28.0			38.7			21.8	
Approach LOS		C			C			D			C	

Intersection Summary

HCM 2000 Control Delay	28.6	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.81		
Actuated Cycle Length (s)	71.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	69.4%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 23: Stanley Blvd & El Charro Rd

BART to Livermore Extension Project
 2040 No Project PM



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	↖	↑↑	↑↑↑	↗	↖↗	↖↗
Traffic Volume (vph)	389	2696	772	12	202	399
Future Volume (vph)	389	2696	772	12	202	399
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95	0.91	1.00	0.97	0.88
Frt	1.00	1.00	1.00	0.85	1.00	0.85
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1770	3539	5085	1583	3433	2787
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1770	3539	5085	1583	3433	2787
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	423	2930	839	13	220	434
RTOR Reduction (vph)	0	0	0	6	0	386
Lane Group Flow (vph)	423	2930	839	7	220	48
Turn Type	Prot	NA	NA	Perm	Prot	Perm
Protected Phases	7	4	8		6	
Permitted Phases				8		6
Actuated Green, G (s)	32.7	96.1	59.4	59.4	12.8	12.8
Effective Green, g (s)	32.7	96.1	59.4	59.4	12.8	12.8
Actuated g/C Ratio	0.28	0.82	0.51	0.51	0.11	0.11
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	495	2909	2583	804	375	305
v/s Ratio Prot	0.24	c0.83	0.16		c0.06	
v/s Ratio Perm				0.00		0.02
v/c Ratio	0.85	1.01	0.32	0.01	0.59	0.16
Uniform Delay, d1	39.8	10.4	16.9	14.2	49.5	47.2
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	13.5	18.4	0.1	0.0	2.3	0.2
Delay (s)	53.3	28.8	17.0	14.2	51.9	47.4
Level of Service	D	C	B	B	D	D
Approach Delay (s)		31.9	17.0		48.9	
Approach LOS		C	B		D	

Intersection Summary

HCM 2000 Control Delay	31.6	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.99		
Actuated Cycle Length (s)	116.9	Sum of lost time (s)	12.0
Intersection Capacity Utilization	87.0%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
24: Airway Blvd/Driveway & N Canyons Pkwy

BART to Livermore Extension Project
2040 No Project PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑	↑	↑↑	↑	↑		↑	↑↑		↑	
Traffic Volume (vph)	0	854	537	973	84	0	52	0	748	0	0	0
Future Volume (vph)	0	854	537	973	84	0	52	0	748	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		2.0	2.0	2.0	2.0			4.2	2.0			
Lane Util. Factor		0.95	1.00	0.97	1.00			1.00	0.88			
Frt		1.00	0.85	1.00	1.00			1.00	0.85			
Flt Protected		1.00	1.00	0.95	1.00			0.95	1.00			
Satd. Flow (prot)		3539	1583	3433	1863			1770	2787			
Flt Permitted		1.00	1.00	0.95	1.00			0.95	1.00			
Satd. Flow (perm)		3539	1583	3433	1863			1770	2787			
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	928	584	1058	91	0	57	0	813	0	0	0
RTOR Reduction (vph)	0	0	243	0	0	0	0	0	476	0	0	0
Lane Group Flow (vph)	0	928	341	1058	91	0	0	57	337	0	0	0
Turn Type		NA	Perm	Prot	NA	Perm	Split	NA	pm+ov			
Protected Phases		2		1	6		8	8	1	4	4	
Permitted Phases			2			6			8			
Actuated Green, G (s)		62.3	62.3	34.6	100.9			11.1	45.7			
Effective Green, g (s)		64.3	64.3	36.6	102.9			10.9	49.7			
Actuated g/C Ratio		0.54	0.54	0.31	0.86			0.09	0.41			
Clearance Time (s)		4.0	4.0	4.0	4.0			4.0	4.0			
Vehicle Extension (s)		3.0	3.0	3.0	3.0			3.0	3.0			
Lane Grp Cap (vph)		1896	848	1047	1597			160	1200			
v/s Ratio Prot		c0.26		c0.31	0.05			0.03	c0.09			
v/s Ratio Perm			0.22						0.04			
v/c Ratio		0.49	0.40	1.01	0.06			0.36	0.28			
Uniform Delay, d1		17.5	16.5	41.7	1.3			51.3	23.3			
Progression Factor		1.00	1.00	1.00	1.00			1.00	1.00			
Incremental Delay, d2		0.9	1.4	30.4	0.1			1.4	0.1			
Delay (s)		18.4	17.9	72.1	1.3			52.6	23.4			
Level of Service		B	B	E	A			D	C			
Approach Delay (s)		18.2			66.5			25.3			0.0	
Approach LOS		B			E			C			A	

Intersection Summary

HCM 2000 Control Delay	35.7	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.67		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	12.2
Intersection Capacity Utilization	67.7%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
25: Airway Blvd & I-580 WB Ramps

BART to Livermore Extension Project
2040 No Project PM




























Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↙	↖	↗		↑↑	↗		↑↑↑	
Traffic Volume (vph)	0	0	0	123	33	175	0	690	382	0	899	710
Future Volume (vph)	0	0	0	123	33	175	0	690	382	0	899	710
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0	4.0	4.0		4.0	4.0		4.0	
Lane Util. Factor				0.95	0.95	0.88		0.95	1.00		0.91	
Frt				1.00	1.00	0.85		1.00	0.85		0.93	
Flt Protected				0.95	0.97	1.00		1.00	1.00		1.00	
Satd. Flow (prot)				1681	1715	2787		3539	1583		4749	
Flt Permitted				0.95	0.97	1.00		1.00	1.00		1.00	
Satd. Flow (perm)				1681	1715	2787		3539	1583		4749	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	134	36	190	0	750	415	0	977	772
RTOR Reduction (vph)	0	0	0	0	0	162	0	0	109	0	170	0
Lane Group Flow (vph)	0	0	0	71	99	28	0	750	306	0	1579	0
Turn Type				Split	NA	Perm		NA	Perm		NA	
Protected Phases				8	8			2			6	
Permitted Phases						8			2			
Actuated Green, G (s)				10.4	10.4	10.4		50.3	50.3		50.3	
Effective Green, g (s)				10.4	10.4	10.4		51.6	51.6		51.6	
Actuated g/C Ratio				0.15	0.15	0.15		0.74	0.74		0.74	
Clearance Time (s)				4.0	4.0	4.0		5.3	5.3		5.3	
Vehicle Extension (s)				2.0	2.0	2.0		4.0	4.0		4.0	
Lane Grp Cap (vph)				249	254	414		2608	1166		3500	
v/s Ratio Prot				0.04	c0.06			0.21			c0.33	
v/s Ratio Perm						0.01			0.19			
v/c Ratio				0.29	0.39	0.07		0.29	0.26		0.45	
Uniform Delay, d1				26.5	26.9	25.6		3.1	3.0		3.6	
Progression Factor				1.00	1.00	1.00		0.34	0.27		1.00	
Incremental Delay, d2				0.2	0.4	0.0		0.2	0.5		0.4	
Delay (s)				26.7	27.3	25.7		1.3	1.3		4.0	
Level of Service				C	C	C		A	A		A	
Approach Delay (s)		0.0			26.3			1.3			4.0	
Approach LOS		A			C			A			A	

Intersection Summary

HCM 2000 Control Delay	5.5	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.44		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	48.3%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 26: Airway Blvd & I-580 EB Ramps/Kitty Hawk Rd

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 							 			 	
Traffic Volume (vph)	569	188	346	64	95	123	53	452	156	123	378	474
Future Volume (vph)	569	188	346	64	95	123	53	452	156	123	378	474
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.4	4.4	4.4	4.5	2.7		4.0	2.7	
Lane Util. Factor	0.97	1.00	1.00	1.00	1.00	1.00	1.00	0.95		1.00	0.95	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.96		1.00	0.92	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	3433	1863	1583	1770	1863	1583	1770	3403		1770	3244	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	3433	1863	1583	1770	1863	1583	1770	3403		1770	3244	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	618	204	376	70	103	134	58	491	170	134	411	515
RTOR Reduction (vph)	0	0	291	0	0	92	0	20	0	0	139	0
Lane Group Flow (vph)	618	204	85	70	103	42	58	641	0	134	787	0
Turn Type	Split	NA	Perm	Split	NA	pm+ov	Prot	NA		Prot	NA	
Protected Phases	7	7		8	8	1	5	2		1	6	
Permitted Phases			7			8						
Actuated Green, G (s)	31.7	31.7	31.7	14.6	14.6	29.5	10.9	62.8		14.9	66.8	
Effective Green, g (s)	31.7	31.7	31.7	14.2	14.2	28.7	10.4	64.1		14.9	68.1	
Actuated g/C Ratio	0.23	0.23	0.23	0.10	0.10	0.20	0.07	0.46		0.11	0.49	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Vehicle Extension (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	3.5		2.0	4.0	
Lane Grp Cap (vph)	777	421	358	179	188	374	131	1558		188	1577	
v/s Ratio Prot	c0.18	0.11		0.04	c0.06	0.01	0.03	c0.19		c0.08	c0.24	
v/s Ratio Perm			0.05			0.01						
v/c Ratio	0.80	0.48	0.24	0.39	0.55	0.11	0.44	0.41		0.71	0.50	
Uniform Delay, d1	51.1	47.1	44.3	58.9	59.8	45.3	62.0	25.3		60.5	24.4	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		0.99	0.91	
Incremental Delay, d2	5.3	0.3	0.1	0.5	1.7	0.0	0.9	0.8		9.3	1.0	
Delay (s)	56.4	47.4	44.4	59.4	61.6	45.3	62.9	26.2		69.1	23.2	
Level of Service	E	D	D	E	E	D	E	C		E	C	
Approach Delay (s)		51.1			54.0			29.1			29.0	
Approach LOS		D			D			C			C	

Intersection Summary

HCM 2000 Control Delay	39.4	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.61		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	15.6
Intersection Capacity Utilization	71.0%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 27: Collier Canyon Rd & N Canyons Pkwy/Portola Ave

BART to Livermore Extension Project
 2040 No Project PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↖	↗↗	↘	↖	↗↗	↘	↖	↗		↘	↗	↘
Traffic Volume (vph)	436	820	192	39	204	13	57	6	190	131	14	187
Future Volume (vph)	436	820	192	39	204	13	57	6	190	131	14	187
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	2.7	2.7	4.0	2.7	2.7	4.0	3.0		4.0	4.6	4.6
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.85		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	1770	1592		1770	1863	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	1770	1592		1770	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	474	891	209	42	222	14	62	7	207	142	15	203
RTOR Reduction (vph)	0	0	121	0	0	10	0	159	0	0	0	150
Lane Group Flow (vph)	474	891	88	42	222	4	62	55	0	142	15	53
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA		Prot	NA	Perm
Protected Phases	1	6		5	2		3	8		7	4	
Permitted Phases			6			2						4
Actuated Green, G (s)	14.5	29.2	29.2	3.3	18.0	18.0	4.7	14.3		9.8	19.4	19.4
Effective Green, g (s)	14.5	30.5	30.5	3.3	19.3	19.3	4.7	15.3		9.8	18.8	18.8
Actuated g/C Ratio	0.20	0.42	0.42	0.05	0.27	0.27	0.06	0.21		0.13	0.26	0.26
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	685	1486	665	80	940	420	114	335		238	482	409
v/s Ratio Prot	c0.14	c0.25		0.02	0.06		0.04	c0.03		c0.08	0.01	
v/s Ratio Perm			0.06			0.00						0.03
v/c Ratio	0.69	0.60	0.13	0.53	0.24	0.01	0.54	0.16		0.60	0.03	0.13
Uniform Delay, d1	27.0	16.3	12.9	33.9	20.9	19.6	32.9	23.4		29.5	20.1	20.6
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	3.0	0.7	0.1	6.1	0.1	0.0	5.2	0.2		4.0	0.0	0.1
Delay (s)	30.0	17.0	13.0	40.0	21.0	19.6	38.1	23.6		33.5	20.1	20.8
Level of Service	C	B	B	D	C	B	D	C		C	C	C
Approach Delay (s)		20.4			23.8			26.9			25.8	
Approach LOS		C			C			C			C	

Intersection Summary

HCM 2000 Control Delay	22.3	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.55		
Actuated Cycle Length (s)	72.6	Sum of lost time (s)	15.3
Intersection Capacity Utilization	58.7%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
28: Isabel Ave/Campus Hill Dr & Portola Ave

BART to Livermore Extension Project
2040 No Project PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↘	↑↑	↗↗	↘↘↘	↑↑		↘↘	↑↑	↗	↘	↑↑	↗
Traffic Volume (vph)	3	694	465	369	135	121	177	402	159	130	232	1
Future Volume (vph)	3	694	465	369	135	121	177	402	159	130	232	1
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	5.8	5.8
Lane Util. Factor	1.00	0.95	0.88	0.94	0.95		0.97	0.95	1.00	1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	0.93		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3539	2787	4990	3288		3433	3539	1583	1770	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	3539	2787	4990	3288		3433	3539	1583	1770	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	3	754	505	401	147	132	192	437	173	141	252	1
RTOR Reduction (vph)	0	0	321	0	72	0	0	0	136	0	0	1
Lane Group Flow (vph)	3	754	184	401	207	0	192	437	37	141	252	0
Turn Type	Prot	NA	Perm	Prot	NA		Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4						2			6
Actuated Green, G (s)	1.5	30.2	30.2	9.2	37.9		9.2	17.0	17.0	11.4	19.6	19.6
Effective Green, g (s)	1.5	31.5	31.5	9.2	39.2		9.2	18.3	18.3	11.4	18.7	18.7
Actuated g/C Ratio	0.02	0.36	0.36	0.11	0.45		0.11	0.21	0.21	0.13	0.22	0.22
Clearance Time (s)	4.0	5.3	5.3	4.0	5.3		4.0	5.3	5.3	4.0	4.9	4.9
Vehicle Extension (s)	2.0	3.0	3.0	2.0	3.0		2.0	3.0	3.0	2.0	3.0	3.0
Lane Grp Cap (vph)	30	1290	1016	531	1491		365	749	335	233	765	342
v/s Ratio Prot	0.00	c0.21		c0.08	0.06		0.06	c0.12		c0.08	0.07	
v/s Ratio Perm			0.07						0.02			0.00
v/c Ratio	0.10	0.58	0.18	0.76	0.14		0.53	0.58	0.11	0.61	0.33	0.00
Uniform Delay, d1	41.8	22.2	18.7	37.5	13.8		36.5	30.6	27.5	35.4	28.6	26.5
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.5	0.7	0.1	5.4	0.0		0.6	1.2	0.1	3.0	0.3	0.0
Delay (s)	42.3	22.8	18.8	42.9	13.8		37.2	31.8	27.6	38.4	28.8	26.5
Level of Service	D	C	B	D	B		D	C	C	D	C	C
Approach Delay (s)		21.3			31.0			32.2			32.2	
Approach LOS		C			C			C			C	

Intersection Summary

HCM 2000 Control Delay	27.5	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.62		
Actuated Cycle Length (s)	86.4	Sum of lost time (s)	17.8
Intersection Capacity Utilization	59.0%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 29: Isabel Ave & I-580 WB Ramps

BART to Livermore Extension Project
 2040 No Project PM





















Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↖↗		↖		↑↑↑	↖		↑↑↑	↖
Traffic Volume (vph)	0	0	0	681	0	445	0	452	0	0	672	486
Future Volume (vph)	0	0	0	681	0	445	0	452	0	0	672	486
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0		4.0		4.8			4.8	4.8
Lane Util. Factor				0.97		1.00		0.91			0.91	1.00
Frt				1.00		0.85		1.00			1.00	0.85
Flt Protected				0.95		1.00		1.00			1.00	1.00
Satd. Flow (prot)				3433		1583		5085			5085	1583
Flt Permitted				0.95		1.00		1.00			1.00	1.00
Satd. Flow (perm)				3433		1583		5085			5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	740	0	484	0	491	0	0	730	528
RTOR Reduction (vph)	0	0	0	0	0	174	0	0	0	0	0	222
Lane Group Flow (vph)	0	0	0	740	0	310	0	491	0	0	730	306
Turn Type				Prot		Prot		NA	Free		NA	Prot
Protected Phases				8		8		2			6	6
Permitted Phases									Free			
Actuated Green, G (s)				20.6		20.6		41.4			41.4	41.4
Effective Green, g (s)				20.6		20.6		40.6			40.6	40.6
Actuated g/C Ratio				0.29		0.29		0.58			0.58	0.58
Clearance Time (s)				4.0		4.0		4.0			4.0	4.0
Vehicle Extension (s)				2.0		2.0		4.0			4.0	4.0
Lane Grp Cap (vph)				1010		465		2949			2949	918
v/s Ratio Prot				c0.22		0.20		0.10			0.14	c0.19
v/s Ratio Perm												
v/c Ratio				0.73		0.67		0.17			0.25	0.33
Uniform Delay, d1				22.2		21.7		6.8			7.2	7.7
Progression Factor				1.00		1.00		0.77			1.00	1.00
Incremental Delay, d2				2.4		2.8		0.1			0.2	1.0
Delay (s)				24.6		24.5		5.4			7.4	8.6
Level of Service				C		C		A			A	A
Approach Delay (s)		0.0			24.6			5.4			7.9	
Approach LOS		A			C			A			A	

Intersection Summary		
HCM 2000 Control Delay	14.4	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.47	B
Actuated Cycle Length (s)	70.0	Sum of lost time (s)
Intersection Capacity Utilization	43.6%	8.8
Analysis Period (min)	15	ICU Level of Service
		A

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 30: Isabel Ave & I-580 EB Ramps

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations													
Traffic Volume (vph)	191	0	384	0	0	0	0	703	692	0	915	664	
Future Volume (vph)	191	0	384	0	0	0	0	703	692	0	915	664	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)	4.0		4.0					4.0	4.0		4.0	4.0	
Lane Util. Factor	0.97		0.88					0.91	1.00		0.91	1.00	
Frt	1.00		0.85					1.00	0.85		1.00	0.85	
Flt Protected	0.95		1.00					1.00	1.00		1.00	1.00	
Satd. Flow (prot)	3433		2787					5085	1583		5085	1583	
Flt Permitted	0.95		1.00					1.00	1.00		1.00	1.00	
Satd. Flow (perm)	3433		2787					5085	1583		5085	1583	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	
Adj. Flow (vph)	208	0	417	0	0	0	0	764	752	0	995	722	
RTOR Reduction (vph)	0	0	162	0	0	0	0	0	0	0	0	0	
Lane Group Flow (vph)	208	0	255	0	0	0	0	764	752	0	995	722	
Turn Type	Prot		Perm					NA	Free		NA	Free	
Protected Phases	4							2			6		
Permitted Phases			4						Free			Free	
Actuated Green, G (s)	10.6		10.6					50.4	70.0		50.4	70.0	
Effective Green, g (s)	10.6		10.6					51.4	70.0		51.4	70.0	
Actuated g/C Ratio	0.15		0.15					0.73	1.00		0.73	1.00	
Clearance Time (s)	4.0		4.0					5.0			5.0		
Vehicle Extension (s)	2.0		2.0					4.0			4.0		
Lane Grp Cap (vph)	519		422					3733	1583		3733	1583	
v/s Ratio Prot	0.06							0.15			0.20		
v/s Ratio Perm			0.09						c0.47			0.46	
v/c Ratio	0.40		0.60					0.20	0.48		0.27	0.46	
Uniform Delay, d1	26.8		27.7					2.9	0.0		3.1	0.0	
Progression Factor	1.00		1.00					1.00	1.00		0.97	1.00	
Incremental Delay, d2	0.2		1.7					0.1	1.0		0.2	0.9	
Delay (s)	27.0		29.4					3.0	1.0		3.1	0.9	
Level of Service	C		C					A	A		A	A	
Approach Delay (s)		28.6			0.0			2.0			2.2		
Approach LOS		C			A			A			A		
Intersection Summary													
HCM 2000 Control Delay			6.4									HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio			0.54										
Actuated Cycle Length (s)			70.0									Sum of lost time (s)	8.0
Intersection Capacity Utilization			37.8%									ICU Level of Service	A
Analysis Period (min)			15										
c Critical Lane Group													



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	8	129	380	46	103	201	445	1061	223	283	1352	16
Future Volume (vph)	8	129	380	46	103	201	445	1061	223	283	1352	16
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.2	5.2	5.6	5.2	5.2	5.6	4.0	4.0	4.0	4.0	4.0	5.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.91	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	1863	1583	1770	1863	1583	1770	5085	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	1863	1583	1770	1863	1583	1770	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	9	140	413	50	112	218	484	1153	242	308	1470	17
RTOR Reduction (vph)	0	0	62	0	0	70	0	0	132	0	0	11
Lane Group Flow (vph)	9	140	351	50	112	148	484	1153	110	308	1470	6
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4	5	3	8	1	5	2		1	6	
Permitted Phases			4			8			2			6
Actuated Green, G (s)	0.8	15.8	39.9	4.4	19.4	32.4	24.1	41.5	41.5	13.0	30.4	30.4
Effective Green, g (s)	0.2	15.2	38.7	3.8	18.8	31.2	25.1	42.5	42.5	14.0	31.4	30.4
Actuated g/C Ratio	0.00	0.16	0.41	0.04	0.20	0.33	0.27	0.45	0.45	0.15	0.33	0.32
Clearance Time (s)	4.6	4.6	5.0	4.6	4.6	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	5.0	5.0	3.0	5.0	5.0
Lane Grp Cap (vph)	3	301	652	71	372	525	473	2301	716	511	1700	512
v/s Ratio Prot	0.01	0.08	c0.13	c0.03	c0.06	0.04	c0.27	0.23		0.09	c0.29	
v/s Ratio Perm			0.09			0.06			0.07			0.00
v/c Ratio	3.00	0.47	0.54	0.70	0.30	0.28	1.02	0.50	0.15	0.60	0.86	0.01
Uniform Delay, d1	46.9	35.7	20.9	44.5	32.0	23.1	34.4	18.2	15.1	37.4	29.3	21.5
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1456.2	1.1	0.9	27.1	0.5	0.3	47.4	0.4	0.2	2.0	5.3	0.0
Delay (s)	1503.1	36.8	21.7	71.6	32.4	23.4	81.8	18.6	15.3	39.4	34.6	21.6
Level of Service	F	D	C	E	C	C	F	B	B	D	C	C
Approach Delay (s)		49.2			32.4			34.4			35.3	
Approach LOS		D			C			C			D	

Intersection Summary

HCM 2000 Control Delay	36.4	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.86		
Actuated Cycle Length (s)	93.9	Sum of lost time (s)	20.0
Intersection Capacity Utilization	76.2%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
32: Isabel Ave & Jack London Blvd



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↕	↖	↖	↕	↖	↖↗	↕↕	↖	↖↗	↕↕	↖
Traffic Volume (vph)	101	863	310	298	180	285	149	1430	687	483	1271	52
Future Volume (vph)	101	863	310	298	180	285	149	1430	687	483	1271	52
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.97	0.91	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	3433	5085	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	3433	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	110	938	337	324	196	310	162	1554	747	525	1382	57
RTOR Reduction (vph)	0	0	140	0	0	31	0	0	205	0	0	36
Lane Group Flow (vph)	110	938	197	324	196	279	162	1554	542	525	1382	21
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8	1	5	2		1	6	
Permitted Phases			4			8			2			6
Actuated Green, G (s)	8.4	33.7	33.7	22.7	48.0	66.7	10.5	43.7	43.7	18.7	51.9	51.9
Effective Green, g (s)	8.4	33.7	33.7	22.7	48.0	66.7	10.5	43.7	43.7	18.7	51.9	51.9
Actuated g/C Ratio	0.06	0.24	0.24	0.16	0.34	0.48	0.08	0.31	0.31	0.13	0.37	0.37
Clearance Time (s)	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	205	851	381	286	1213	814	257	1587	494	458	1885	586
v/s Ratio Prot	0.03	c0.27		c0.18	0.06	0.05	0.05	0.31		c0.15	0.27	
v/s Ratio Perm			0.12			0.13			c0.34			0.01
v/c Ratio	0.54	1.10	0.52	1.13	0.16	0.34	0.63	0.98	1.10	1.15	0.73	0.04
Uniform Delay, d1	63.9	53.1	46.1	58.6	32.0	22.9	62.9	47.7	48.1	60.6	38.1	28.1
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	2.7	62.7	1.2	93.9	0.1	0.3	5.0	17.6	69.6	88.7	1.5	0.0
Delay (s)	66.6	115.9	47.3	152.6	32.1	23.2	67.8	65.3	117.7	149.3	39.6	28.1
Level of Service	E	F	D	F	C	C	E	E	F	F	D	C
Approach Delay (s)		95.3			75.8			81.4			68.6	
Approach LOS		F			E			F			E	

Intersection Summary

HCM 2000 Control Delay	79.8	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.11		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	21.2
Intersection Capacity Utilization	99.4%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 33: Isabel Ave Connector & Stanley Blvd



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑	↑	↔	↑↑	↔	↔
Traffic Volume (vph)	2209	765	810	572	131	847
Future Volume (vph)	2209	765	810	572	131	847
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	2.3	2.3	4.0	2.3	2.5	2.5
Lane Util. Factor	0.95	1.00	0.97	0.95	0.97	0.88
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	3539	1583	3433	3539	3433	2787
Flt Permitted	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (perm)	3539	1583	3433	3539	3433	2787
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	2401	832	880	622	142	921
RTOR Reduction (vph)	0	0	0	0	0	1
Lane Group Flow (vph)	2401	832	880	622	142	920
Turn Type	NA	pm+ov	Prot	NA	Prot	pm+ov
Protected Phases	2	8	1	6	8	1
Permitted Phases		2				8
Actuated Green, G (s)	59.0	68.3	19.0	82.0	9.3	28.3
Effective Green, g (s)	60.7	71.7	19.0	83.7	10.8	31.3
Actuated g/C Ratio	0.61	0.72	0.19	0.84	0.11	0.32
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Grp Cap (vph)	2163	1179	656	2983	373	948
v/s Ratio Prot	c0.68	0.08	c0.26	0.18	0.04	c0.20
v/s Ratio Perm		0.45				0.13
v/c Ratio	1.11	0.71	1.34	0.21	0.38	0.97
Uniform Delay, d1	19.3	7.8	40.1	1.5	41.1	33.5
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	56.8	1.6	163.8	0.0	0.2	22.1
Delay (s)	76.1	9.4	203.9	1.5	41.4	55.6
Level of Service	E	A	F	A	D	E
Approach Delay (s)	59.0			120.1	53.7	
Approach LOS	E			F	D	

Intersection Summary

HCM 2000 Control Delay	73.8	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.14		
Actuated Cycle Length (s)	99.3	Sum of lost time (s)	8.8
Intersection Capacity Utilization	100.8%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 34: Murrieta Blvd/Driveway & Portola Ave



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗		↖	↗		↖	↗	↗		↗	
Traffic Volume (vph)	0	1144	169	252	633	1	183	5	428	4	7	0
Future Volume (vph)	0	1144	169	252	633	1	183	5	428	4	7	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.8		4.0	5.8		5.2	5.2	5.2		4.0	
Lane Util. Factor		0.95		1.00	0.95		0.95	0.95	1.00		1.00	
Frt		0.98		1.00	1.00		1.00	1.00	0.85		1.00	
Flt Protected		1.00		0.95	1.00		0.95	0.95	1.00		0.98	
Satd. Flow (prot)		3471		1770	3538		1681	1689	1583		1832	
Flt Permitted		1.00		0.95	1.00		0.95	0.95	1.00		0.98	
Satd. Flow (perm)		3471		1770	3538		1681	1689	1583		1832	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	1243	184	274	688	1	199	5	465	4	8	0
RTOR Reduction (vph)	0	10	0	0	0	0	0	0	248	0	0	0
Lane Group Flow (vph)	0	1417	0	274	689	0	103	101	217	0	12	0
Turn Type	Prot	NA		Prot	NA		Split	NA	Perm		Split	NA
Protected Phases	5	2		1	6		8	8			4	4
Permitted Phases									8			
Actuated Green, G (s)		44.9		17.3	66.2		16.6	16.6	16.6		0.7	
Effective Green, g (s)		44.0		17.3	65.3		16.0	16.0	16.0		0.7	
Actuated g/C Ratio		0.45		0.18	0.67		0.16	0.16	0.16		0.01	
Clearance Time (s)		4.9		4.0	4.9		4.6	4.6	4.6		4.0	
Vehicle Extension (s)		2.0		2.0	2.0		2.0	2.0	2.0		2.0	
Lane Grp Cap (vph)		1574		315	2381		277	278	261		13	
v/s Ratio Prot		c0.41		c0.15	0.19		0.06	0.06			c0.01	
v/s Ratio Perm									c0.14			
v/c Ratio		0.90		0.87	0.29		0.37	0.36	0.83		0.92	
Uniform Delay, d1		24.5		38.8	6.4		36.0	36.0	39.2		48.1	
Progression Factor		1.00		1.00	1.00		1.00	1.00	1.00		1.00	
Incremental Delay, d2		7.3		21.0	0.0		0.3	0.3	18.9		205.3	
Delay (s)		31.8		59.8	6.5		36.3	36.3	58.1		253.4	
Level of Service		C		E	A		D	D	E		F	
Approach Delay (s)		31.8			21.6			51.4			253.4	
Approach LOS		C			C			D			F	

Intersection Summary		
HCM 2000 Control Delay	33.7	HCM 2000 Level of Service C
HCM 2000 Volume to Capacity ratio	0.88	
Actuated Cycle Length (s)	97.0	Sum of lost time (s) 19.0
Intersection Capacity Utilization	79.3%	ICU Level of Service D
Analysis Period (min)	15	

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 35: Murrieta Blvd & Jack London Blvd



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	366	1158	497	287	377	157
Future Volume (vph)	366	1158	497	287	377	157
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00	1.00	0.95	0.91	
Frt	1.00	0.85	1.00	1.00	0.96	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1770	1583	1770	3539	4861	
Flt Permitted	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	1770	1583	1770	3539	4861	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	398	1259	540	312	410	171
RTOR Reduction (vph)	0	369	0	0	86	0
Lane Group Flow (vph)	398	890	540	312	495	0
Turn Type	Prot	Perm	Prot	NA	NA	
Protected Phases	4		5	2	6	
Permitted Phases		4				
Actuated Green, G (s)	38.0	38.0	23.0	41.4	14.4	
Effective Green, g (s)	38.0	38.0	23.0	41.4	14.4	
Actuated g/C Ratio	0.43	0.43	0.26	0.47	0.16	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	769	688	465	1676	800	
v/s Ratio Prot	0.22		c0.31	0.09	c0.10	
v/s Ratio Perm		c0.56				
v/c Ratio	0.52	1.29	1.16	0.19	0.62	
Uniform Delay, d1	18.0	24.7	32.2	13.3	33.9	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.6	142.7	94.1	0.1	1.4	
Delay (s)	18.6	167.4	126.3	13.3	35.4	
Level of Service	B	F	F	B	D	
Approach Delay (s)	131.7			84.9	35.4	
Approach LOS	F			F	D	

Intersection Summary

HCM 2000 Control Delay	100.7	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.12		
Actuated Cycle Length (s)	87.4	Sum of lost time (s)	12.0
Intersection Capacity Utilization	89.2%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
36: Murrieta Blvd & Stanley Blvd

BART to Livermore Extension Project
2040 No Project PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↕	↖	↖	↕	↖	↖↗	↕		↖	↕	↖
Traffic Volume (vph)	330	1484	822	78	1048	216	292	338	18	225	356	203
Future Volume (vph)	330	1484	822	78	1048	216	292	338	18	225	356	203
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	5.8	5.8	4.0	5.8	4.9	4.9	5.8		4.9	5.8	4.9
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.97	0.95		1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	3433	3512		1770	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	3433	3512		1770	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	359	1613	893	85	1139	235	317	367	20	245	387	221
RTOR Reduction (vph)	0	0	217	0	0	55	0	3	0	0	0	132
Lane Group Flow (vph)	359	1613	676	85	1139	180	317	384	0	245	387	89
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Prot	NA		Prot	NA	Perm
Protected Phases	1	6		5	2	3	7	4		3	8	
Permitted Phases			6			2						8
Actuated Green, G (s)	13.0	52.3	52.3	5.0	44.3	59.3	14.0	18.0		15.0	19.0	19.0
Effective Green, g (s)	13.0	51.4	51.4	5.0	43.4	57.5	13.1	17.1		14.1	18.1	19.0
Actuated g/C Ratio	0.12	0.48	0.48	0.05	0.40	0.53	0.12	0.16		0.13	0.17	0.18
Clearance Time (s)	4.0	4.9	4.9	4.0	4.9	4.0	4.0	4.9		4.0	4.9	4.9
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	412	1682	752	81	1420	842	416	555		230	592	278
v/s Ratio Prot	c0.10	c0.46		0.05	0.32	0.03	0.09	0.11		c0.14	c0.11	
v/s Ratio Perm			0.43			0.09						0.06
v/c Ratio	0.87	0.96	0.90	1.05	0.80	0.21	0.76	0.69		1.07	0.65	0.32
Uniform Delay, d1	46.7	27.3	26.0	51.5	28.6	13.4	46.0	43.0		47.0	42.1	38.9
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	17.9	13.4	13.5	114.2	3.4	0.1	8.0	3.7		77.7	2.6	0.7
Delay (s)	64.6	40.7	39.5	165.7	31.9	13.5	54.0	46.7		124.7	44.7	39.6
Level of Service	E	D	D	F	C	B	D	D		F	D	D
Approach Delay (s)		43.3			36.8			50.0			66.3	
Approach LOS		D			D			D			E	

Intersection Summary

HCM 2000 Control Delay	45.8	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.94		
Actuated Cycle Length (s)	108.1	Sum of lost time (s)	20.5
Intersection Capacity Utilization	84.8%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
37: Livermore Ave & I-580 WB Ramps

BART to Livermore Extension Project
2040 No Project PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↖	↔		↗	↑			↕	
Traffic Volume (vph)	0	0	0	702	23	32	580	452	0	0	111	0
Future Volume (vph)	0	0	0	702	23	32	580	452	0	0	111	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)					4.0		4.0	4.0			4.0	
Lane Util. Factor					0.95		0.97	1.00			0.95	
Frt					0.99		1.00	1.00			1.00	
Flt Protected					0.96		0.95	1.00			1.00	
Satd. Flow (prot)					1680		3433	1863			3539	
Flt Permitted					0.96		0.95	1.00			1.00	
Satd. Flow (perm)					1680		3433	1863			3539	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	763	25	35	630	491	0	0	121	0
RTOR Reduction (vph)	0	0	0	0	1	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	0	822	0	630	491	0	0	121	0
Turn Type				Split	NA		Prot	NA			NA	
Protected Phases				8	8		5	2			6	
Permitted Phases												
Actuated Green, G (s)					76.9		29.4	53.4			20.5	
Effective Green, g (s)					76.9		28.9	55.1			22.2	
Actuated g/C Ratio					0.55		0.21	0.39			0.16	
Clearance Time (s)					4.0		3.5	5.7			5.7	
Vehicle Extension (s)					2.0		2.0	2.5			2.5	
Lane Grp Cap (vph)					922		708	733			561	
v/s Ratio Prot					c0.49		c0.18	c0.26			0.03	
v/s Ratio Perm												
v/c Ratio					0.89		0.89	0.67			0.22	
Uniform Delay, d1					27.9		54.0	35.0			51.3	
Progression Factor					1.00		0.40	0.28			1.00	
Incremental Delay, d2					10.5		1.4	0.4			0.9	
Delay (s)					38.4		23.0	10.2			52.2	
Level of Service					D		C	B			D	
Approach Delay (s)		0.0			38.4			17.4			52.2	
Approach LOS		A			D			B			D	

Intersection Summary

HCM 2000 Control Delay	27.8	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.86		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	111.2%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
38: Livermore Ave & I-580 EB Ramps



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔	↗					↕		↘	↕	
Traffic Volume (vph)	229	11	1350	0	0	0	0	819	230	114	692	0
Future Volume (vph)	229	11	1350	0	0	0	0	819	230	114	692	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0					3.0		5.0	3.0	
Lane Util. Factor		0.95	0.95					0.95		1.00	0.95	
Frt		0.89	0.85					0.97		1.00	1.00	
Flt Protected		0.99	1.00					1.00		0.95	1.00	
Satd. Flow (prot)		1555	1504					3423		1770	3539	
Flt Permitted		0.99	1.00					1.00		0.95	1.00	
Satd. Flow (perm)		1555	1504					3423		1770	3539	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	249	12	1467	0	0	0	0	890	250	124	752	0
RTOR Reduction (vph)	0	68	68	0	0	0	0	19	0	0	0	0
Lane Group Flow (vph)	0	912	680	0	0	0	0	1121	0	124	752	0
Turn Type	Prot	NA	Perm					NA		Prot	NA	
Protected Phases	7	4						2		1	6	
Permitted Phases			4									
Actuated Green, G (s)		68.1	68.1					48.1		11.8	63.9	
Effective Green, g (s)		68.1	68.1					49.1		10.8	64.9	
Actuated g/C Ratio		0.49	0.49					0.35		0.08	0.46	
Clearance Time (s)		4.0	4.0					4.0		4.0	4.0	
Vehicle Extension (s)		2.0	2.0					2.5		2.0	2.5	
Lane Grp Cap (vph)		756	731					1200		136	1640	
v/s Ratio Prot								c0.33		c0.07	0.21	
v/s Ratio Perm		0.59	0.45									
v/c Ratio		1.21	0.93					0.93		0.91	0.46	
Uniform Delay, d1		36.0	33.7					43.9		64.1	25.6	
Progression Factor		1.00	1.00					1.00		0.79	1.24	
Incremental Delay, d2		105.0	17.8					14.4		37.3	0.6	
Delay (s)		140.9	51.6					58.3		87.8	32.4	
Level of Service		F	D					E		F	C	
Approach Delay (s)		102.2			0.0			58.3			40.2	
Approach LOS		F			A			E			D	





























Intersection Summary

HCM 2000 Control Delay	74.3	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.08		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	111.2%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 39: Livermore Ave & Portola Ave

BART to Livermore Extension Project
 2040 No Project PM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 	 			 			 			 	
Traffic Volume (vph)	833	629	182	17	315	74	188	679	83	239	1014	487
Future Volume (vph)	833	629	182	17	315	74	188	679	83	239	1014	487
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	2.7	4.0	4.0	2.7	4.0	4.0	4.9		4.0	4.9	4.9
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	1.00	0.95		1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.98		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	1770	3482		1770	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	1770	3482		1770	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	905	684	198	18	342	80	204	738	90	260	1102	529
RTOR Reduction (vph)	0	0	122	0	0	68	0	8	0	0	0	81
Lane Group Flow (vph)	905	684	76	18	342	12	204	820	0	260	1102	448
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA		Prot	NA	pm+ov
Protected Phases	3	8		7	4		1	6		5	2	3
Permitted Phases			8			4						2
Actuated Green, G (s)	26.5	39.9	39.9	1.9	15.3	15.3	11.0	33.0		13.0	35.0	61.5
Effective Green, g (s)	26.5	41.2	39.9	1.9	16.6	15.3	11.0	32.1		13.0	34.1	59.7
Actuated g/C Ratio	0.26	0.40	0.38	0.02	0.16	0.15	0.11	0.31		0.13	0.33	0.58
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	876	1404	608	32	565	233	187	1076		221	1162	910
v/s Ratio Prot	c0.26	0.19		0.01	c0.10		0.12	0.24		c0.15	c0.31	0.12
v/s Ratio Perm			0.05			0.01						0.16
v/c Ratio	1.03	0.49	0.13	0.56	0.61	0.05	1.09	0.76		1.18	0.95	0.49
Uniform Delay, d1	38.6	23.4	20.7	50.5	40.6	38.0	46.4	32.4		45.4	34.0	13.1
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	39.2	0.3	0.1	20.7	1.8	0.1	92.2	3.3		116.4	15.4	0.4
Delay (s)	77.9	23.7	20.8	71.2	42.4	38.1	138.6	35.7		161.8	49.4	13.5
Level of Service	E	C	C	E	D	D	F	D		F	D	B
Approach Delay (s)		50.8			42.8			56.0			54.8	
Approach LOS		D			D			E			D	
Intersection Summary												
HCM 2000 Control Delay			52.6				HCM 2000 Level of Service				D	
HCM 2000 Volume to Capacity ratio			0.97									
Actuated Cycle Length (s)			103.8			Sum of lost time (s)				16.5		
Intersection Capacity Utilization			85.0%			ICU Level of Service				E		
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis
40: First St/Springtown Blvd & I-580 WB Ramps

BART to Livermore Extension Project
2040 No Project PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations			↗↗			↗	↗↗	↑			↖↖	↖
Traffic Volume (vph)	0	0	262	0	0	0	385	1439	0	0	421	176
Future Volume (vph)	0	0	262	0	0	0	385	1439	0	0	421	176
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)			4.5				4.5	4.0			4.5	4.5
Lane Util. Factor			0.88				0.97	1.00			0.95	1.00
Frt			0.85				1.00	1.00			1.00	0.85
Flt Protected			1.00				0.95	1.00			1.00	1.00
Satd. Flow (prot)			2787				3433	1863			3539	1583
Flt Permitted			1.00				0.95	1.00			1.00	1.00
Satd. Flow (perm)			2787				3433	1863			3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	285	0	0	0	418	1564	0	0	458	191
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	9
Lane Group Flow (vph)	0	0	285	0	0	0	418	1564	0	0	458	182
Turn Type			Over			Free	Prot	NA			NA	Perm
Protected Phases			5				5	2			6	
Permitted Phases						Free						6
Actuated Green, G (s)			21.0				21.0	140.0			111.0	111.0
Effective Green, g (s)			20.5				20.5	140.0			110.5	110.5
Actuated g/C Ratio			0.15				0.15	1.00			0.79	0.79
Clearance Time (s)			4.0				4.0	4.0			4.0	4.0
Vehicle Extension (s)			2.0				2.0	0.2			4.0	4.0
Lane Grp Cap (vph)			408				502	1863			2793	1249
v/s Ratio Prot			0.10				0.12	c0.84			0.13	
v/s Ratio Perm												0.11
v/c Ratio			0.70				0.83	0.84			0.16	0.15
Uniform Delay, d1			56.8				58.1	0.0			3.6	3.5
Progression Factor			1.00				0.83	1.00			1.00	1.00
Incremental Delay, d2			4.2				1.1	0.5			0.1	0.2
Delay (s)			61.0				49.2	0.5			3.7	3.8
Level of Service			E				D	A			A	A
Approach Delay (s)		61.0			0.0			10.7			3.7	
Approach LOS		E			A			B			A	

Intersection Summary

HCM 2000 Control Delay	14.1	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.90		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	79.1%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
41: First St & I-580 EB Ramps



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕	↗↘					↕↕	↗	↘	↕↕	
Traffic Volume (vph)	538	3	703	0	0	0	0	1695	448	96	1192	0
Future Volume (vph)	538	3	703	0	0	0	0	1695	448	96	1192	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0					5.0	5.0	5.0	5.0	
Lane Util. Factor		1.00	0.88					0.95	1.00	1.00	0.95	
Frt		1.00	0.85					1.00	0.85	1.00	1.00	
Flt Protected		0.95	1.00					1.00	1.00	0.95	1.00	
Satd. Flow (prot)		1774	2787					3539	1583	1770	3539	
Flt Permitted		0.95	1.00					1.00	1.00	0.95	1.00	
Satd. Flow (perm)		1774	2787					3539	1583	1770	3539	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	585	3	764	0	0	0	0	1842	487	104	1296	0
RTOR Reduction (vph)	0	0	78	0	0	0	0	0	142	0	0	0
Lane Group Flow (vph)	0	588	686	0	0	0	0	1842	345	104	1296	0
Turn Type	Perm	NA	Perm					NA	Perm	Prot	NA	
Protected Phases		4						2		1	6	
Permitted Phases	4		4						2			
Actuated Green, G (s)		45.5	45.5					73.5	73.5	9.0	86.5	
Effective Green, g (s)		45.0	45.0					73.0	73.0	8.0	86.0	
Actuated g/C Ratio		0.32	0.32					0.52	0.52	0.06	0.61	
Clearance Time (s)		3.5	3.5					4.5	4.5	4.0	4.5	
Vehicle Extension (s)		2.5	2.5					4.0	4.0	2.0	4.0	
Lane Grp Cap (vph)		570	895					1845	825	101	2173	
v/s Ratio Prot								c0.52		c0.06	0.37	
v/s Ratio Perm		0.33	0.25						0.22			
v/c Ratio		1.03	0.77					1.00	0.42	1.03	0.60	
Uniform Delay, d1		47.5	42.8					33.4	20.5	66.0	16.4	
Progression Factor		1.00	1.00					1.00	1.00	0.93	0.95	
Incremental Delay, d2		46.0	3.8					20.6	1.6	97.5	1.2	
Delay (s)		93.5	46.6					54.0	22.1	158.9	16.9	
Level of Service		F	D					D	C	F	B	
Approach Delay (s)		67.0			0.0			47.3			27.4	
Approach LOS		E			A			D			C	

























Intersection Summary

HCM 2000 Control Delay	47.1	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	1.01		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	14.0
Intersection Capacity Utilization	93.8%	ICU Level of Service	F
Analysis Period (min)	15		























c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
42: 1st St & Mines Rd























BART to Livermore Extension Project
2040 No Project PM

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations													
Traffic Volume (vph)	77	251	83	440	226	321	72	1539	858	377	1213	51	
Future Volume (vph)	77	251	83	440	226	321	72	1539	858	377	1213	51	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00	1.00	0.97	1.00	1.00	1.00	0.91	1.00	0.97	0.91	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1770	1863	1583	3433	1863	1583	1770	5085	1583	3433	5085	1583	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	1770	1863	1583	3433	1863	1583	1770	5085	1583	3433	5085	1583	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	
Adj. Flow (vph)	84	273	90	478	246	349	78	1673	933	410	1318	55	
RTOR Reduction (vph)	0	0	75	0	0	36	0	0	164	0	0	29	
Lane Group Flow (vph)	84	273	15	478	246	313	78	1673	769	410	1318	26	
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	Perm	
Protected Phases	7	4		3	8	1	5	2		1	NA	6	
Permitted Phases			4			8			2			6	
Actuated Green, G (s)	5.6	16.8	16.8	13.0	24.2	35.2	7.6	44.8	44.8	11.0	48.2	48.2	
Effective Green, g (s)	5.6	16.8	16.8	13.0	24.2	35.2	7.6	44.8	44.8	11.0	48.2	48.2	
Actuated g/C Ratio	0.06	0.17	0.17	0.13	0.24	0.35	0.07	0.44	0.44	0.11	0.47	0.47	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	97	308	261	439	443	610	132	2242	698	371	2412	750	
v/s Ratio Prot	0.05	c0.15		c0.14	0.13	0.06	0.04	0.33		c0.12	c0.26		
v/s Ratio Perm			0.01			0.14			c0.49			0.02	
v/c Ratio	0.87	0.89	0.06	1.09	0.56	0.51	0.59	0.75	1.10	1.11	0.55	0.03	
Uniform Delay, d1	47.6	41.5	35.7	44.3	34.0	26.4	45.5	23.7	28.4	45.3	18.9	14.3	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	50.6	24.8	0.1	69.1	1.5	0.7	6.9	1.4	65.2	78.2	0.3	0.0	
Delay (s)	98.2	66.3	35.8	113.4	35.5	27.1	52.4	25.1	93.6	123.5	19.2	14.3	
Level of Service	F	E	D	F	D	C	D	C	F	F	B	B	
Approach Delay (s)		66.1			67.5			49.7			43.0		
Approach LOS		E			E			D			D		
Intersection Summary													
HCM 2000 Control Delay			52.1									HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio			1.04										
Actuated Cycle Length (s)			101.6									Sum of lost time (s)	16.0
Intersection Capacity Utilization			87.1%									ICU Level of Service	E
Analysis Period (min)			15										
c Critical Lane Group													


























HCM Unsignalized Intersection Capacity Analysis
43: Vasco Rd & I-580 WB Ramps

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations								  			  		
Traffic Volume (veh/h)	0	0	0	0	0	156	0	2465	0	0	585	0	
Future Volume (Veh/h)	0	0	0	0	0	156	0	2465	0	0	585	0	
Sign Control		Stop			Stop			Free			Free		
Grade		0%			0%			0%			0%		
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	
Hourly flow rate (vph)	0	0	0	0	0	170	0	2679	0	0	636	0	
Pedestrians													
Lane Width (ft)													
Walking Speed (ft/s)													
Percent Blockage													
Right turn flare (veh)													
Median type							None			None			
Median storage (veh)													
Upstream signal (ft)											524		
pX, platoon unblocked													
vC, conflicting volume	1699	3315	212	2891	3315	893	636				2679		
vC1, stage 1 conf vol													
vC2, stage 2 conf vol													
vCu, unblocked vol	1699	3315	212	2891	3315	893	636				2679		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1				4.1		
tC, 2 stage (s)													
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2				2.2		
p0 queue free %	100	100	100	100	100	40	100				100		
cM capacity (veh/h)	24	8	793	7	8	285	943				152		
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	NB 4	SB 1	SB 2	SB 3	SB 4			
Volume Total	0	170	893	893	893	0	212	212	212	0			
Volume Left	0	0	0	0	0	0	0	0	0	0			
Volume Right	0	170	0	0	0	0	0	0	0	0			
cSH	1700	285	1700	1700	1700	1700	1700	1700	1700	1700			
Volume to Capacity	0.00	0.60	0.53	0.53	0.53	0.00	0.12	0.12	0.12	0.00			
Queue Length 95th (ft)	0	89	0	0	0	0	0	0	0	0			
Control Delay (s)	0.0	34.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
Lane LOS	A	D											
Approach Delay (s)	0.0	34.8	0.0					0.0					
Approach LOS	A	D											
Intersection Summary													
Average Delay			1.7										
Intersection Capacity Utilization			64.0%		ICU Level of Service				B				
Analysis Period (min)			15										

HCM Unsignalized Intersection Capacity Analysis
44: Vasco Rd & I-580 EB Ramps

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations								  			  	
Traffic Volume (veh/h)	0	0	0	0	0	0	0	2890	0	64	728	0
Future Volume (Veh/h)	0	0	0	0	0	0	0	2890	0	64	728	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	0	0	0	0	0	3141	0	70	791	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1978	4072	264	3545	4072	1047	791			3141		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1978	4072	264	3545	4072	1047	791			3141		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	100	100	100	100			29		
cM capacity (veh/h)	16	1	735	1	1	225	825			99		
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	NB 4	SB 1	SB 2	SB 3	SB 4		
Volume Total	0	0	1047	1047	1047	0	70	264	264	264		
Volume Left	0	0	0	0	0	0	70	0	0	0		
Volume Right	0	0	0	0	0	0	0	0	0	0		
cSH	1700	1700	1700	1700	1700	1700	99	1700	1700	1700		
Volume to Capacity	0.00	0.00	0.62	0.62	0.62	0.00	0.71	0.16	0.16	0.16		
Queue Length 95th (ft)	0	0	0	0	0	0	90	0	0	0		
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	101.5	0.0	0.0	0.0		
Lane LOS	A	A					F					
Approach Delay (s)	0.0	0.0	0.0				8.2					
Approach LOS	A	A										
Intersection Summary												
Average Delay			1.8									
Intersection Capacity Utilization			59.2%		ICU Level of Service				B			
Analysis Period (min)			15									

HCM Signalized Intersection Capacity Analysis
45: Vasco Rd & East Ave

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		 			 			 		 		
Traffic Volume (vph)	737	37	117	134	397	286	113	416	13	15	384	459
Future Volume (vph)	737	37	117	134	397	286	113	416	13	15	384	459
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	0.95		0.97	1.00	1.00
Frt	1.00	0.89		1.00	0.94		1.00	1.00		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	3135		1770	3317		1770	3523		3433	1863	1583
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1770	3135		1770	3317		1770	3523		3433	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	801	40	127	146	432	311	123	452	14	16	417	499
RTOR Reduction (vph)	0	70	0	0	109	0	0	1	0	0	0	383
Lane Group Flow (vph)	801	97	0	146	634	0	123	465	0	16	417	116
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												6
Actuated Green, G (s)	50.0	55.4		14.6	20.0		8.0	34.8		1.6	28.4	28.4
Effective Green, g (s)	50.0	55.4		14.6	20.0		8.0	34.8		1.6	28.4	28.4
Actuated g/C Ratio	0.41	0.45		0.12	0.16		0.07	0.28		0.01	0.23	0.23
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	723	1418		211	541		115	1001		44	432	367
v/s Ratio Prot	c0.45	0.03		0.08	c0.19		c0.07	0.13		0.00	c0.22	
v/s Ratio Perm												0.07
v/c Ratio	1.11	0.07		0.69	1.17		1.07	0.46		0.36	0.97	0.32
Uniform Delay, d1	36.2	18.9		51.7	51.2		57.2	36.1		59.9	46.5	38.9
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	67.1	0.0		9.4	95.9		103.8	0.3		5.1	34.1	0.5
Delay (s)	103.3	18.9		61.1	147.1		161.0	36.5		64.9	80.6	39.4
Level of Service	F	B		E	F		F	D		E	F	D
Approach Delay (s)		88.7			133.0			62.5			58.3	
Approach LOS		F			F			E			E	

Intersection Summary

HCM 2000 Control Delay	87.4	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.08		
Actuated Cycle Length (s)	122.4	Sum of lost time (s)	16.0
Intersection Capacity Utilization	100.8%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
46: Greenville Rd & I-580 WB Ramps

BART to Livermore Extension Project
2040 No Project PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↔		↔		↕	↔		↕	↔
Traffic Volume (vph)	0	0	0	105	0	32	0	1315	570	0	164	26
Future Volume (vph)	0	0	0	105	0	32	0	1315	570	0	164	26
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0		4.0		4.0	4.0		4.0	
Lane Util. Factor				0.97		1.00		0.95	1.00		0.95	
Frt				1.00		0.85		1.00	0.85		0.98	
Flt Protected				0.95		1.00		1.00	1.00		1.00	
Satd. Flow (prot)				3433		1583		3539	1583		3467	
Flt Permitted				0.95		1.00		1.00	1.00		1.00	
Satd. Flow (perm)				3433		1583		3539	1583		3467	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	114	0	35	0	1429	620	0	178	28
RTOR Reduction (vph)	0	0	0	0	0	33	0	0	80	0	4	0
Lane Group Flow (vph)	0	0	0	114	0	3	0	1429	540	0	202	0
Turn Type				Prot		Prot		NA	Perm		NA	
Protected Phases				3		3		2			6	
Permitted Phases									2			
Actuated Green, G (s)				10.0		10.0		122.0	122.0		122.0	
Effective Green, g (s)				10.0		10.0		122.0	122.0		122.0	
Actuated g/C Ratio				0.07		0.07		0.87	0.87		0.87	
Clearance Time (s)				4.0		4.0		4.0	4.0		4.0	
Vehicle Extension (s)				3.0		3.0		3.0	3.0		3.0	
Lane Grp Cap (vph)				245		113		3083	1379		3021	
v/s Ratio Prot				c0.03		0.00		c0.40			0.06	
v/s Ratio Perm									0.34			
v/c Ratio				0.47		0.02		0.46	0.39		0.07	
Uniform Delay, d1				62.4		60.5		1.9	1.8		1.2	
Progression Factor				1.00		1.00		0.63	0.12		1.00	
Incremental Delay, d2				1.4		0.1		0.5	0.8		0.0	
Delay (s)				63.8		60.5		1.7	1.0		1.3	
Level of Service				E		E		A	A		A	
Approach Delay (s)		0.0			63.1			1.5			1.3	
Approach LOS		A			E			A			A	

Intersection Summary		
HCM 2000 Control Delay	5.3	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.46	A
Actuated Cycle Length (s)	140.0	Sum of lost time (s)
Intersection Capacity Utilization	46.4%	8.0
Analysis Period (min)	15	ICU Level of Service
		A

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
47: Greenville Rd & I-580 EB Ramps



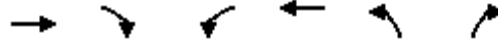
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↗↘		↗					↕↕	↗		↕↕	↗
Traffic Volume (vph)	189	0	87	0	0	0	0	1377	376	0	200	63
Future Volume (vph)	189	0	87	0	0	0	0	1377	376	0	200	63
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0					4.0	4.0		4.0	4.0
Lane Util. Factor	0.97		1.00					0.95	1.00		0.95	1.00
Frt	1.00		0.85					1.00	0.85		1.00	0.85
Flt Protected	0.95		1.00					1.00	1.00		1.00	1.00
Satd. Flow (prot)	3433		1583					3539	1583		3539	1583
Flt Permitted	0.95		1.00					1.00	1.00		1.00	1.00
Satd. Flow (perm)	3433		1583					3539	1583		3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	205	0	95	0	0	0	0	1497	409	0	217	68
RTOR Reduction (vph)	0	0	86	0	0	0	0	0	63	0	0	11
Lane Group Flow (vph)	205	0	9	0	0	0	0	1497	346	0	217	57
Turn Type	Prot		Prot					NA	Perm		NA	Perm
Protected Phases	7		7					2			6	
Permitted Phases									2			6
Actuated Green, G (s)	13.7		13.7					118.3	118.3		118.3	118.3
Effective Green, g (s)	13.7		13.7					118.3	118.3		118.3	118.3
Actuated g/C Ratio	0.10		0.10					0.84	0.84		0.84	0.84
Clearance Time (s)	4.0		4.0					4.0	4.0		4.0	4.0
Vehicle Extension (s)	3.0		3.0					3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	335		154					2990	1337		2990	1337
v/s Ratio Prot	c0.06		0.01					c0.42			0.06	
v/s Ratio Perm									0.22			0.04
v/c Ratio	0.61		0.06					0.50	0.26		0.07	0.04
Uniform Delay, d1	60.6		57.3					2.9	2.2		1.8	1.7
Progression Factor	1.00		1.00					0.71	0.15		0.60	0.09
Incremental Delay, d2	3.3		0.2					0.5	0.4		0.0	0.1
Delay (s)	63.9		57.5					2.6	0.7		1.1	0.2
Level of Service	E		E					A	A		A	A
Approach Delay (s)		61.9			0.0			2.2			0.9	
Approach LOS		E			A			A			A	

Intersection Summary

HCM 2000 Control Delay	9.2	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.51		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	50.1%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
48: Greenville Rd & Northfront Road/Altamont Pass Road



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↗	↖	↑	↘	↗
Traffic Volume (vph)	555	179	2	73	267	1144
Future Volume (vph)	555	179	2	73	267	1144
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	1863	1583	1770	1863	1770	1583
Flt Permitted	1.00	1.00	0.11	1.00	0.95	1.00
Satd. Flow (perm)	1863	1583	213	1863	1770	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	603	195	2	79	290	1243
RTOR Reduction (vph)	0	87	0	0	0	25
Lane Group Flow (vph)	603	108	2	79	290	1218
Turn Type	NA	Perm	Perm	NA	Prot	Perm
Protected Phases	4			8	2	
Permitted Phases		4	8			2
Actuated Green, G (s)	35.0	35.0	35.0	35.0	77.0	77.0
Effective Green, g (s)	35.0	35.0	35.0	35.0	77.0	77.0
Actuated g/C Ratio	0.29	0.29	0.29	0.29	0.64	0.64
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	543	461	62	543	1135	1015
v/s Ratio Prot	c0.32			0.04	0.16	
v/s Ratio Perm		0.07	0.01			c0.77
v/c Ratio	1.11	0.23	0.03	0.15	0.26	1.20
Uniform Delay, d1	42.5	32.3	30.4	31.4	9.2	21.5
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	72.6	0.3	0.2	0.1	0.1	99.7
Delay (s)	115.1	32.6	30.6	31.6	9.3	121.2
Level of Service	F	C	C	C	A	F
Approach Delay (s)	94.9			31.5	100.1	
Approach LOS	F			C	F	

Intersection Summary

HCM 2000 Control Delay	96.1	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.17		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	106.7%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	399	114	225	1175	151	135
Future Volume (vph)	399	114	225	1175	151	135
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.2	5.2	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.88	0.97	0.95	0.95	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	3433	2787	3433	3539	3539	1583
Flt Permitted	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (perm)	3433	2787	3433	3539	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	434	124	245	1277	164	147
RTOR Reduction (vph)	0	97	0	0	0	83
Lane Group Flow (vph)	434	27	245	1277	164	64
Turn Type	Prot	Perm	Prot	NA	NA	Perm
Protected Phases	8		1	6	2	
Permitted Phases		8				2
Actuated Green, G (s)	15.7	15.7	11.3	44.0	28.7	28.7
Effective Green, g (s)	15.1	15.1	11.3	45.7	30.4	30.4
Actuated g/C Ratio	0.22	0.22	0.16	0.65	0.43	0.43
Clearance Time (s)	4.6	4.6	4.0	5.7	5.7	5.7
Vehicle Extension (s)	5.0	5.0	6.0	2.5	2.5	2.5
Lane Grp Cap (vph)	740	601	554	2310	1536	687
v/s Ratio Prot	c0.13		0.07	c0.36	0.05	
v/s Ratio Perm		0.01				0.04
v/c Ratio	0.59	0.04	0.44	0.55	0.11	0.09
Uniform Delay, d1	24.6	21.7	26.5	6.6	11.7	11.7
Progression Factor	1.00	1.00	1.00	1.00	0.71	0.69
Incremental Delay, d2	1.8	0.1	1.6	1.0	0.1	0.3
Delay (s)	26.5	21.8	28.1	7.6	8.5	8.3
Level of Service	C	C	C	A	A	A
Approach Delay (s)	25.4			10.9	8.4	
Approach LOS	C			B	A	

Intersection Summary

HCM 2000 Control Delay	13.9	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.60		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	13.2
Intersection Capacity Utilization	51.5%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
50: Greenville Rd & Patterson Pass Rd

BART to Livermore Extension Project
2040 No Project PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	41	529	65	6	12	8	67	481	334	410	217	40
Future Volume (vph)	41	529	65	6	12	8	67	481	334	410	217	40
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.98		1.00	0.94		1.00	0.94		1.00	0.98	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1832		1770	1748		1770	1748		1770	1820	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	1832		1770	1748		1770	1748		1770	1820	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	45	575	71	7	13	9	73	523	363	446	236	43
RTOR Reduction (vph)	0	4	0	0	7	0	0	20	0	0	5	0
Lane Group Flow (vph)	45	642	0	7	15	0	73	866	0	446	274	0
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												
Actuated Green, G (s)	9.4	31.0		0.8	22.4		7.6	47.8		22.0	62.2	
Effective Green, g (s)	9.4	31.0		0.8	22.4		7.6	47.8		22.0	62.2	
Actuated g/C Ratio	0.08	0.26		0.01	0.19		0.06	0.41		0.19	0.53	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	141	482		12	332		114	710		331	962	
v/s Ratio Prot	c0.03	c0.35		0.00	0.01		0.04	c0.50		c0.25	0.15	
v/s Ratio Perm												
v/c Ratio	0.32	1.33		0.58	0.04		0.64	1.22		1.35	0.28	
Uniform Delay, d1	51.1	43.3		58.2	38.9		53.7	34.9		47.8	15.4	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	1.3	163.4		56.2	0.1		11.6	111.3		175.2	0.7	
Delay (s)	52.4	206.7		114.5	38.9		65.3	146.2		223.0	16.1	
Level of Service	D	F		F	D		E	F		F	B	
Approach Delay (s)		196.6			57.2			140.0			143.4	
Approach LOS		F			E			F			F	

Intersection Summary

HCM 2000 Control Delay	156.3	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.28		
Actuated Cycle Length (s)	117.6	Sum of lost time (s)	16.0
Intersection Capacity Utilization	110.2%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
1: Dougherty Rd & Amador Valley Rd



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	105	897	486	855	2284	129
Future Volume (vph)	105	897	486	855	2284	129
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00	0.97	0.91	0.91	
Frt	1.00	0.85	1.00	1.00	0.99	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1770	1583	3433	5085	5045	
Flt Permitted	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	1770	1583	3433	5085	5045	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	114	975	528	929	2483	140
RTOR Reduction (vph)	0	130	0	0	5	0
Lane Group Flow (vph)	114	845	528	929	2618	0
Turn Type	Perm	Perm	Prot	NA	NA	
Protected Phases			5	2	6	
Permitted Phases	4	4				
Actuated Green, G (s)	45.0	45.0	12.0	67.0	51.0	
Effective Green, g (s)	45.0	45.0	12.0	67.0	51.0	
Actuated g/C Ratio	0.38	0.38	0.10	0.56	0.42	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	663	593	343	2839	2144	
v/s Ratio Prot			c0.15	0.18	c0.52	
v/s Ratio Perm	0.06	c0.53				
v/c Ratio	0.17	1.42	1.54	0.33	1.22	
Uniform Delay, d1	25.1	37.5	54.0	14.3	34.5	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.1	200.9	256.9	0.1	103.9	
Delay (s)	25.2	238.4	310.9	14.4	138.4	
Level of Service	C	F	F	B	F	
Approach Delay (s)	216.1			121.8	138.4	
Approach LOS	F			F	F	

Intersection Summary

HCM 2000 Control Delay	150.1	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.34		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	109.2%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
2: Hopyard Road/Dougherty Rd & Dublin Blvd

BART to Livermore Extension Project
2040 BART AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	55	538	511	323	806	486	691	1120	144	1083	2293	108
Future Volume (vph)	55	538	511	323	806	486	691	1120	144	1083	2293	108
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	6.0	5.0	5.0	5.5	5.0	5.0	5.5	5.0	5.0	5.5	
Lane Util. Factor	0.97	0.91	0.88	0.94	0.91	1.00	0.94	0.91	0.88	0.97	0.86	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	3433	5085	2787	4990	5085	1583	4990	5085	2787	3433	6365	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	3433	5085	2787	4990	5085	1583	4990	5085	2787	3433	6365	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	60	585	555	351	876	528	751	1217	157	1177	2492	117
RTOR Reduction (vph)	0	0	65	0	0	80	0	0	60	0	4	0
Lane Group Flow (vph)	60	585	490	351	876	448	751	1217	97	1177	2605	0
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	
Protected Phases	5	2	3	1	6	7	3	8	1	7	4	
Permitted Phases			2			6			8			
Actuated Green, G (s)	12.0	30.4	46.4	15.0	33.9	62.0	16.0	45.0	60.0	28.1	57.1	
Effective Green, g (s)	12.0	30.4	46.4	15.0	33.9	62.0	16.0	45.0	60.0	28.1	57.1	
Actuated g/C Ratio	0.09	0.22	0.33	0.11	0.24	0.44	0.11	0.32	0.43	0.20	0.41	
Clearance Time (s)	5.0	6.0	5.0	5.0	5.5	5.0	5.0	5.5	5.0	5.0	5.5	
Vehicle Extension (s)	2.0	4.5	2.0	2.0	4.5	2.0	2.0	4.5	2.0	2.0	4.5	
Lane Grp Cap (vph)	294	1104	923	534	1231	701	570	1634	1194	689	2596	
v/s Ratio Prot	0.02	0.12	c0.06	0.07	c0.17	0.13	c0.15	0.24	0.01	c0.34	c0.41	
v/s Ratio Perm			0.12			0.15			0.03			
v/c Ratio	0.20	0.53	0.53	0.66	0.71	0.64	1.32	0.74	0.08	1.71	1.00	
Uniform Delay, d1	59.6	48.5	38.0	60.0	48.6	30.3	62.0	42.4	23.7	56.0	41.5	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	0.86	0.77	0.86	1.00	1.00	
Incremental Delay, d2	0.1	1.8	0.3	2.2	3.5	1.4	152.5	1.7	0.0	324.9	18.5	
Delay (s)	59.7	50.3	38.3	62.3	52.1	31.7	206.1	34.5	20.4	380.9	59.9	
Level of Service	E	D	D	E	D	C	F	C	C	F	E	
Approach Delay (s)		45.2			48.0			94.1			159.7	
Approach LOS		D			D			F			F	

Intersection Summary

HCM 2000 Control Delay	106.4	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.07		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	21.5
Intersection Capacity Utilization	98.1%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
3: Dougherty Rd/Hopyard Road & I-580 WB Ramps

BART to Livermore Extension Project
2040 BART AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↔↔		↔↔		↑↑↑			↑↑↑	↔
Traffic Volume (vph)	0	0	0	392	0	637	0	1746	0	0	2263	0
Future Volume (vph)	0	0	0	392	0	637	0	1746	0	0	2263	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0		4.0		4.0			4.0	
Lane Util. Factor				0.97		0.88		0.91			0.86	
Frt				1.00		0.85		1.00			1.00	
Flt Protected				0.95		1.00		1.00			1.00	
Satd. Flow (prot)				3433		2787		5085			4806	
Flt Permitted				0.95		1.00		1.00			1.00	
Satd. Flow (perm)				3433		2787		5085			4806	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	426	0	692	0	1898	0	0	2460	0
RTOR Reduction (vph)	0	0	0	0	0	22	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	426	0	670	0	1898	0	0	2460	0
Turn Type				Prot		Prot		NA			NA	Perm
Protected Phases				4		4		2			6	
Permitted Phases												6
Actuated Green, G (s)				38.9		38.9		90.3			90.3	
Effective Green, g (s)				40.3		40.3		91.7			91.7	
Actuated g/C Ratio				0.29		0.29		0.66			0.66	
Clearance Time (s)				5.4		5.4		5.4			5.4	
Vehicle Extension (s)				3.0		3.0		3.0			3.0	
Lane Grp Cap (vph)				988		802		3330			3147	
v/s Ratio Prot				0.12		c0.24		0.37			c0.51	
v/s Ratio Perm												
v/c Ratio				0.43		0.84		0.57			0.78	
Uniform Delay, d1				40.5		46.7		13.3			17.1	
Progression Factor				1.00		1.00		1.01			0.44	
Incremental Delay, d2				0.3		7.5		0.6			0.9	
Delay (s)				40.8		54.3		14.0			8.3	
Level of Service				D		D		B			A	
Approach Delay (s)		0.0			49.1			14.0			8.3	
Approach LOS		A			D			B			A	

Intersection Summary

HCM 2000 Control Delay	18.6	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.80		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	62.7%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 4: Hopyard Rd/Dougherty Rd & I-580 EB Ramps

BART to Livermore Extension Project
 2040 BART AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗		↖↗					↑↑↑	↖		↑↑↑	↖
Traffic Volume (vph)	895	0	1455	0	0	0	0	950	0	0	1854	0
Future Volume (vph)	895	0	1455	0	0	0	0	950	0	0	1854	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0					4.0			4.0	
Lane Util. Factor	0.97		0.88					0.91			0.86	
Frt	1.00		0.85					1.00			1.00	
Flt Protected	0.95		1.00					1.00			1.00	
Satd. Flow (prot)	3433		2787					5085			4806	
Flt Permitted	0.95		1.00					1.00			1.00	
Satd. Flow (perm)	3433		2787					5085			4806	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	973	0	1582	0	0	0	0	1033	0	0	2015	0
RTOR Reduction (vph)	0	0	9	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	973	0	1573	0	0	0	0	1033	0	0	2015	0
Turn Type	Prot		Prot					NA	Free		NA	Perm
Protected Phases	4		4					2			6	
Permitted Phases									Free			6
Actuated Green, G (s)	71.6		71.6					57.6			57.6	
Effective Green, g (s)	73.0		73.0					59.0			59.0	
Actuated g/C Ratio	0.52		0.52					0.42			0.42	
Clearance Time (s)	5.4		5.4					5.4			5.4	
Vehicle Extension (s)	3.0		3.0					3.0			3.0	
Lane Grp Cap (vph)	1790		1453					2142			2025	
v/s Ratio Prot	0.28		c0.56					0.20			c0.42	
v/s Ratio Perm												
v/c Ratio	0.54		1.08					0.48			1.00	
Uniform Delay, d1	22.4		33.5					29.4			40.4	
Progression Factor	1.00		1.00					1.00			1.13	
Incremental Delay, d2	0.3		49.4					0.8			15.3	
Delay (s)	22.7		82.9					30.2			60.9	
Level of Service	C		F					C			E	
Approach Delay (s)		60.0			0.0			30.2			60.9	
Approach LOS		E			A			C			E	

Intersection Summary			
HCM 2000 Control Delay	54.8	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	1.04		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	93.4%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
5: Hopyard Rd & Owens Rd

BART to Livermore Extension Project
2040 BART AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↔↗		↖	↗	↗	↖	↑↑↑	↗	↖↗	↑↑↗	
Traffic Volume (vph)	194	105	50	135	135	235	156	879	207	1048	1777	535
Future Volume (vph)	194	105	50	135	135	235	156	879	207	1048	1777	535
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	2.7	2.7		2.7	2.7	2.7	4.0	2.3	2.3	4.0	2.3	
Lane Util. Factor	0.91	0.91		1.00	0.95	0.95	1.00	0.91	1.00	0.97	0.91	
Frt	1.00	0.97		1.00	0.95	0.85	1.00	1.00	0.85	1.00	0.97	
Flt Protected	0.95	0.98		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1610	3227		1770	1677	1504	1770	5085	1583	3433	4909	
Flt Permitted	0.95	0.98		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1610	3227		1770	1677	1504	1770	5085	1583	3433	4909	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	211	114	54	147	147	255	170	955	225	1139	1932	582
RTOR Reduction (vph)	0	24	0	0	21	55	0	0	157	0	60	0
Lane Group Flow (vph)	116	239	0	147	205	122	170	955	68	1139	2454	0
Turn Type	Split	NA		Split	NA	pm+ov	Prot	NA	Perm	Prot	NA	
Protected Phases	8	8		4	4	1	5	2		1	6	
Permitted Phases						4			2			
Actuated Green, G (s)	6.0	6.0		9.0	9.0	42.4	9.0	25.6	25.6	33.4	50.0	
Effective Green, g (s)	7.3	7.3		10.3	10.3	45.0	9.0	27.3	27.3	33.4	51.7	
Actuated g/C Ratio	0.08	0.08		0.11	0.11	0.50	0.10	0.30	0.30	0.37	0.57	
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	130	261		202	191	797	177	1542	480	1274	2819	
v/s Ratio Prot	0.07	c0.07		0.08	c0.12	0.06	c0.10	0.19		0.33	c0.50	
v/s Ratio Perm						0.02			0.04			
v/c Ratio	0.89	0.92		0.73	1.07	0.15	0.96	0.62	0.14	0.89	0.87	
Uniform Delay, d1	41.0	41.0		38.5	39.9	12.2	40.3	26.9	22.8	26.6	16.3	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	47.7	33.9		12.3	85.5	0.1	55.9	1.9	0.6	8.4	4.0	
Delay (s)	88.6	75.0		50.8	125.4	12.3	96.2	28.8	23.4	35.0	20.3	
Level of Service	F	E		D	F	B	F	C	C	C	C	
Approach Delay (s)		79.2			69.1			36.4			24.9	
Approach LOS		E			E			D			C	




































Intersection Summary

HCM 2000 Control Delay	35.1	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.91		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	11.7
Intersection Capacity Utilization	86.9%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
6: Hopyard Rd & Stoneridge Dr

BART to Livermore Extension Project
2040 BART AM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 	  		 	  		  	 		  		
Traffic Volume (vph)	233	788	474	67	962	138	630	873	71	294	1026	291
Future Volume (vph)	233	788	474	67	962	138	630	873	71	294	1026	291
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.91	1.00	0.97	0.91	1.00	0.94	0.95	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5085	1583	3433	5085	1583	4990	3539	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5085	1583	3433	5085	1583	4990	3539	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	253	857	515	73	1046	150	685	949	77	320	1115	316
RTOR Reduction (vph)	0	0	203	0	0	107	0	0	54	0	0	127
Lane Group Flow (vph)	253	857	312	73	1046	43	685	949	23	320	1115	189
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8			2			6
Actuated Green, G (s)	4.0	19.1	19.1	2.4	17.5	17.5	8.0	18.0	18.0	6.0	16.0	16.0
Effective Green, g (s)	4.0	19.1	19.1	2.4	17.5	17.5	8.0	18.0	18.0	6.0	16.0	16.0
Actuated g/C Ratio	0.07	0.31	0.31	0.04	0.28	0.28	0.13	0.29	0.29	0.10	0.26	0.26
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	223	1579	491	133	1446	450	649	1035	463	334	1322	411
v/s Ratio Prot	c0.07	0.17		0.02	c0.21		c0.14	c0.27		0.09	0.22	
v/s Ratio Perm			0.20			0.03			0.01			0.12
v/c Ratio	1.13	0.54	0.64	0.55	0.72	0.09	1.06	0.92	0.05	0.96	0.84	0.46
Uniform Delay, d1	28.8	17.6	18.2	29.0	19.8	16.2	26.8	21.0	15.6	27.6	21.6	19.1
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	101.2	0.4	2.7	4.6	1.8	0.1	50.9	12.3	0.0	37.8	5.1	0.8
Delay (s)	130.0	18.0	20.9	33.6	21.6	16.3	77.6	33.4	15.7	65.4	26.7	19.9
Level of Service	F	B	C	C	C	B	E	C	B	E	C	B
Approach Delay (s)		36.3			21.7			50.3			32.5	
Approach LOS		D			C			D			C	



































Intersection Summary

HCM 2000 Control Delay	36.1	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.91		
Actuated Cycle Length (s)	61.5	Sum of lost time (s)	16.0
Intersection Capacity Utilization	71.1%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
7: Hopyard Rd & Las Positas Blvd

BART to Livermore Extension Project
2040 BART AM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 	 		 	 		 	  		 	  	
Traffic Volume (vph)	163	484	404	361	451	58	451	1282	395	114	1079	94
Future Volume (vph)	163	484	404	361	451	58	451	1282	395	114	1079	94
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.95	1.00	0.97	0.95	1.00	0.97	0.91	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	3433	3539	1583	3433	5085	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	3433	3539	1583	3433	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	177	526	439	392	490	63	490	1393	429	124	1173	102
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	74
Lane Group Flow (vph)	177	526	439	392	490	63	490	1393	429	124	1173	28
Turn Type	Prot	NA	Free	Prot	NA	Free	Prot	NA	Free	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			Free			Free			Free			6
Actuated Green, G (s)	6.9	14.5	69.4	9.0	16.6	69.4	11.0	26.7	69.4	3.2	18.9	18.9
Effective Green, g (s)	6.9	14.5	69.4	9.0	16.6	69.4	11.0	26.7	69.4	3.2	18.9	18.9
Actuated g/C Ratio	0.10	0.21	1.00	0.13	0.24	1.00	0.16	0.38	1.00	0.05	0.27	0.27
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	341	739	1583	445	846	1583	544	1956	1583	158	1384	431
v/s Ratio Prot	0.05	c0.15		c0.11	0.14		c0.14	0.27		0.04	c0.23	
v/s Ratio Perm			c0.28			0.04			0.27			0.02
v/c Ratio	0.52	0.71	0.28	0.88	0.58	0.04	0.90	0.71	0.27	0.78	0.85	0.06
Uniform Delay, d1	29.7	25.5	0.0	29.7	23.3	0.0	28.7	18.1	0.0	32.8	23.9	18.7
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.3	3.3	0.4	18.1	1.0	0.0	18.0	1.2	0.4	22.1	5.0	0.1
Delay (s)	31.0	28.8	0.4	47.7	24.3	0.0	46.6	19.3	0.4	54.8	28.9	18.8
Level of Service	C	C	A	D	C	A	D	B	A	D	C	B
Approach Delay (s)		18.2			32.4			21.6			30.5	
Approach LOS		B			C			C			C	

Intersection Summary

HCM 2000 Control Delay	24.8	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.83		
Actuated Cycle Length (s)	69.4	Sum of lost time (s)	16.0
Intersection Capacity Utilization	70.7%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
8: Willow Rd & Owens Rd

BART to Livermore Extension Project
2040 BART AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	244	465	271	84	340	108	105	120	0	96	84	110
Future Volume (vph)	244	465	271	84	340	108	105	120	0	96	84	110
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	5.3	4.0		5.3	4.0	4.0
Lane Util. Factor	0.97	0.91		0.97	0.91	1.00	1.00	0.95		1.00	1.00	1.00
Frt	1.00	0.94		1.00	1.00	0.85	1.00	1.00		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	4804		3433	5085	1583	1770	3539		1770	1863	1583
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.70	1.00		0.67	1.00	1.00
Satd. Flow (perm)	3433	4804		3433	5085	1583	1300	3539		1247	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	265	505	295	91	370	117	114	130	0	104	91	120
RTOR Reduction (vph)	0	137	0	0	0	73	0	0	0	0	0	95
Lane Group Flow (vph)	265	663	0	91	370	44	114	130	0	104	91	25
Turn Type	Prot	NA		Prot	NA	Perm	Perm	NA	Perm	Perm	NA	Perm
Protected Phases	1	6		5	2			4				8
Permitted Phases						2	4		4	8		8
Actuated Green, G (s)	5.7	17.2		2.5	14.0	14.0	7.3	7.3		7.3	7.3	7.3
Effective Green, g (s)	5.7	18.9		2.5	15.7	15.7	7.3	8.6		7.3	8.6	8.6
Actuated g/C Ratio	0.14	0.45		0.06	0.37	0.37	0.17	0.20		0.17	0.20	0.20
Clearance Time (s)	4.0	5.7		4.0	5.7	5.7	5.3	5.3		5.3	5.3	5.3
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	465	2161		204	1900	591	225	724		216	381	324
v/s Ratio Prot	c0.08	c0.14		c0.03	0.07			0.04				0.05
v/s Ratio Perm						0.03	c0.09			0.08		0.02
v/c Ratio	0.57	0.31		0.45	0.19	0.07	0.51	0.18		0.48	0.24	0.08
Uniform Delay, d1	17.0	7.4		19.1	8.9	8.5	15.7	13.8		15.6	14.0	13.5
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	1.6	0.1		1.6	0.1	0.1	1.8	0.1		1.7	0.3	0.1
Delay (s)	18.6	7.5		20.6	8.9	8.5	17.5	13.9		17.3	14.3	13.6
Level of Service	B	A		C	A	A	B	B		B	B	B
Approach Delay (s)		10.2			10.7			15.6			15.0	
Approach LOS		B			B			B			B	

Intersection Summary		
HCM 2000 Control Delay	11.6	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.39	B
Actuated Cycle Length (s)	42.0	Sum of lost time (s)
Intersection Capacity Utilization	40.9%	12.0
Analysis Period (min)	15	ICU Level of Service
		A

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 9: Hacienda Dr & Dublin Blvd

BART to Livermore Extension Project
 2040 BART AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↑↑↑	↖↗	↖↗	↑↑↑		↖↗	↑↑	↖↗	↖↗	↑↑↑	↖↗
Traffic Volume (vph)	88	392	119	280	765	79	184	710	125	11	400	135
Future Volume (vph)	88	392	119	280	765	79	184	710	125	11	400	135
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	6.0	5.0	4.5	6.0		5.0	6.0	6.0	4.5	5.5	5.5
Lane Util. Factor	0.97	0.91	0.88	0.97	0.91		0.94	0.95	0.88	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5085	2787	3433	5014		4990	3539	2787	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5085	2787	3433	5014		4990	3539	2787	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	96	426	129	304	832	86	200	772	136	12	435	147
RTOR Reduction (vph)	0	0	53	0	8	0	0	0	98	0	0	127
Lane Group Flow (vph)	96	426	76	304	910	0	200	772	38	12	435	20
Turn Type	Prot	NA	pm+ov	Prot	NA		Prot	NA	Perm	Prot	NA	Perm
Protected Phases	5	2	3	1	6		3	8		7	4	
Permitted Phases			2						8			4
Actuated Green, G (s)	9.3	59.9	82.8	17.6	68.2		22.9	38.9	38.9	2.6	18.6	18.6
Effective Green, g (s)	9.3	59.9	82.8	17.6	68.2		22.9	38.9	38.9	2.6	18.6	18.6
Actuated g/C Ratio	0.07	0.43	0.59	0.13	0.49		0.16	0.28	0.28	0.02	0.13	0.13
Clearance Time (s)	4.5	6.0	5.0	4.5	6.0		5.0	6.0	6.0	4.5	5.5	5.5
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	228	2175	1648	431	2442		816	983	774	63	675	210
v/s Ratio Prot	0.03	0.08	0.01	c0.09	c0.18		0.04	c0.22		0.00	c0.09	
v/s Ratio Perm			0.02						0.01			0.01
v/c Ratio	0.42	0.20	0.05	0.71	0.37		0.25	0.79	0.05	0.19	0.64	0.09
Uniform Delay, d1	62.8	25.0	12.0	58.7	22.5		51.0	46.7	37.0	67.7	57.6	53.3
Progression Factor	1.00	1.00	1.00	1.00	1.00		0.82	0.80	0.82	1.00	1.00	1.00
Incremental Delay, d2	1.3	0.2	0.0	5.2	0.4		0.2	4.1	0.0	1.5	2.1	0.2
Delay (s)	64.0	25.2	12.0	63.9	22.9		41.7	41.5	30.4	69.1	59.7	53.5
Level of Service	E	C	B	E	C		D	D	C	E	E	D
Approach Delay (s)		28.3			33.1			40.2			58.3	
Approach LOS		C			C			D			E	

Intersection Summary

HCM 2000 Control Delay	38.6	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.58		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	21.0
Intersection Capacity Utilization	60.3%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 10: Hacienda Dr & Martinelli Blvd/Hacienda Crossings



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗	↘↙	↘↙	↗		↘↙↘↙	↕↕↕	↗	↘↙	↕↕↕	
Traffic Volume (vph)	16	10	225	107	13	9	254	976	109	17	735	54
Future Volume (vph)	16	10	225	107	13	9	254	976	109	17	735	54
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	2.0	2.0	4.5	2.0		3.0	2.0	2.0	4.5	2.5	
Lane Util. Factor	1.00	0.91	0.91	0.97	1.00		0.94	0.91	1.00	0.97	0.86	
Frt	1.00	0.90	0.85	1.00	0.94		1.00	1.00	0.85	1.00	0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1770	1519	2882	3433	1746		4990	5085	1583	3433	6342	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1770	1519	2882	3433	1746		4990	5085	1583	3433	6342	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	17	11	245	116	14	10	276	1061	118	18	799	59
RTOR Reduction (vph)	0	22	194	0	9	0	0	0	26	0	5	0
Lane Group Flow (vph)	17	14	26	116	15	0	276	1061	92	18	853	0
Turn Type	Prot	NA	Perm	Prot	NA		Prot	NA	pm+ov	Prot	NA	
Protected Phases	5	2		1	6		3	8	1	7	4	
Permitted Phases			2						8			
Actuated Green, G (s)	4.8	14.4	14.4	9.1	18.7		15.2	96.2	105.3	4.3	85.3	
Effective Green, g (s)	4.3	16.4	16.4	8.6	20.7		16.2	98.2	109.3	3.8	86.8	
Actuated g/C Ratio	0.03	0.12	0.12	0.06	0.15		0.12	0.70	0.78	0.03	0.62	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	4.0	4.0	2.0	4.0		3.0	4.0	2.0	3.0	4.0	
Lane Grp Cap (vph)	54	177	337	210	258		577	3566	1235	93	3932	
v/s Ratio Prot	c0.01	0.01		c0.03	c0.01		c0.06	c0.21	0.01	0.01	0.13	
v/s Ratio Perm			0.01						0.05			
v/c Ratio	0.31	0.08	0.08	0.55	0.06		0.48	0.30	0.07	0.19	0.22	
Uniform Delay, d1	66.4	55.1	55.1	63.8	51.3		57.9	7.9	3.6	66.6	11.7	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.07	1.03	1.04	1.01	0.15	
Incremental Delay, d2	3.3	0.3	0.1	1.8	0.1		0.6	0.2	0.0	1.0	0.1	
Delay (s)	69.7	55.3	55.2	65.6	51.4		62.4	8.3	3.7	68.3	1.9	
Level of Service	E	E	E	E	D		E	A	A	E	A	
Approach Delay (s)		56.1			63.2			18.2			3.2	
Approach LOS		E			E			B			A	

Intersection Summary

HCM 2000 Control Delay	19.5	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.32		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	13.0
Intersection Capacity Utilization	44.3%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 11: Hacienda Dr & I-580 WB Ramps

BART to Livermore Extension Project
 2040 BART AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↔↔		↔↔		↑↑↑			↑↑↑	↔
Traffic Volume (vph)	0	0	0	269	0	451	0	1259	282	0	720	416
Future Volume (vph)	0	0	0	269	0	451	0	1259	282	0	720	416
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				2.6		2.6		2.1			2.1	2.1
Lane Util. Factor				0.97		0.88		0.91			0.86	0.86
Frt				1.00		0.85		0.97			0.97	0.85
Flt Protected				0.95		1.00		1.00			1.00	1.00
Satd. Flow (prot)				3433		2787		4945			4644	1362
Flt Permitted				0.95		1.00		1.00			1.00	1.00
Satd. Flow (perm)				3433		2787		4945			4644	1362
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	292	0	490	0	1368	307	0	783	452
RTOR Reduction (vph)	0	0	0	0	0	67	0	41	0	0	56	72
Lane Group Flow (vph)	0	0	0	292	0	423	0	1634	0	0	953	154
Turn Type				Prot		Prot		NA			NA	Perm
Protected Phases				4		4		2			6	
Permitted Phases												6
Actuated Green, G (s)				16.2		16.2		45.8			45.8	45.8
Effective Green, g (s)				17.6		17.6		47.7			47.7	47.7
Actuated g/C Ratio				0.25		0.25		0.68			0.68	0.68
Clearance Time (s)				4.0		4.0		4.0			4.0	4.0
Vehicle Extension (s)				3.0		3.0		3.0			3.0	3.0
Lane Grp Cap (vph)				863		700		3369			3164	928
v/s Ratio Prot				0.09		c0.15		c0.33			0.21	
v/s Ratio Perm												0.11
v/c Ratio				0.34		0.60		0.49			0.30	0.17
Uniform Delay, d1				21.4		23.1		5.3			4.5	4.0
Progression Factor				1.00		1.00		0.70			0.33	0.48
Incremental Delay, d2				0.2		1.5		0.5			0.2	0.4
Delay (s)				21.7		24.6		4.1			1.7	2.3
Level of Service				C		C		A			A	A
Approach Delay (s)		0.0			23.5			4.1			1.8	
Approach LOS		A			C			A			A	

Intersection Summary			
HCM 2000 Control Delay	7.5	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.51		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	4.7
Intersection Capacity Utilization	53.1%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 12: Hacienda Dr & I-580 EB Ramps



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗		↖↗					↖↗↘	↖		↖↗↘	
Traffic Volume (vph)	819	0	1170	0	0	0	0	686	166	0	1044	198
Future Volume (vph)	819	0	1170	0	0	0	0	686	166	0	1044	198
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0					4.0	4.0		4.0	
Lane Util. Factor	0.97		0.88					0.86	0.86		0.91	
Frt	1.00		0.85					0.99	0.85		0.98	
Flt Protected	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (prot)	3433		2787					4756	1362		4964	
Flt Permitted	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (perm)	3433		2787					4756	1362		4964	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	890	0	1272	0	0	0	0	746	180	0	1135	215
RTOR Reduction (vph)	0	0	24	0	0	0	0	11	74	0	40	0
Lane Group Flow (vph)	890	0	1248	0	0	0	0	791	50	0	1310	0
Turn Type	Prot		Prot					NA	Perm		NA	
Protected Phases	4		4					2			6	
Permitted Phases									2			
Actuated Green, G (s)	32.4		32.4					26.3	26.3		26.3	
Effective Green, g (s)	33.8		33.8					28.2	28.2		28.2	
Actuated g/C Ratio	0.48		0.48					0.40	0.40		0.40	
Clearance Time (s)	5.4		5.4					5.9	5.9		5.9	
Vehicle Extension (s)	2.0		2.0					2.0	2.0		2.0	
Lane Grp Cap (vph)	1657		1345					1915	548		1999	
v/s Ratio Prot	0.26		c0.45					0.17			c0.26	
v/s Ratio Perm									0.04			
v/c Ratio	0.54		0.93					0.41	0.09		0.66	
Uniform Delay, d1	12.6		17.0					15.0	13.0		17.0	
Progression Factor	1.00		1.00					1.00	1.00		0.87	
Incremental Delay, d2	0.2		11.0					0.7	0.3		1.7	
Delay (s)	12.8		27.9					15.6	13.3		16.5	
Level of Service	B		C					B	B		B	
Approach Delay (s)		21.7			0.0			15.3			16.5	
Approach LOS		C			A			B			B	





































Intersection Summary

HCM 2000 Control Delay	18.8	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.80		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	72.2%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
13: Hacienda Dr & Owens Rd

BART to Livermore Extension Project
2040 BART AM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 	  		 	  		 	  		 	  	
Traffic Volume (vph)	156	273	25	144	428	435	27	306	139	685	923	598
Future Volume (vph)	156	273	25	144	428	435	27	306	139	685	923	598
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	2.3	4.0	4.0	2.3	4.0	4.0	2.7	4.0	4.0	2.7
Lane Util. Factor	0.97	0.91	1.00	0.97	0.91	1.00	0.97	0.91	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5085	1583	3433	5085	1583	3433	5085	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5085	1583	3433	5085	1583	3433	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	170	297	27	157	465	473	29	333	151	745	1003	650
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	170	297	27	157	465	473	29	333	151	745	1003	650
Turn Type	Prot	NA	Free	Prot	NA	Free	Prot	NA	Free	Prot	NA	Free
Protected Phases	1	6		5	2		7	4		3	8	
Permitted Phases			Free			Free			Free			Free
Actuated Green, G (s)	12.2	17.1	115.0	11.3	16.2	115.0	4.2	32.7	115.0	34.9	63.4	115.0
Effective Green, g (s)	12.2	18.8	115.0	11.3	17.9	115.0	4.2	34.0	115.0	34.9	64.7	115.0
Actuated g/C Ratio	0.11	0.16	1.00	0.10	0.16	1.00	0.04	0.30	1.00	0.30	0.56	1.00
Clearance Time (s)	4.0	5.7		4.0	5.7		4.0	5.3		4.0	5.3	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	364	831	1583	337	791	1583	125	1503	1583	1041	2860	1583
v/s Ratio Prot	0.05	0.06		0.05	c0.09		0.01	0.07		c0.22	0.20	
v/s Ratio Perm			0.02			0.30			0.10			c0.41
v/c Ratio	0.47	0.36	0.02	0.47	0.59	0.30	0.23	0.22	0.10	0.72	0.35	0.41
Uniform Delay, d1	48.3	42.7	0.0	49.0	45.1	0.0	53.8	30.5	0.0	35.6	13.7	0.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.9	0.3	0.0	1.0	1.1	0.5	1.0	0.3	0.1	2.4	0.3	0.8
Delay (s)	49.3	43.0	0.0	50.0	46.2	0.5	54.8	30.9	0.1	38.0	14.0	0.8
Level of Service	D	D	A	D	D	A	D	C	A	D	B	A
Approach Delay (s)		42.8			27.0			23.2			17.9	
Approach LOS		D			C			C			B	
Intersection Summary												
HCM 2000 Control Delay			23.5			HCM 2000 Level of Service			C			
HCM 2000 Volume to Capacity ratio			0.58									
Actuated Cycle Length (s)			115.0			Sum of lost time (s)			16.0			
Intersection Capacity Utilization			51.5%			ICU Level of Service			A			
Analysis Period (min)			15									

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
14: Tassajara Rd & Dublin Blvd

BART to Livermore Extension Project
2040 BART AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔↔	↑↑↑	↔↔	↔↔↔	↑↑↑		↔↔↔	↑↑↑	↔	↔↔	↑↑↑	↔↔
Traffic Volume (vph)	98	196	155	496	701	45	231	514	181	33	1224	254
Future Volume (vph)	98	196	155	496	701	45	231	514	181	33	1224	254
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	6.0	6.0	5.0	6.0		5.0	6.0	6.0	5.0	5.7	5.7
Lane Util. Factor	0.97	0.86	0.88	0.94	0.91		0.94	0.86	1.00	0.97	0.86	0.88
Frt	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	6408	2787	4990	5039		4990	6408	1583	3433	6408	2787
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	6408	2787	4990	5039		4990	6408	1583	3433	6408	2787
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	107	213	168	539	762	49	251	559	197	36	1330	276
RTOR Reduction (vph)	0	0	135	0	5	0	0	0	140	0	0	186
Lane Group Flow (vph)	107	213	33	539	806	0	251	559	57	36	1330	90
Turn Type	Prot	NA	Perm	Prot	NA		Prot	NA	Perm	Prot	NA	Perm
Protected Phases	5	2		1	6		3	8		7	NA	4
Permitted Phases			2						8			4
Actuated Green, G (s)	16.2	24.5	24.5	18.7	27.0		18.4	35.6	35.6	22.5	40.0	40.0
Effective Green, g (s)	16.2	24.5	24.5	18.7	27.0		18.4	35.6	35.6	22.5	40.0	40.0
Actuated g/C Ratio	0.13	0.20	0.20	0.15	0.22		0.15	0.29	0.29	0.18	0.32	0.32
Clearance Time (s)	5.0	6.0	6.0	5.0	6.0		5.0	6.0	6.0	5.0	5.7	5.7
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	451	1273	553	756	1103		744	1850	457	626	2078	904
v/s Ratio Prot	0.03	0.03		c0.11	c0.16		c0.05	0.09		c0.01	c0.21	
v/s Ratio Perm			0.01						0.04			0.03
v/c Ratio	0.24	0.17	0.06	0.71	0.73		0.34	0.30	0.12	0.06	0.64	0.10
Uniform Delay, d1	48.0	40.9	40.1	49.7	44.8		47.0	34.2	32.4	41.6	35.5	29.1
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.3	0.1	0.0	3.2	2.5		0.3	0.1	0.1	0.0	0.7	0.0
Delay (s)	48.3	41.0	40.1	52.9	47.3		47.3	34.3	32.5	41.7	36.2	29.1
Level of Service	D	D	D	D	D		D	C	C	D	D	C
Approach Delay (s)		42.3			49.5			37.2			35.1	
Approach LOS		D			D			D			D	

Intersection Summary

HCM 2000 Control Delay	40.7	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.64		
Actuated Cycle Length (s)	123.3	Sum of lost time (s)	22.0
Intersection Capacity Utilization	77.0%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 15: Tassajara Rd & I-580 WB Ramps

BART to Livermore Extension Project
 2040 BART AM


































Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↔↔		↔↔		↑↑	↔		↑↑↔	↔
Traffic Volume (vph)	0	0	0	603	0	296	0	1195	472	0	1031	935
Future Volume (vph)	0	0	0	603	0	296	0	1195	472	0	1031	935
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0		4.0		4.0	4.0		4.0	4.0
Lane Util. Factor				0.97		0.88		0.95	1.00		0.86	0.86
Frt				1.00		0.85		1.00	0.85		0.95	0.85
Flt Protected				0.95		1.00		1.00	1.00		1.00	1.00
Satd. Flow (prot)				3433		2787		3539	1583		4581	1362
Flt Permitted				0.95		1.00		1.00	1.00		1.00	1.00
Satd. Flow (perm)				3433		2787		3539	1583		4581	1362
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	655	0	322	0	1299	513	0	1121	1016
RTOR Reduction (vph)	0	0	0	0	0	67	0	0	196	0	104	194
Lane Group Flow (vph)	0	0	0	655	0	255	0	1299	317	0	1525	314
Turn Type				Perm		Perm		NA	Perm		NA	Perm
Protected Phases								2			6	
Permitted Phases				8		8			2			6
Actuated Green, G (s)				18.8		18.8		43.2	43.2		43.2	43.2
Effective Green, g (s)				18.8		18.8		43.2	43.2		43.2	43.2
Actuated g/C Ratio				0.27		0.27		0.62	0.62		0.62	0.62
Clearance Time (s)				4.0		4.0		4.0	4.0		4.0	4.0
Vehicle Extension (s)				3.0		3.0		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)				922		748		2184	976		2827	840
v/s Ratio Prot								c0.37			0.33	
v/s Ratio Perm				c0.19		0.09			0.20			0.23
v/c Ratio				0.71		0.34		0.59	0.32		0.54	0.37
Uniform Delay, d1				23.1		20.6		8.1	6.4		7.7	6.7
Progression Factor				1.00		1.00		1.00	1.00		1.00	1.00
Incremental Delay, d2				2.6		0.3		1.2	0.9		0.7	1.3
Delay (s)				25.7		20.9		9.3	7.3		8.4	7.9
Level of Service				C		C		A	A		A	A
Approach Delay (s)		0.0			24.1			8.7			8.3	
Approach LOS		A			C			A			A	

Intersection Summary		
HCM 2000 Control Delay	11.6	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.63	B
Actuated Cycle Length (s)	70.0	Sum of lost time (s)
Intersection Capacity Utilization	56.9%	8.0
Analysis Period (min)	15	ICU Level of Service
		B

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 16: Santa Rita Rd & I-580 EB Ramps/Pimilco Dr

BART to Livermore Extension Project
 2040 BART AM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 		 	 		 		  		 	  	 
Traffic Volume (vph)	565	116	744	186	0	188	0	888	119	184	1348	0
Future Volume (vph)	565	116	744	186	0	188	0	888	119	184	1348	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0		4.0		4.0		4.0	4.0	
Lane Util. Factor	0.97	1.00	1.00	0.97		0.88		0.86		1.00	0.95	
Frt	1.00	1.00	0.85	1.00		0.85		0.98		1.00	1.00	
Flt Protected	0.95	1.00	1.00	0.95		1.00		1.00		0.95	1.00	
Satd. Flow (prot)	3433	1863	1583	3433		2787		6295		1770	3539	
Flt Permitted	0.95	1.00	1.00	0.95		1.00		1.00		0.95	1.00	
Satd. Flow (perm)	3433	1863	1583	3433		2787		6295		1770	3539	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	614	126	809	202	0	204	0	965	129	200	1465	0
RTOR Reduction (vph)	0	0	0	0	0	71	0	40	0	0	0	0
Lane Group Flow (vph)	614	126	809	202	0	133	0	1054	0	200	1465	0
Turn Type	Perm	NA	Free	Prot		pm+ov		NA		Prot	NA	Perm
Protected Phases		4		3		1		2		1	6	
Permitted Phases	4		Free			3						6
Actuated Green, G (s)	14.9	14.9	60.0	4.5		12.9		16.2		8.4	28.6	
Effective Green, g (s)	14.9	14.9	60.0	4.5		12.9		16.2		8.4	28.6	
Actuated g/C Ratio	0.25	0.25	1.00	0.08		0.22		0.27		0.14	0.48	
Clearance Time (s)	4.0	4.0		4.0		4.0		4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0		3.0		3.0		3.0	3.0	
Lane Grp Cap (vph)	852	462	1583	257		599		1699		247	1686	
v/s Ratio Prot		0.07		0.06		0.03		0.17		0.11	c0.41	
v/s Ratio Perm	c0.18		c0.51			0.02						
v/c Ratio	0.72	0.27	0.51	0.79		0.22		0.62		0.81	0.87	
Uniform Delay, d1	20.6	18.2	0.0	27.3		19.4		19.2		25.0	14.0	
Progression Factor	1.00	1.00	1.00	1.00		1.00		1.00		1.00	1.00	
Incremental Delay, d2	3.0	0.3	1.2	14.6		0.2		1.7		17.5	6.4	
Delay (s)	23.7	18.5	1.2	41.8		19.6		20.9		42.5	20.4	
Level of Service	C	B	A	D		B		C		D	C	
Approach Delay (s)		11.5			30.7			20.9			23.1	
Approach LOS		B			C			C			C	































Intersection Summary

HCM 2000 Control Delay	19.4	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.91		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	60.0%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 17: Santa Rita Rd & Valley Ave

BART to Livermore Extension Project
 2040 BART AM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 	 			 		 	 		 	 	
Traffic Volume (vph)	205	257	86	194	473	904	139	545	87	587	889	198
Future Volume (vph)	205	257	86	194	473	904	139	545	87	587	889	198
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.97	0.95		0.97	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.98		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	3433	3466		3433	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	3433	3466		3433	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	223	279	93	211	514	983	151	592	95	638	966	215
RTOR Reduction (vph)	0	0	74	0	0	0	0	18	0	0	0	132
Lane Group Flow (vph)	223	279	19	211	514	983	151	669	0	638	966	83
Turn Type	Prot	NA	Perm	Prot	NA	Free	Prot	NA		Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			Free						6
Actuated Green, G (s)	7.8	14.0	14.0	8.0	14.2	68.1	3.9	17.0		13.1	26.2	26.2
Effective Green, g (s)	7.8	14.0	14.0	8.0	14.2	68.1	3.9	17.0		13.1	26.2	26.2
Actuated g/C Ratio	0.11	0.21	0.21	0.12	0.21	1.00	0.06	0.25		0.19	0.38	0.38
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	393	727	325	207	737	1583	196	865		660	1361	609
v/s Ratio Prot	0.06	0.08		c0.12	0.15		0.04	0.19		c0.19	c0.27	
v/s Ratio Perm			0.01			c0.62						0.05
v/c Ratio	0.57	0.38	0.06	1.02	0.70	0.62	0.77	0.77		0.97	0.71	0.14
Uniform Delay, d1	28.6	23.3	21.8	30.0	25.0	0.0	31.7	23.8		27.3	17.7	13.6
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	1.9	0.3	0.1	67.7	2.9	1.8	16.9	4.3		26.7	1.7	0.1
Delay (s)	30.4	23.7	21.8	97.7	27.8	1.8	48.6	28.1		53.9	19.5	13.7
Level of Service	C	C	C	F	C	A	D	C		D	B	B
Approach Delay (s)		25.9			21.5			31.8			30.9	
Approach LOS		C			C			C			C	
Intersection Summary												
HCM 2000 Control Delay			27.2			HCM 2000 Level of Service		C				
HCM 2000 Volume to Capacity ratio			0.88									
Actuated Cycle Length (s)			68.1			Sum of lost time (s)		16.0				
Intersection Capacity Utilization			66.8%			ICU Level of Service		C				
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis
18: Bernal Ave/Valley Ave & Stanley Blvd

BART to Livermore Extension Project
2040 BART AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	218	204	55	249	895	955	174	480	101	142	368	125
Future Volume (vph)	218	204	55	249	895	955	174	480	101	142	368	125
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.95	1.00	0.97	0.91	0.91	1.00	0.95	1.00	0.97	0.95	0.95
Frt	1.00	1.00	0.85	1.00	0.96	0.85	1.00	1.00	0.85	1.00	0.96	0.96
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	3433	3238	1441	1770	3539	1583	3433	3405	3405
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	3433	3238	1441	1770	3539	1583	3433	3405	3405
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	237	222	60	271	973	1038	189	522	110	154	400	136
RTOR Reduction (vph)	0	0	30	0	47	28	0	0	87	0	38	0
Lane Group Flow (vph)	237	222	30	271	1341	595	189	522	23	154	498	0
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	NA
Protected Phases	7	4	5	3	8	1	5	2		1	6	
Permitted Phases			4			8			2			
Actuated Green, G (s)	7.0	33.0	44.6	11.1	37.1	47.0	11.6	18.2	18.2	9.9	16.5	16.5
Effective Green, g (s)	7.0	33.0	44.6	11.1	37.1	47.0	11.6	18.2	18.2	9.9	16.5	16.5
Actuated g/C Ratio	0.08	0.37	0.51	0.13	0.42	0.53	0.13	0.21	0.21	0.11	0.19	0.19
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	272	1324	872	432	1362	833	232	730	326	385	636	636
v/s Ratio Prot	c0.07	0.06	0.00	c0.08	c0.41	0.08	c0.11	c0.15		0.04	0.15	0.15
v/s Ratio Perm			0.01			0.33			0.01			
v/c Ratio	0.87	0.17	0.03	0.63	0.98	0.71	0.81	0.72	0.07	0.40	0.78	0.78
Uniform Delay, d1	40.2	18.4	11.0	36.6	25.3	15.5	37.3	32.6	28.2	36.4	34.1	34.1
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	24.8	0.1	0.0	2.8	20.6	2.9	19.3	3.3	0.1	0.7	6.2	6.2
Delay (s)	65.0	18.5	11.0	39.4	45.9	18.4	56.5	35.9	28.3	37.1	40.4	40.4
Level of Service	E	B	B	D	D	B	E	D	C	D	D	D
Approach Delay (s)		38.9			37.6			39.6			39.6	
Approach LOS		D			D			D			D	



































Intersection Summary

HCM 2000 Control Delay	38.5	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.90		
Actuated Cycle Length (s)	88.2	Sum of lost time (s)	16.0
Intersection Capacity Utilization	78.3%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 19: Fallon Rd & Dublin Blvd/Croak Rd

BART to Livermore Extension Project
 2040 BART AM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 	  	 	  	  	 	  	  				
Traffic Volume (vph)	51	74	96	312	940	376	769	317	44	76	754	283
Future Volume (vph)	51	74	96	312	940	376	769	317	44	76	754	283
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.91	0.88	0.94	0.91	1.00	0.94	0.91	0.88	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5085	2787	4990	5085	1583	4990	5085	2787	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5085	2787	4990	5085	1583	4990	5085	2787	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	55	80	104	339	1022	409	836	345	48	83	820	308
RTOR Reduction (vph)	0	0	55	0	0	228	0	0	31	0	0	89
Lane Group Flow (vph)	55	80	49	339	1022	181	836	345	17	83	820	219
Turn Type	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4	5	3	8		5	2		1	6	
Permitted Phases			4			8			2			6
Actuated Green, G (s)	2.2	21.9	37.2	9.3	29.0	29.0	15.3	27.6	27.6	3.8	16.1	16.1
Effective Green, g (s)	2.2	21.9	37.2	9.3	29.0	29.0	15.3	27.6	27.6	3.8	16.1	16.1
Actuated g/C Ratio	0.03	0.28	0.47	0.12	0.37	0.37	0.19	0.35	0.35	0.05	0.20	0.20
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	96	1416	1319	590	1876	584	971	1785	978	165	1041	324
v/s Ratio Prot	0.02	0.02	0.01	c0.07	c0.20		c0.17	0.07		0.02	c0.16	
v/s Ratio Perm			0.01			0.11			0.01			0.14
v/c Ratio	0.57	0.06	0.04	0.57	0.54	0.31	0.86	0.19	0.02	0.50	0.79	0.68
Uniform Delay, d1	37.7	20.8	11.1	32.8	19.6	17.7	30.6	17.8	16.6	36.5	29.6	28.8
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	8.0	0.0	0.0	1.4	0.3	0.3	7.9	0.1	0.0	2.4	4.0	5.5
Delay (s)	45.8	20.8	11.1	34.1	19.9	18.0	38.5	17.8	16.7	38.9	33.6	34.3
Level of Service	D	C	B	C	B	B	D	B	B	D	C	C
Approach Delay (s)		22.3			22.2			31.9			34.2	
Approach LOS		C			C			C			C	

Intersection Summary		
HCM 2000 Control Delay	28.1	HCM 2000 Level of Service C
HCM 2000 Volume to Capacity ratio	0.71	
Actuated Cycle Length (s)	78.6	Sum of lost time (s) 16.0
Intersection Capacity Utilization	61.0%	ICU Level of Service B
Analysis Period (min)	15	

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
20: El Charro Rd/Fallon Rd & I-580 WB Ramps

BART to Livermore Extension Project
2040 BART AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↙	↖	↗		↑↑↑	↗		↑↑↑	↗
Traffic Volume (vph)	0	0	0	241	0	616	0	815	478	0	649	399
Future Volume (vph)	0	0	0	241	0	616	0	815	478	0	649	399
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0	4.0	4.0		4.0	4.0		4.0	4.0
Lane Util. Factor				0.95	0.95	0.88		0.91	1.00		0.91	1.00
Frt				1.00	1.00	0.85		1.00	0.85		1.00	0.85
Flt Protected				0.95	0.95	1.00		1.00	1.00		1.00	1.00
Satd. Flow (prot)				1681	1681	2787		5085	1583		5085	1583
Flt Permitted				0.95	0.95	1.00		1.00	1.00		1.00	1.00
Satd. Flow (perm)				1681	1681	2787		5085	1583		5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	262	0	670	0	886	520	0	705	434
RTOR Reduction (vph)	0	0	0	0	0	137	0	0	192	0	0	161
Lane Group Flow (vph)	0	0	0	134	128	533	0	886	328	0	705	273
Turn Type				Perm	NA	Perm		NA	Perm		NA	Perm
Protected Phases					8			2			6	
Permitted Phases				8		8			2			6
Actuated Green, G (s)				18.4	18.4	18.4		44.1	44.1		44.1	44.1
Effective Green, g (s)				17.9	17.9	17.9		44.1	44.1		44.1	44.1
Actuated g/C Ratio				0.26	0.26	0.26		0.63	0.63		0.63	0.63
Clearance Time (s)				3.5	3.5	3.5		4.0	4.0		4.0	4.0
Vehicle Extension (s)				2.0	2.0	2.0		2.0	2.0		2.0	2.0
Lane Grp Cap (vph)				429	429	712		3203	997		3203	997
v/s Ratio Prot								0.17			0.14	
v/s Ratio Perm				0.08	0.08	c0.19			c0.21			0.17
v/c Ratio				0.31	0.30	0.75		0.28	0.33		0.22	0.27
Uniform Delay, d1				21.1	21.0	24.0		5.8	6.0		5.6	5.8
Progression Factor				1.00	1.00	1.00		0.87	1.06		1.00	1.00
Incremental Delay, d2				0.2	0.1	3.8		0.2	0.7		0.2	0.7
Delay (s)				21.2	21.1	27.8		5.2	7.2		5.7	6.5
Level of Service				C	C	C		A	A		A	A
Approach Delay (s)		0.0			25.9			6.0			6.0	
Approach LOS		A			C			A			A	

Intersection Summary

HCM 2000 Control Delay	11.3	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.45		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	44.0%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 21: El Charro Rd & I-580 EB Ramps

BART to Livermore Extension Project
 2040 BART AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔↔		↔↔					↕↔	↔		↕↔	↔
Traffic Volume (vph)	278	0	632	0	0	0	0	1291	437	0	544	0
Future Volume (vph)	278	0	632	0	0	0	0	1291	437	0	544	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0					4.0	4.0		4.0	
Lane Util. Factor	0.97		0.88					0.91	0.91		0.91	
Frt	1.00		0.85					0.99	0.85		1.00	
Flt Protected	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (prot)	3433		2787					3370	1441		3390	
Flt Permitted	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (perm)	3433		2787					3370	1441		3390	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	302	0	687	0	0	0	0	1403	475	0	591	0
RTOR Reduction (vph)	0	0	464	0	0	0	0	3	113	0	0	0
Lane Group Flow (vph)	302	0	223	0	0	0	0	1457	305	0	591	0
Turn Type	Prot		Perm					NA	Perm		NA	Perm
Protected Phases	4							2			6	
Permitted Phases			4						2			6
Actuated Green, G (s)	11.0		11.0					51.0	51.0		51.0	
Effective Green, g (s)	11.0		11.0					51.0	51.0		51.0	
Actuated g/C Ratio	0.16		0.16					0.73	0.73		0.73	
Clearance Time (s)	4.0		4.0					4.0	4.0		4.0	
Vehicle Extension (s)	2.0		2.0					3.0	3.0		3.0	
Lane Grp Cap (vph)	539		437					2455	1049		2469	
v/s Ratio Prot	c0.09							c0.43			0.17	
v/s Ratio Perm			0.08						0.21			
v/c Ratio	0.56		0.51					0.59	0.29		0.24	
Uniform Delay, d1	27.3		27.0					4.5	3.3		3.1	
Progression Factor	1.00		1.00					1.00	1.00		1.03	
Incremental Delay, d2	0.8		0.3					1.1	0.7		0.2	
Delay (s)	28.1		27.4					5.6	4.0		3.4	
Level of Service	C		C					A	A		A	
Approach Delay (s)		27.6			0.0			5.2			3.4	
Approach LOS		C			A			A			A	

Intersection Summary

HCM 2000 Control Delay	11.3	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.59		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	54.9%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 22: El Charro Rd & Stoneridge Dr/Jack London Blvd

BART to Livermore Extension Project
 2040 BART AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔↔↔	↑↑	↗	↖	↑↑	↗↗	↖	↑↑		↖↖↖	↑	↗↗
Traffic Volume (vph)	91	134	16	62	614	719	34	555	30	329	215	113
Future Volume (vph)	91	134	16	62	614	719	34	555	30	329	215	113
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	0.94	0.95	1.00	1.00	0.95	0.88	1.00	0.95		0.94	1.00	0.88
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	4491	3185	1425	1593	3185	2508	1593	3161		4491	1676	2508
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	4491	3185	1425	1593	3185	2508	1593	3161		4491	1676	2508
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	99	146	17	67	667	782	37	603	33	358	234	123
RTOR Reduction (vph)	0	0	13	0	0	101	0	6	0	0	0	76
Lane Group Flow (vph)	99	146	4	67	667	681	37	630	0	358	234	47
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Prot	NA		Prot	NA	Perm
Protected Phases	7	4		3	8	1	5	2		1	6	
Permitted Phases			4			8						6
Actuated Green, G (s)	3.0	15.0	15.0	3.0	15.0	22.9	2.7	17.5		7.9	22.7	22.7
Effective Green, g (s)	3.0	15.0	15.0	3.0	15.0	22.9	2.7	17.5		7.9	22.7	22.7
Actuated g/C Ratio	0.05	0.25	0.25	0.05	0.25	0.39	0.05	0.29		0.13	0.38	0.38
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	226	804	359	80	804	966	72	931		597	640	958
v/s Ratio Prot	c0.02	0.05		0.04	c0.21	c0.09	0.02	c0.20		0.08	0.14	
v/s Ratio Perm			0.00			0.18						0.02
v/c Ratio	0.44	0.18	0.01	0.84	0.83	0.71	0.51	0.68		0.60	0.37	0.05
Uniform Delay, d1	27.4	17.4	16.6	28.0	21.0	15.4	27.7	18.5		24.3	13.2	11.6
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	1.4	0.1	0.0	50.1	7.1	2.4	6.1	2.0		1.6	0.4	0.0
Delay (s)	28.7	17.5	16.7	78.1	28.1	17.8	33.8	20.4		25.9	13.5	11.6
Level of Service	C	B	B	E	C	B	C	C		C	B	B
Approach Delay (s)		21.7			25.0			21.2			19.4	
Approach LOS		C			C			C			B	

Intersection Summary

HCM 2000 Control Delay	22.6	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.72		
Actuated Cycle Length (s)	59.4	Sum of lost time (s)	16.0
Intersection Capacity Utilization	60.6%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
23: Stanley Blvd & El Charro Rd

BART to Livermore Extension Project
2040 BART AM



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	405	459	2677	109	26	120
Future Volume (vph)	405	459	2677	109	26	120
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95	0.91	1.00	0.97	0.88
Frt	1.00	1.00	1.00	0.85	1.00	0.85
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1770	3539	5085	1583	3433	2787
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1770	3539	5085	1583	3433	2787
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	440	499	2910	118	28	130
RTOR Reduction (vph)	0	0	0	27	0	122
Lane Group Flow (vph)	440	499	2910	91	28	8
Turn Type	Prot	NA	NA	Perm	Prot	Perm
Protected Phases	7	4	8		6	
Permitted Phases				8		6
Actuated Green, G (s)	27.0	95.0	64.0	64.0	6.6	6.6
Effective Green, g (s)	27.0	95.0	64.0	64.0	6.6	6.6
Actuated g/C Ratio	0.25	0.87	0.58	0.58	0.06	0.06
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	436	3067	2969	924	206	167
v/s Ratio Prot	c0.25	0.14	c0.57		c0.01	
v/s Ratio Perm				0.06		0.00
v/c Ratio	1.01	0.16	0.98	0.10	0.14	0.05
Uniform Delay, d1	41.3	1.1	22.2	10.1	48.8	48.5
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	45.4	0.0	12.2	0.0	0.3	0.1
Delay (s)	86.7	1.2	34.4	10.1	49.1	48.7
Level of Service	F	A	C	B	D	D
Approach Delay (s)		41.2	33.5		48.7	
Approach LOS		D	C		D	

Intersection Summary

HCM 2000 Control Delay	35.8	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.93		
Actuated Cycle Length (s)	109.6	Sum of lost time (s)	12.0
Intersection Capacity Utilization	87.5%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
24: Airway Blvd/Driveway & N Canyons Pkwy

BART to Livermore Extension Project
2040 BART AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑	↑	↑↑	↑	↑		↑	↑↑		↑	
Traffic Volume (vph)	0	79	61	711	661	0	888	0	974	0	0	0
Future Volume (vph)	0	79	61	711	661	0	888	0	974	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		2.0	2.0	2.0	2.0			4.2	2.0			
Lane Util. Factor		0.95	1.00	0.97	1.00			1.00	0.88			
Frt		1.00	0.85	1.00	1.00			1.00	0.85			
Flt Protected		1.00	1.00	0.95	1.00			0.95	1.00			
Satd. Flow (prot)		3539	1583	3433	1863			1770	2787			
Flt Permitted		1.00	1.00	0.95	1.00			0.95	1.00			
Satd. Flow (perm)		3539	1583	3433	1863			1770	2787			
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	86	66	773	718	0	965	0	1059	0	0	0
RTOR Reduction (vph)	0	0	57	0	0	0	0	0	106	0	0	0
Lane Group Flow (vph)	0	86	9	773	718	0	0	965	953	0	0	0
Turn Type		NA	Perm	Prot	NA	Perm	Split	NA	pm+ov			
Protected Phases		2		1	6		8	8	1	4	4	
Permitted Phases			2			6			8			
Actuated Green, G (s)		10.1	10.1	30.8	44.9			40.2	71.0			
Effective Green, g (s)		12.1	12.1	32.8	46.9			40.0	75.0			
Actuated g/C Ratio		0.13	0.13	0.35	0.50			0.43	0.81			
Clearance Time (s)		4.0	4.0	4.0	4.0			4.0	4.0			
Vehicle Extension (s)		3.0	3.0	3.0	3.0			3.0	3.0			
Lane Grp Cap (vph)		459	205	1209	938			760	2305			
v/s Ratio Prot		0.02		0.23	c0.39			c0.55	0.15			
v/s Ratio Perm			0.01						0.20			
v/c Ratio		0.19	0.04	0.64	0.77			1.27	0.41			
Uniform Delay, d1		36.1	35.4	25.2	18.7			26.5	2.6			
Progression Factor		1.00	1.00	1.00	1.00			1.00	1.00			
Incremental Delay, d2		0.2	0.1	1.1	3.8			131.7	0.1			
Delay (s)		36.3	35.5	26.3	22.4			158.2	2.8			
Level of Service		D	D	C	C			F	A			
Approach Delay (s)		36.0			24.5			76.9			0.0	
Approach LOS		D			C			E			A	

Intersection Summary

HCM 2000 Control Delay	53.9	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	1.07		
Actuated Cycle Length (s)	93.1	Sum of lost time (s)	12.2
Intersection Capacity Utilization	90.8%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
25: Airway Blvd & I-580 WB Ramps

BART to Livermore Extension Project
2040 BART AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↰	↰	↰↰		↰↰	↰		↰↰↰	
Traffic Volume (vph)	0	0	0	79	47	788	0	1181	343	0	318	549
Future Volume (vph)	0	0	0	79	47	788	0	1181	343	0	318	549
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0	4.0	4.0		4.0	4.0		4.0	
Lane Util. Factor				0.95	0.95	0.88		0.95	1.00		0.91	
Frt				1.00	1.00	0.85		1.00	0.85		0.91	
Flt Protected				0.95	0.98	1.00		1.00	1.00		1.00	
Satd. Flow (prot)				1681	1732	2787		3539	1583		4602	
Flt Permitted				0.95	0.98	1.00		1.00	1.00		1.00	
Satd. Flow (perm)				1681	1732	2787		3539	1583		4602	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	86	51	857	0	1284	373	0	346	597
RTOR Reduction (vph)	0	0	0	0	0	39	0	0	184	0	295	0
Lane Group Flow (vph)	0	0	0	46	91	818	0	1284	189	0	648	0
Turn Type				Split	NA	Perm		NA	Perm		NA	
Protected Phases				8	8			2			6	
Permitted Phases						8			2			
Actuated Green, G (s)				19.5	19.5	19.5		26.9	26.9		26.9	
Effective Green, g (s)				19.5	19.5	19.5		28.2	28.2		28.2	
Actuated g/C Ratio				0.35	0.35	0.35		0.51	0.51		0.51	
Clearance Time (s)				4.0	4.0	4.0		5.3	5.3		5.3	
Vehicle Extension (s)				2.0	2.0	2.0		4.0	4.0		4.0	
Lane Grp Cap (vph)				588	606	975		1791	801		2329	
v/s Ratio Prot				0.03	0.05			c0.36			0.14	
v/s Ratio Perm						c0.29			0.12			
v/c Ratio				0.08	0.15	0.84		0.72	0.24		0.28	
Uniform Delay, d1				12.1	12.4	16.7		10.7	7.7		7.9	
Progression Factor				1.00	1.00	1.00		1.00	1.00		1.00	
Incremental Delay, d2				0.0	0.0	6.2		1.5	0.2		0.1	
Delay (s)				12.1	12.5	22.8		12.2	7.9		8.0	
Level of Service				B	B	C		B	A		A	
Approach Delay (s)		0.0			21.4			11.2			8.0	
Approach LOS		A			C			B			A	


























Intersection Summary

HCM 2000 Control Delay	13.2	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.77		
Actuated Cycle Length (s)	55.7	Sum of lost time (s)	8.0
Intersection Capacity Utilization	66.9%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
26: Airway Blvd & I-580 EB Ramps/Kitty Hawk Rd

BART to Livermore Extension Project
2040 BART AM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 							 			 	
Traffic Volume (vph)	675	211	466	44	39	74	40	503	165	55	204	151
Future Volume (vph)	675	211	466	44	39	74	40	503	165	55	204	151
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.4	4.4	4.4	4.5	2.7		4.0	2.7	
Lane Util. Factor	0.97	1.00	1.00	1.00	1.00	1.00	1.00	0.95		1.00	0.95	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.96		1.00	0.94	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	3433	1863	1583	1770	1863	1583	1770	3408		1770	3314	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	3433	1863	1583	1770	1863	1583	1770	3408		1770	3314	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	734	229	507	48	42	80	43	547	179	60	222	164
RTOR Reduction (vph)	0	0	369	0	0	69	0	42	0	0	112	0
Lane Group Flow (vph)	734	229	138	48	42	11	43	684	0	60	274	0
Turn Type	Split	NA	Perm	Split	NA	pm+ov	Prot	NA		Prot	NA	
Protected Phases	7	7		8	8	1	5	2		1	6	
Permitted Phases			7			8						
Actuated Green, G (s)	17.6	17.6	17.6	7.0	7.0	10.0	4.8	21.1		3.0	19.3	
Effective Green, g (s)	17.6	17.6	17.6	6.6	6.6	9.2	4.3	22.4		3.0	20.6	
Actuated g/C Ratio	0.27	0.27	0.27	0.10	0.10	0.14	0.07	0.35		0.05	0.32	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Vehicle Extension (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	3.5		2.0	4.0	
Lane Grp Cap (vph)	933	506	430	180	190	332	117	1179		82	1055	
v/s Ratio Prot	c0.21	0.12		c0.03	0.02	0.00	0.02	c0.20		c0.03	0.08	
v/s Ratio Perm			0.09			0.01						
v/c Ratio	0.79	0.45	0.32	0.27	0.22	0.03	0.37	0.58		0.73	0.26	
Uniform Delay, d1	21.8	19.6	18.8	26.8	26.7	23.9	28.9	17.3		30.5	16.4	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	4.1	0.2	0.2	0.3	0.2	0.0	0.7	0.8		24.8	0.2	
Delay (s)	25.9	19.8	18.9	27.1	26.9	23.9	29.6	18.1		55.3	16.6	
Level of Service	C	B	B	C	C	C	C	B		E	B	
Approach Delay (s)		22.6			25.6			18.7			21.8	
Approach LOS		C			C			B			C	
Intersection Summary												
HCM 2000 Control Delay			21.6									C
HCM 2000 Volume to Capacity ratio			0.63									
Actuated Cycle Length (s)			64.7							15.6		
Intersection Capacity Utilization			67.1%									C
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis
 27: Collier Canyon Rd & N Canyons Pkwy/Portola Ave

BART to Livermore Extension Project
 2040 BART AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	269	188	100	150	843	57	73	8	100	59	14	205
Future Volume (vph)	269	188	100	150	843	57	73	8	100	59	14	205
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	2.7	2.7	4.0	2.7	2.7	4.0	3.0		4.0	4.6	4.6
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.86		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	1770	1605		1770	1863	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	1770	1605		1770	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	292	204	109	163	916	62	79	9	109	64	15	223
RTOR Reduction (vph)	0	0	71	0	0	37	0	84	0	0	0	180
Lane Group Flow (vph)	292	204	38	163	916	25	79	34	0	64	15	43
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA		Prot	NA	Perm
Protected Phases	1	6		5	2		3	8		7		4
Permitted Phases			6			2						4
Actuated Green, G (s)	7.0	21.0	21.0	10.1	24.1	24.1	4.0	13.9		3.1	13.0	13.0
Effective Green, g (s)	7.0	22.3	22.3	10.1	25.4	25.4	4.0	14.9		3.1	12.4	12.4
Actuated g/C Ratio	0.11	0.35	0.35	0.16	0.40	0.40	0.06	0.23		0.05	0.19	0.19
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	374	1231	550	278	1402	627	110	373		85	360	306
v/s Ratio Prot	c0.09	0.06		0.09	c0.26		c0.04	0.02		0.04	0.01	
v/s Ratio Perm			0.02			0.02						c0.03
v/c Ratio	0.78	0.17	0.07	0.59	0.65	0.04	0.72	0.09		0.75	0.04	0.14
Uniform Delay, d1	27.8	14.5	14.0	25.1	15.8	11.9	29.5	19.3		30.1	21.0	21.4
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	10.1	0.1	0.1	3.1	1.1	0.0	20.0	0.1		30.8	0.0	0.2
Delay (s)	37.9	14.5	14.0	28.2	16.9	11.9	49.5	19.4		60.9	21.1	21.6
Level of Service	D	B	B	C	B	B	D	B		E	C	C
Approach Delay (s)		25.7			18.2			31.5			29.9	
Approach LOS		C			B			C			C	
























Intersection Summary

HCM 2000 Control Delay	23.0	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.55		
Actuated Cycle Length (s)	64.1	Sum of lost time (s)	15.3
Intersection Capacity Utilization	51.7%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
28: Isabel Ave/Campus Hill Dr & Portola Ave

BART to Livermore Extension Project
2040 BART AM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	1	204	218	506	561	139	498	312	92	71	202	2
Future Volume (vph)	1	204	218	506	561	139	498	312	92	71	202	2
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	5.8	5.8
Lane Util. Factor	1.00	0.95	0.88	0.94	0.95		0.97	0.95	1.00	1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	0.97		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3539	2787	4990	3434		3433	3539	1583	1770	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	3539	2787	4990	3434		3433	3539	1583	1770	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	1	222	237	550	610	151	541	339	100	77	220	2
RTOR Reduction (vph)	0	0	184	0	15	0	0	0	68	0	0	2
Lane Group Flow (vph)	1	222	53	550	746	0	541	339	32	77	220	0
Turn Type	Prot	NA	Perm	Prot	NA		Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4						2			6
Actuated Green, G (s)	1.5	17.8	17.8	15.1	31.4		20.2	25.5	25.5	7.7	13.4	13.4
Effective Green, g (s)	1.5	19.1	19.1	15.1	32.7		20.2	26.8	26.8	7.7	12.5	12.5
Actuated g/C Ratio	0.02	0.23	0.23	0.18	0.39		0.24	0.32	0.32	0.09	0.15	0.15
Clearance Time (s)	4.0	5.3	5.3	4.0	5.3		4.0	5.3	5.3	4.0	4.9	4.9
Vehicle Extension (s)	2.0	3.0	3.0	2.0	3.0		2.0	3.0	3.0	2.0	3.0	3.0
Lane Grp Cap (vph)	31	798	628	889	1325		818	1119	500	160	522	233
v/s Ratio Prot	0.00	0.06		c0.11	c0.22		c0.16	0.10		0.04	c0.06	
v/s Ratio Perm			0.02						0.02			0.00
v/c Ratio	0.03	0.28	0.09	0.62	0.56		0.66	0.30	0.06	0.48	0.42	0.00
Uniform Delay, d1	40.9	27.1	25.9	32.1	20.4		29.2	21.9	20.2	36.6	32.8	30.8
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.2	0.2	0.1	0.9	0.6		1.6	0.2	0.1	0.8	0.6	0.0
Delay (s)	41.0	27.3	26.0	33.0	20.9		30.7	22.0	20.2	37.4	33.4	30.8
Level of Service	D	C	C	C	C		C	C	C	D	C	C
Approach Delay (s)		26.6			26.0			26.7			34.4	
Approach LOS		C			C			C			C	

Intersection Summary

HCM 2000 Control Delay	27.1	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.60		
Actuated Cycle Length (s)	84.7	Sum of lost time (s)	17.8
Intersection Capacity Utilization	66.5%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
29: Isabel Ave & I-580 WB Ramps

BART to Livermore Extension Project
2040 BART AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↔↔		↗		↑↑↑	↗		↑↑↑	↗
Traffic Volume (vph)	0	0	0	1259	0	480	0	512	0	0	631	442
Future Volume (vph)	0	0	0	1259	0	480	0	512	0	0	631	442
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0		4.0		4.8			4.8	4.8
Lane Util. Factor				0.97		1.00		0.91			0.91	1.00
Frt				1.00		0.85		1.00			1.00	0.85
Flt Protected				0.95		1.00		1.00			1.00	1.00
Satd. Flow (prot)				3433		1583		5085			5085	1583
Flt Permitted				0.95		1.00		1.00			1.00	1.00
Satd. Flow (perm)				3433		1583		5085			5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	1368	0	522	0	557	0	0	686	480
RTOR Reduction (vph)	0	0	0	0	0	49	0	0	0	0	0	304
Lane Group Flow (vph)	0	0	0	1368	0	473	0	557	0	0	686	176
Turn Type				Prot		Prot		NA	Free		NA	Prot
Protected Phases				8		8		2			6	6
Permitted Phases									Free			
Actuated Green, G (s)				29.2		29.2		22.8			22.8	22.8
Effective Green, g (s)				29.2		29.2		22.0			22.0	22.0
Actuated g/C Ratio				0.49		0.49		0.37			0.37	0.37
Clearance Time (s)				4.0		4.0		4.0			4.0	4.0
Vehicle Extension (s)				2.0		2.0		4.0			4.0	4.0
Lane Grp Cap (vph)				1670		770		1864			1864	580
v/s Ratio Prot				c0.40		0.30		0.11			c0.13	0.11
v/s Ratio Perm												
v/c Ratio				0.82		0.61		0.30			0.37	0.30
Uniform Delay, d1				13.1		11.3		13.5			13.9	13.5
Progression Factor				1.00		1.00		1.09			1.00	1.00
Incremental Delay, d2				3.1		1.0		0.4			0.6	1.3
Delay (s)				16.2		12.3		15.1			14.5	14.9
Level of Service				B		B		B			B	B
Approach Delay (s)		0.0			15.2			15.1			14.6	
Approach LOS		A			B			B			B	

























Intersection Summary

HCM 2000 Control Delay	15.0	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.63		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.8
Intersection Capacity Utilization	55.4%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
30: Isabel Ave & I-580 EB Ramps

BART to Livermore Extension Project
2040 BART AM

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations	 		 					  			  		
Traffic Volume (vph)	218	0	387	0	0	0	0	729	509	0	1630	355	
Future Volume (vph)	218	0	387	0	0	0	0	729	509	0	1630	355	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)	4.0		4.0					4.0	4.0		4.0	4.0	
Lane Util. Factor	0.97		0.88					0.91	1.00		0.91	1.00	
Frt	1.00		0.85					1.00	0.85		1.00	0.85	
Flt Protected	0.95		1.00					1.00	1.00		1.00	1.00	
Satd. Flow (prot)	3433		2787					5085	1583		5085	1583	
Flt Permitted	0.95		1.00					1.00	1.00		1.00	1.00	
Satd. Flow (perm)	3433		2787					5085	1583		5085	1583	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	
Adj. Flow (vph)	237	0	421	0	0	0	0	792	553	0	1772	386	
RTOR Reduction (vph)	0	0	29	0	0	0	0	0	0	0	0	0	
Lane Group Flow (vph)	237	0	393	0	0	0	0	792	553	0	1772	386	
Turn Type	Prot		Perm					NA	Free		NA	Free	
Protected Phases	4							2			6		
Permitted Phases			4						Free			Free	
Actuated Green, G (s)	12.5		12.5					38.5	60.0		38.5	60.0	
Effective Green, g (s)	12.5		12.5					39.5	60.0		39.5	60.0	
Actuated g/C Ratio	0.21		0.21					0.66	1.00		0.66	1.00	
Clearance Time (s)	4.0		4.0					5.0			5.0		
Vehicle Extension (s)	2.0		2.0					4.0			4.0		
Lane Grp Cap (vph)	715		580					3347	1583		3347	1583	
v/s Ratio Prot	0.07							0.16			c0.35		
v/s Ratio Perm			c0.14						0.35			0.24	
v/c Ratio	0.33		0.68					0.24	0.35		0.53	0.24	
Uniform Delay, d1	20.2		21.9					4.1	0.0		5.4	0.0	
Progression Factor	1.00		1.00					1.00	1.00		0.55	1.00	
Incremental Delay, d2	0.1		2.5					0.2	0.6		0.5	0.3	
Delay (s)	20.3		24.4					4.3	0.6		3.5	0.3	
Level of Service	C		C					A	A		A	A	
Approach Delay (s)		22.9			0.0			2.8			2.9		
Approach LOS		C			A			A			A		
Intersection Summary													
HCM 2000 Control Delay			6.0									HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio			0.56										
Actuated Cycle Length (s)			60.0									Sum of lost time (s)	8.0
Intersection Capacity Utilization			51.7%									ICU Level of Service	A
Analysis Period (min)			15										

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
31: Isabel Ave & Airway Blvd

BART to Livermore Extension Project
2040 BART AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗	↘	↖	↗	↘	↖	↑↑↑	↗	↖↗	↑↑↑	↘
Traffic Volume (vph)	0	135	517	267	328	179	318	1075	306	895	1227	15
Future Volume (vph)	0	135	517	267	328	179	318	1075	306	895	1227	15
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.2	5.6	5.2	5.2	5.6	4.0	4.0	4.0	4.0	4.0	5.0
Lane Util. Factor		1.00	1.00	1.00	1.00	1.00	1.00	0.91	1.00	0.97	0.91	1.00
Frt		1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1863	1583	1770	1863	1583	1770	5085	1583	3433	5085	1583
Flt Permitted		1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)		1863	1583	1770	1863	1583	1770	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	147	562	290	357	195	346	1168	333	973	1334	16
RTOR Reduction (vph)	0	0	104	0	0	83	0	0	246	0	0	11
Lane Group Flow (vph)	0	147	458	290	357	112	346	1168	87	973	1334	5
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4	5	3	8	1	5	2		1	NA	6
Permitted Phases			4			8			2			6
Actuated Green, G (s)		12.3	27.3	14.4	31.3	52.3	15.0	22.4	22.4	21.0	28.4	28.4
Effective Green, g (s)		11.7	26.1	13.8	30.7	51.1	16.0	23.4	23.4	22.0	29.4	28.4
Actuated g/C Ratio		0.13	0.29	0.15	0.34	0.57	0.18	0.26	0.26	0.25	0.33	0.32
Clearance Time (s)		4.6	5.0	4.6	4.6	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Extension (s)		3.0	3.0	3.0	3.0	3.0	3.0	5.0	5.0	3.0	5.0	5.0
Lane Grp Cap (vph)		244	462	273	640	905	317	1332	414	845	1674	503
v/s Ratio Prot		0.08	c0.16	c0.16	0.19	0.03	c0.20	0.23		c0.28	c0.26	
v/s Ratio Perm			0.13			0.04			0.06			0.00
v/c Ratio		0.60	0.99	1.06	0.56	0.12	1.09	0.88	0.21	1.15	0.80	0.01
Uniform Delay, d1		36.6	31.5	37.8	23.8	8.8	36.6	31.6	25.7	33.6	27.2	20.8
Progression Factor		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2		4.2	39.4	71.9	1.1	0.1	77.3	7.3	0.5	81.7	3.1	0.0
Delay (s)		40.8	70.9	109.6	24.8	8.9	113.9	38.9	26.3	115.3	30.4	20.8
Level of Service		D	E	F	C	A	F	D	C	F	C	C
Approach Delay (s)		64.7			50.3			50.7			65.9	
Approach LOS		E			D			D			E	


































Intersection Summary

HCM 2000 Control Delay	58.5	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.06		
Actuated Cycle Length (s)	89.3	Sum of lost time (s)	20.0
Intersection Capacity Utilization	83.5%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
32: Isabel Ave & Jack London Blvd

BART to Livermore Extension Project
2040 BART AM

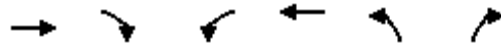
												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 	 			 		 	  		 	  	
Traffic Volume (vph)	25	56	64	300	872	353	408	998	123	170	1418	280
Future Volume (vph)	25	56	64	300	872	353	408	998	123	170	1418	280
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.97	0.91	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	3433	5085	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	3433	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	27	61	70	326	948	384	443	1085	134	185	1541	304
RTOR Reduction (vph)	0	0	58	0	0	65	0	0	85	0	0	110
Lane Group Flow (vph)	27	61	12	326	948	319	443	1085	49	185	1541	194
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8	1	5	2		1	NA	6
Permitted Phases			4			8			2			6
Actuated Green, G (s)	3.8	18.4	18.4	19.2	33.8	43.0	12.9	39.7	39.7	9.2	36.0	36.0
Effective Green, g (s)	3.8	18.4	18.4	19.2	33.8	43.0	12.9	39.7	39.7	9.2	36.0	36.0
Actuated g/C Ratio	0.04	0.17	0.17	0.18	0.31	0.40	0.12	0.37	0.37	0.09	0.33	0.33
Clearance Time (s)	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	121	604	270	315	1110	709	411	1874	583	293	1699	529
v/s Ratio Prot	0.01	0.02		c0.18	c0.27	0.04	c0.13	c0.21		0.05	c0.30	
v/s Ratio Perm			0.01			0.16			0.03			0.12
v/c Ratio	0.22	0.10	0.04	1.03	0.85	0.45	1.08	0.58	0.08	0.63	0.91	0.37
Uniform Delay, d1	50.5	37.7	37.3	44.2	34.6	23.7	47.4	27.3	22.2	47.6	34.3	27.2
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.9	0.1	0.1	60.0	6.6	0.5	66.8	0.4	0.1	4.4	7.4	0.4
Delay (s)	51.5	37.7	37.4	104.3	41.2	24.1	114.2	27.7	22.2	52.0	41.6	27.6
Level of Service	D	D	D	F	D	C	F	C	C	D	D	C
Approach Delay (s)		39.9			49.7			50.3			40.5	
Approach LOS		D			D			D			D	

Intersection Summary

HCM 2000 Control Delay	46.2	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.97		
Actuated Cycle Length (s)	107.7	Sum of lost time (s)	21.2
Intersection Capacity Utilization	76.4%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
33: Isabel Ave Connector & Stanley Blvd



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑	↑	↔	↑↑	↔	↔
Traffic Volume (vph)	349	136	796	2472	508	664
Future Volume (vph)	349	136	796	2472	508	664
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	2.3	2.3	4.0	2.3	2.5	2.5
Lane Util. Factor	0.95	1.00	0.97	0.95	0.97	0.88
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	3539	1583	3433	3539	3433	2787
Flt Permitted	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (perm)	3539	1583	3433	3539	3433	2787
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	379	148	865	2687	552	722
RTOR Reduction (vph)	0	12	0	0	0	207
Lane Group Flow (vph)	379	136	865	2687	552	515
Turn Type	NA	pm+ov	Prot	NA	Prot	pm+ov
Protected Phases	2	8	1	6	8	1
Permitted Phases		2				8
Actuated Green, G (s)	45.0	67.2	33.1	82.1	22.2	55.3
Effective Green, g (s)	46.7	70.6	33.1	83.8	23.7	58.3
Actuated g/C Ratio	0.42	0.63	0.29	0.75	0.21	0.52
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Grp Cap (vph)	1471	1027	1011	2640	724	1508
v/s Ratio Prot	0.11	0.03	0.25	c0.76	c0.16	0.11
v/s Ratio Perm		0.06				0.08
v/c Ratio	0.26	0.13	0.86	1.02	0.76	0.34
Uniform Delay, d1	21.5	8.4	37.3	14.2	41.7	15.8
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.0	0.0	7.0	22.1	4.3	0.0
Delay (s)	21.5	8.5	44.3	36.4	45.9	15.8
Level of Service	C	A	D	D	D	B
Approach Delay (s)	17.8			38.3	28.9	
Approach LOS	B			D	C	

Intersection Summary

HCM 2000 Control Delay	34.0	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	1.00		
Actuated Cycle Length (s)	112.3	Sum of lost time (s)	8.8
Intersection Capacity Utilization	89.5%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 34: Murrieta Blvd/Driveway & Portola Ave

BART to Livermore Extension Project
 2040 BART AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↕		↰	↕		↰	↕	↰		↕	
Traffic Volume (vph)	0	661	131	245	1047	1	166	6	170	1	3	0
Future Volume (vph)	0	661	131	245	1047	1	166	6	170	1	3	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.8		4.0	5.8		5.2	5.2	5.2		4.0	
Lane Util. Factor		0.95		1.00	0.95		0.95	0.95	1.00		1.00	
Frt		0.98		1.00	1.00		1.00	1.00	0.85		1.00	
Flt Protected		1.00		0.95	1.00		0.95	0.96	1.00		0.99	
Satd. Flow (prot)		3452		1770	3539		1681	1691	1583		1840	
Flt Permitted		1.00		0.95	1.00		0.95	0.96	1.00		0.99	
Satd. Flow (perm)		3452		1770	3539		1681	1691	1583		1840	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	718	142	266	1138	1	180	7	185	1	3	0
RTOR Reduction (vph)	0	19	0	0	0	0	0	0	162	0	0	0
Lane Group Flow (vph)	0	841	0	266	1139	0	94	93	23	0	4	0
Turn Type	Prot	NA		Prot	NA		Split	NA	Perm		Split	NA
Protected Phases	5	2		1	6		8	8		4	4	
Permitted Phases									8			
Actuated Green, G (s)		19.4		14.3	37.7		8.1	8.1	8.1		0.6	
Effective Green, g (s)		18.5		14.3	36.8		7.5	7.5	7.5		0.6	
Actuated g/C Ratio		0.31		0.24	0.61		0.13	0.13	0.13		0.01	
Clearance Time (s)		4.9		4.0	4.9		4.6	4.6	4.6		4.0	
Vehicle Extension (s)		2.0		2.0	2.0		2.0	2.0	2.0		2.0	
Lane Grp Cap (vph)		1066		422	2174		210	211	198		18	
v/s Ratio Prot		c0.24		c0.15	0.32		c0.06	0.05			c0.00	
v/s Ratio Perm									0.01			
v/c Ratio		0.79		0.63	0.52		0.45	0.44	0.12		0.22	
Uniform Delay, d1		18.9		20.4	6.6		24.3	24.3	23.3		29.4	
Progression Factor		1.00		1.00	1.00		1.00	1.00	1.00		1.00	
Incremental Delay, d2		3.7		2.3	0.1		0.6	0.5	0.1		2.3	
Delay (s)		22.6		22.7	6.7		24.8	24.8	23.4		31.7	
Level of Service		C		C	A		C	C	C		C	
Approach Delay (s)		22.6			9.7			24.1			31.7	
Approach LOS		C			A			C			C	

Intersection Summary

HCM 2000 Control Delay	16.0	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.66		
Actuated Cycle Length (s)	59.9	Sum of lost time (s)	19.0
Intersection Capacity Utilization	59.9%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
35: Murrieta Blvd & Jack London Blvd

BART to Livermore Extension Project
2040 BART AM



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	84	296	997	327	253	168
Future Volume (vph)	84	296	997	327	253	168
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00	1.00	0.95	0.91	
Frt	1.00	0.85	1.00	1.00	0.94	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1770	1583	1770	3539	4781	
Flt Permitted	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	1770	1583	1770	3539	4781	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	91	322	1084	355	275	183
RTOR Reduction (vph)	0	288	0	0	111	0
Lane Group Flow (vph)	91	34	1084	355	347	0
Turn Type	Prot	Perm	Prot	NA	NA	
Protected Phases	4		5	2	6	
Permitted Phases		4				
Actuated Green, G (s)	10.7	10.7	66.2	82.8	12.6	
Effective Green, g (s)	10.7	10.7	66.2	82.8	12.6	
Actuated g/C Ratio	0.11	0.11	0.65	0.82	0.12	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	186	166	1154	2886	593	
v/s Ratio Prot	c0.05		c0.61	0.10	c0.07	
v/s Ratio Perm		0.02				
v/c Ratio	0.49	0.20	0.94	0.12	0.58	
Uniform Delay, d1	42.8	41.5	15.8	1.9	42.0	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	2.0	0.6	14.1	0.0	1.5	
Delay (s)	44.8	42.1	30.0	1.9	43.5	
Level of Service	D	D	C	A	D	
Approach Delay (s)	42.7			23.1	43.5	
Approach LOS	D			C	D	






























Intersection Summary

HCM 2000 Control Delay	30.6	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.84		
Actuated Cycle Length (s)	101.5	Sum of lost time (s)	12.0
Intersection Capacity Utilization	78.5%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
36: Murrieta Blvd & Stanley Blvd

BART to Livermore Extension Project
2040 BART AM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 	 			 		 	 			 	
Traffic Volume (vph)	240	796	251	24	1364	156	718	461	19	216	194	476
Future Volume (vph)	240	796	251	24	1364	156	718	461	19	216	194	476
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	5.8	5.8	4.0	5.8	4.9	4.9	5.8		4.9	5.8	4.9
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.97	0.95		1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	3433	3518		1770	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	3433	3518		1770	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	261	865	273	26	1483	170	780	501	21	235	211	517
RTOR Reduction (vph)	0	0	122	0	0	21	0	2	0	0	0	61
Lane Group Flow (vph)	261	865	151	26	1483	149	780	520	0	235	211	456
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Prot	NA		Prot	NA	Perm
Protected Phases	1	6		5	2	3	7	4		3	8	
Permitted Phases			6			2						8
Actuated Green, G (s)	8.0	60.1	60.1	3.6	55.7	79.0	26.0	36.8		23.3	34.1	34.1
Effective Green, g (s)	8.0	59.2	59.2	3.6	54.8	77.2	25.1	35.9		22.4	33.2	34.1
Actuated g/C Ratio	0.06	0.42	0.42	0.03	0.39	0.55	0.18	0.25		0.16	0.23	0.24
Clearance Time (s)	4.0	4.9	4.9	4.0	4.9	4.0	4.0	4.9		4.0	4.9	4.9
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	193	1479	661	45	1369	863	608	891		280	829	381
v/s Ratio Prot	c0.08	0.24		0.01	c0.42	0.03	c0.23	c0.15		0.13	0.06	
v/s Ratio Perm			0.10			0.07						c0.29
v/c Ratio	1.35	0.58	0.23	0.58	1.08	0.17	1.28	0.58		0.84	0.25	1.20
Uniform Delay, d1	66.8	31.7	26.5	68.2	43.4	16.2	58.2	46.3		57.9	44.1	53.8
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	188.6	0.6	0.2	16.7	50.2	0.1	139.5	1.0		19.3	0.2	111.7
Delay (s)	255.4	32.3	26.7	85.0	93.6	16.3	197.8	47.3		77.1	44.3	165.4
Level of Service	F	C	C	F	F	B	F	D		E	D	F
Approach Delay (s)		72.9			85.7			137.5			117.3	
Approach LOS		E			F			F			F	

Intersection Summary

HCM 2000 Control Delay	100.6	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.18		
Actuated Cycle Length (s)	141.6	Sum of lost time (s)	20.5
Intersection Capacity Utilization	100.7%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
37: Livermore Ave & I-580 WB Ramps

BART to Livermore Extension Project
2040 BART AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	344	90	26	503	81	0	0	151	0
Future Volume (vph)	0	0	0	344	90	26	503	81	0	0	151	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)					4.0		4.0	4.0			4.0	
Lane Util. Factor					0.95		0.97	1.00			0.95	
Frt					0.99		1.00	1.00			1.00	
Flt Protected					0.96		0.95	1.00			1.00	
Satd. Flow (prot)					1691		3433	1863			3539	
Flt Permitted					0.96		0.95	1.00			1.00	
Satd. Flow (perm)					1691		3433	1863			3539	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	374	98	28	547	88	0	0	164	0
RTOR Reduction (vph)	0	0	0	0	4	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	0	496	0	547	88	0	0	164	0
Turn Type				Split	NA		Prot	NA			NA	
Protected Phases				8	8		5	2			6	
Permitted Phases												
Actuated Green, G (s)					20.5		13.1	29.8			13.2	
Effective Green, g (s)					20.5		12.6	31.5			14.9	
Actuated g/C Ratio					0.34		0.21	0.52			0.25	
Clearance Time (s)					4.0		3.5	5.7			5.7	
Vehicle Extension (s)					2.0		2.0	2.5			2.5	
Lane Grp Cap (vph)					577		720	978			878	
v/s Ratio Prot					c0.29		c0.16	0.05			c0.05	
v/s Ratio Perm												
v/c Ratio					0.86		0.76	0.09			0.19	
Uniform Delay, d1					18.4		22.3	7.1			17.8	
Progression Factor					1.00		0.78	0.51			1.00	
Incremental Delay, d2					11.8		3.4	0.2			0.5	
Delay (s)					30.2		20.7	3.8			18.2	
Level of Service					C		C	A			B	
Approach Delay (s)		0.0			30.2			18.3			18.2	
Approach LOS		A			C			B			B	

Intersection Summary

HCM 2000 Control Delay	22.9	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.62		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	62.3%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
38: Livermore Ave & I-580 EB Ramps

BART to Livermore Extension Project
2040 BART AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔	↗					↕		↘	↕	
Traffic Volume (vph)	11	2	664	0	0	0	0	570	561	26	475	0
Future Volume (vph)	11	2	664	0	0	0	0	570	561	26	475	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0					3.0		5.0	3.0	
Lane Util. Factor		0.95	0.95					0.95		1.00	0.95	
Frt		0.86	0.85					0.93		1.00	1.00	
Flt Protected		1.00	1.00					1.00		0.95	1.00	
Satd. Flow (prot)		1512	1504					3276		1770	3539	
Flt Permitted		1.00	1.00					1.00		0.95	1.00	
Satd. Flow (perm)		1512	1504					3276		1770	3539	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	12	2	722	0	0	0	0	620	610	28	516	0
RTOR Reduction (vph)	0	265	265	0	0	0	0	240	0	0	0	0
Lane Group Flow (vph)	0	103	103	0	0	0	0	990	0	28	516	0
Turn Type	Prot	NA	Perm					NA		Prot	NA	
Protected Phases	7	4						2		1	6	
Permitted Phases			4									
Actuated Green, G (s)		14.2	14.2					32.2		1.6	37.8	
Effective Green, g (s)		14.2	14.2					33.2		0.6	38.8	
Actuated g/C Ratio		0.24	0.24					0.55		0.01	0.65	
Clearance Time (s)		4.0	4.0					4.0		4.0	4.0	
Vehicle Extension (s)		2.0	2.0					2.5		2.0	2.5	
Lane Grp Cap (vph)		357	355					1812		17	2288	
v/s Ratio Prot								c0.30		c0.02	0.15	
v/s Ratio Perm		0.07	c0.07									
v/c Ratio		0.29	0.29					0.55		1.65	0.23	
Uniform Delay, d1		18.8	18.8					8.6		29.7	4.4	
Progression Factor		1.00	1.00					1.00		1.15	0.21	
Incremental Delay, d2		0.2	0.2					1.2		437.7	0.2	
Delay (s)		18.9	18.9					9.8		472.0	1.1	
Level of Service		B	B					A		F	A	
Approach Delay (s)		18.9			0.0			9.8			25.4	
Approach LOS		B			A			A			C	

Intersection Summary

HCM 2000 Control Delay	15.8	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.48		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	62.3%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
39: Livermore Ave & Portola Ave

BART to Livermore Extension Project
2040 BART AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↕	↖	↖	↕	↖	↖	↕	↖	↖	↕	↖
Traffic Volume (vph)	436	291	121	25	560	87	229	542	58	131	799	461
Future Volume (vph)	436	291	121	25	560	87	229	542	58	131	799	461
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	2.7	4.0	4.0	2.7	4.0	4.0	4.9		4.0	4.9	4.9
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	1.00	0.95		1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	1770	3488		1770	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	1770	3488		1770	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	474	316	132	27	609	95	249	589	63	142	868	501
RTOR Reduction (vph)	0	0	82	0	0	72	0	6	0	0	0	51
Lane Group Flow (vph)	474	316	50	27	609	23	249	646	0	142	868	450
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA		Prot	NA	pm+ov
Protected Phases	3	8		7	4		1	6		5	2	3
Permitted Phases			8			4						2
Actuated Green, G (s)	21.3	48.0	48.0	3.2	29.9	29.9	21.7	43.3		15.2	36.8	58.1
Effective Green, g (s)	21.3	49.3	48.0	3.2	31.2	29.9	21.7	42.4		15.2	35.9	56.3
Actuated g/C Ratio	0.17	0.39	0.38	0.03	0.25	0.24	0.17	0.34		0.12	0.29	0.45
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	581	1388	604	45	878	376	305	1176		214	1010	770
v/s Ratio Prot	c0.14	0.09		0.02	c0.17		c0.14	0.19		0.08	c0.25	c0.09
v/s Ratio Perm			0.03			0.01						0.19
v/c Ratio	0.82	0.23	0.08	0.60	0.69	0.06	0.82	0.55		0.66	0.86	0.58
Uniform Delay, d1	50.3	25.5	24.8	60.6	42.9	37.0	50.1	33.9		52.8	42.5	25.9
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	8.6	0.1	0.1	19.7	2.4	0.1	15.4	0.5		7.5	7.4	1.1
Delay (s)	59.0	25.6	24.9	80.3	45.3	37.1	65.5	34.4		60.3	49.9	27.1
Level of Service	E	C	C	F	D	D	E	C		E	D	C
Approach Delay (s)		42.6			45.5			43.0			43.3	
Approach LOS		D			D			D			D	

Intersection Summary

HCM 2000 Control Delay	43.5	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.80		
Actuated Cycle Length (s)	125.7	Sum of lost time (s)	16.5
Intersection Capacity Utilization	76.8%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
40: First St/Springtown Blvd & I-580 WB Ramps

BART to Livermore Extension Project
2040 BART AM





















Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations			↗↘			↗	↗↘	↑			↗↘	↗
Traffic Volume (vph)	0	0	207	0	0	0	341	375	0	0	823	562
Future Volume (vph)	0	0	207	0	0	0	341	375	0	0	823	562
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)			4.5				4.5	4.0			4.5	4.5
Lane Util. Factor			0.88				0.97	1.00			0.95	1.00
Frt			0.85				1.00	1.00			1.00	0.85
Flt Protected			1.00				0.95	1.00			1.00	1.00
Satd. Flow (prot)			2787				3433	1863			3539	1583
Flt Permitted			1.00				0.95	1.00			1.00	1.00
Satd. Flow (perm)			2787				3433	1863			3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	225	0	0	0	371	408	0	0	895	611
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	26
Lane Group Flow (vph)	0	0	225	0	0	0	371	408	0	0	895	585
Turn Type			Over			Free	Prot	NA			NA	Perm
Protected Phases			5				5	2			6	
Permitted Phases						Free						6
Actuated Green, G (s)			10.3				10.3	60.0			41.7	41.7
Effective Green, g (s)			9.8				9.8	60.0			41.2	41.2
Actuated g/C Ratio			0.16				0.16	1.00			0.69	0.69
Clearance Time (s)			4.0				4.0	4.0			4.0	4.0
Vehicle Extension (s)			2.0				2.0	0.2			4.0	4.0
Lane Grp Cap (vph)			455				560	1863			2430	1086
v/s Ratio Prot			0.08				c0.11	0.22			0.25	
v/s Ratio Perm												c0.37
v/c Ratio			0.49				0.66	0.22			0.37	0.54
Uniform Delay, d1			22.8				23.5	0.0			3.9	4.7
Progression Factor			1.00				0.70	1.00			1.00	1.00
Incremental Delay, d2			0.3				2.1	0.2			0.4	1.9
Delay (s)			23.2				18.6	0.2			4.4	6.6
Level of Service			C				B	A			A	A
Approach Delay (s)		23.2			0.0			9.0			5.3	
Approach LOS		C			A			A			A	

Intersection Summary

HCM 2000 Control Delay	8.0	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.56		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	52.0%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
41: First St & I-580 EB Ramps

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations													
Traffic Volume (vph)	81	2	363	0	0	0	0	948	907	78	921	0	
Future Volume (vph)	81	2	363	0	0	0	0	948	907	78	921	0	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)		4.0	4.0					5.0	5.0	5.0	5.0		
Lane Util. Factor		1.00	0.88					0.95	1.00	1.00	0.95		
Frt		1.00	0.85					1.00	0.85	1.00	1.00		
Flt Protected		0.95	1.00					1.00	1.00	0.95	1.00		
Satd. Flow (prot)		1776	2787					3539	1583	1770	3539		
Flt Permitted		0.95	1.00					1.00	1.00	0.95	1.00		
Satd. Flow (perm)		1776	2787					3539	1583	1770	3539		
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	
Adj. Flow (vph)	88	2	395	0	0	0	0	1030	986	85	1001	0	
RTOR Reduction (vph)	0	0	287	0	0	0	0	0	296	0	0	0	
Lane Group Flow (vph)	0	90	108	0	0	0	0	1030	690	85	1001	0	
Turn Type	Perm	NA	Perm					NA	Perm	Prot	NA		
Protected Phases		4						2		1	6		
Permitted Phases	4		4						2				
Actuated Green, G (s)		6.8	6.8					36.4	36.4	4.8	45.2		
Effective Green, g (s)		6.3	6.3					35.9	35.9	3.8	44.7		
Actuated g/C Ratio		0.10	0.10					0.60	0.60	0.06	0.75		
Clearance Time (s)		3.5	3.5					4.5	4.5	4.0	4.5		
Vehicle Extension (s)		2.5	2.5					4.0	4.0	2.0	4.0		
Lane Grp Cap (vph)		186	292					2117	947	112	2636		
v/s Ratio Prot								0.29		c0.05	0.28		
v/s Ratio Perm		0.05	0.04						c0.44				
v/c Ratio		0.48	0.37					0.49	0.73	0.76	0.38		
Uniform Delay, d1		25.3	25.0					6.8	8.6	27.6	2.7		
Progression Factor		1.00	1.00					1.00	1.00	1.03	0.68		
Incremental Delay, d2		1.4	0.6					0.8	4.9	21.5	0.4		
Delay (s)		26.8	25.6					7.6	13.5	49.9	2.2		
Level of Service		C	C					A	B	D	A		
Approach Delay (s)		25.8			0.0			10.5			6.0		
Approach LOS		C			A			B			A		
Intersection Summary													
HCM 2000 Control Delay			11.2									HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio			0.70										
Actuated Cycle Length (s)			60.0									Sum of lost time (s)	14.0
Intersection Capacity Utilization			76.7%									ICU Level of Service	D
Analysis Period (min)			15										

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
42: 1st St & Mines Rd

BART to Livermore Extension Project
2040 BART AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	41	60	45	509	101	369	26	1427	356	163	1181	19
Future Volume (vph)	41	60	45	509	101	369	26	1427	356	163	1181	19
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		0.97	1.00	1.00	1.00	0.91		0.97	0.91	
Frt	1.00	0.94		1.00	1.00	0.85	1.00	0.97		1.00	1.00	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1743		3433	1863	1583	1770	4933		3433	5073	
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	1743		3433	1863	1583	1770	4933		3433	5073	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	45	65	49	553	110	401	28	1551	387	177	1284	21
RTOR Reduction (vph)	0	33	0	0	0	48	0	43	0	0	1	0
Lane Group Flow (vph)	45	81	0	553	110	353	28	1895	0	177	1304	0
Turn Type	Prot	NA		Prot	NA	pm+ov	Prot	NA		Prot	NA	
Protected Phases	7	4		3	8	1	5	2		1	6	
Permitted Phases						8						
Actuated Green, G (s)	3.4	8.6		15.1	20.3	26.3	1.9	39.8		6.0	43.9	
Effective Green, g (s)	3.4	8.6		15.1	20.3	26.3	1.9	39.8		6.0	43.9	
Actuated g/C Ratio	0.04	0.10		0.18	0.24	0.31	0.02	0.47		0.07	0.51	
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	70	175		606	442	560	39	2296		240	2604	
v/s Ratio Prot	0.03	0.05		c0.16	0.06	c0.04	0.02	c0.38		c0.05	0.26	
v/s Ratio Perm						0.18						
v/c Ratio	0.64	0.46		0.91	0.25	0.63	0.72	0.83		0.74	0.50	
Uniform Delay, d1	40.5	36.3		34.6	26.4	25.4	41.5	19.8		39.0	13.6	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	18.4	1.9		18.2	0.3	2.3	47.4	2.6		11.2	0.2	
Delay (s)	58.9	38.2		52.7	26.7	27.7	88.9	22.4		50.2	13.8	
Level of Service	E	D		D	C	C	F	C		D	B	
Approach Delay (s)		44.0			40.6			23.3			18.1	
Approach LOS		D			D			C			B	























Intersection Summary

HCM 2000 Control Delay	26.3	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.87		
Actuated Cycle Length (s)	85.5	Sum of lost time (s)	16.0
Intersection Capacity Utilization	71.7%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group























HCM Unsignalized Intersection Capacity Analysis
43: Vasco Rd & I-580 WB Ramps

BART to Livermore Extension Project
2040 BART AM

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations								  			  		
Traffic Volume (veh/h)	0	0	0	0	0	140	0	1047	0	0	1881	0	
Future Volume (Veh/h)	0	0	0	0	0	140	0	1047	0	0	1881	0	
Sign Control		Stop			Stop			Free			Free		
Grade		0%			0%			0%			0%		
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	
Hourly flow rate (vph)	0	0	0	0	0	152	0	1138	0	0	2045	0	
Pedestrians													
Lane Width (ft)													
Walking Speed (ft/s)													
Percent Blockage													
Right turn flare (veh)													
Median type							None			None			
Median storage (veh)													
Upstream signal (ft)											524		
pX, platoon unblocked													
vC, conflicting volume	2576	3183	682	1820	3183	379	2045				1138		
vC1, stage 1 conf vol													
vC2, stage 2 conf vol													
vCu, unblocked vol	2576	3183	682	1820	3183	379	2045				1138		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1				4.1		
tC, 2 stage (s)													
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2				2.2		
p0 queue free %	100	100	100	100	100	75	100				100		
cM capacity (veh/h)	10	10	392	48	10	618	272				610		
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	NB 4	SB 1	SB 2	SB 3	SB 4			
Volume Total	0	152	379	379	379	0	682	682	682	0			
Volume Left	0	0	0	0	0	0	0	0	0	0			
Volume Right	0	152	0	0	0	0	0	0	0	0			
cSH	1700	618	1700	1700	1700	1700	1700	1700	1700	1700			
Volume to Capacity	0.00	0.25	0.22	0.22	0.22	0.00	0.40	0.40	0.40	0.00			
Queue Length 95th (ft)	0	24	0	0	0	0	0	0	0	0			
Control Delay (s)	0.0	12.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
Lane LOS	A	B											
Approach Delay (s)	0.0	12.7	0.0					0.0					
Approach LOS	A	B											
Intersection Summary													
Average Delay			0.6										
Intersection Capacity Utilization			39.7%		ICU Level of Service				A				
Analysis Period (min)			15										

HCM Unsignalized Intersection Capacity Analysis
44: Vasco Rd & I-580 EB Ramps

BART to Livermore Extension Project
2040 BART AM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations								  			  	
Traffic Volume (veh/h)	0	0	0	0	0	0	0	1090	0	73	2010	0
Future Volume (Veh/h)	0	0	0	0	0	0	0	1090	0	73	2010	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	0	0	0	0	0	1185	0	79	2185	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	2738	3528	728	2071	3528	395	2185			1185		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	2738	3528	728	2071	3528	395	2185			1185		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	100	100	100	100			86		
cM capacity (veh/h)	9	5	366	28	5	604	239			585		
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	NB 4	SB 1	SB 2	SB 3	SB 4		
Volume Total	0	0	395	395	395	0	79	728	728	728		
Volume Left	0	0	0	0	0	0	79	0	0	0		
Volume Right	0	0	0	0	0	0	0	0	0	0		
cSH	1700	1700	1700	1700	1700	1700	585	1700	1700	1700		
Volume to Capacity	0.00	0.00	0.23	0.23	0.23	0.00	0.14	0.43	0.43	0.43		
Queue Length 95th (ft)	0	0	0	0	0	0	12	0	0	0		
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	12.1	0.0	0.0	0.0		
Lane LOS	A	A					B					
Approach Delay (s)	0.0	0.0	0.0				0.4					
Approach LOS	A	A										
Intersection Summary												
Average Delay			0.3									
Intersection Capacity Utilization			42.2%		ICU Level of Service					A		
Analysis Period (min)			15									

HCM Signalized Intersection Capacity Analysis
45: Vasco Rd & East Ave

BART to Livermore Extension Project
2040 BART AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	295	368	52	11	28	21	65	253	196	258	288	299
Future Volume (vph)	295	368	52	11	28	21	65	253	196	258	288	299
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	0.95		0.97	1.00	1.00
Frt	1.00	0.98		1.00	0.93		1.00	0.93		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	3473		1770	3309		1770	3307		3433	1863	1583
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1770	3473		1770	3309		1770	3307		3433	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	321	400	57	12	30	23	71	275	213	280	313	325
RTOR Reduction (vph)	0	19	0	0	21	0	0	156	0	0	0	217
Lane Group Flow (vph)	321	438	0	12	32	0	71	332	0	280	313	108
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												6
Actuated Green, G (s)	11.6	16.2		0.6	5.2		2.0	14.0		5.3	17.3	17.3
Effective Green, g (s)	11.6	16.2		0.6	5.2		2.0	14.0		5.3	17.3	17.3
Actuated g/C Ratio	0.22	0.31		0.01	0.10		0.04	0.27		0.10	0.33	0.33
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	394	1079		20	330		67	888		349	618	525
v/s Ratio Prot	c0.18	c0.13		0.01	0.01		0.04	0.10		c0.08	c0.17	
v/s Ratio Perm												0.07
v/c Ratio	0.81	0.41		0.60	0.10		1.06	0.37		0.80	0.51	0.21
Uniform Delay, d1	19.2	14.2		25.6	21.3		25.1	15.5		22.9	14.0	12.5
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	12.2	0.3		40.2	0.1		127.4	0.3		12.5	0.7	0.2
Delay (s)	31.4	14.4		65.8	21.4		152.5	15.8		35.4	14.6	12.7
Level of Service	C	B		E	C		F	B		D	B	B
Approach Delay (s)		21.4			29.6			33.1			20.3	
Approach LOS		C			C			C			C	

Intersection Summary

HCM 2000 Control Delay	24.0	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.67		
Actuated Cycle Length (s)	52.1	Sum of lost time (s)	16.0
Intersection Capacity Utilization	53.7%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
46: Greenville Rd & I-580 WB Ramps

BART to Livermore Extension Project
2040 BART AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↔↔		↗		↕↕	↗		↕↕	
Traffic Volume (vph)	0	0	0	245	0	55	0	129	381	0	936	579
Future Volume (vph)	0	0	0	245	0	55	0	129	381	0	936	579
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0		4.0		4.0	4.0		4.0	
Lane Util. Factor				0.97		1.00		0.95	1.00		0.95	
Frt				1.00		0.85		1.00	0.85		0.94	
Flt Protected				0.95		1.00		1.00	1.00		1.00	
Satd. Flow (prot)				3433		1583		3539	1583		3336	
Flt Permitted				0.95		1.00		1.00	1.00		1.00	
Satd. Flow (perm)				3433		1583		3539	1583		3336	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	266	0	60	0	140	414	0	1017	629
RTOR Reduction (vph)	0	0	0	0	0	51	0	0	116	0	157	0
Lane Group Flow (vph)	0	0	0	266	0	9	0	140	298	0	1489	0
Turn Type				Prot		Prot		NA	Perm		NA	
Protected Phases				3		3		2			6	
Permitted Phases									2			
Actuated Green, G (s)				8.8		8.8		43.2	43.2		43.2	
Effective Green, g (s)				8.8		8.8		43.2	43.2		43.2	
Actuated g/C Ratio				0.15		0.15		0.72	0.72		0.72	
Clearance Time (s)				4.0		4.0		4.0	4.0		4.0	
Vehicle Extension (s)				3.0		3.0		3.0	3.0		3.0	
Lane Grp Cap (vph)				503		232		2548	1139		2401	
v/s Ratio Prot				c0.08		0.01		0.04			c0.45	
v/s Ratio Perm									0.19			
v/c Ratio				0.53		0.04		0.05	0.26		0.62	
Uniform Delay, d1				23.7		22.0		2.4	2.9		4.2	
Progression Factor				1.00		1.00		0.66	1.64		1.00	
Incremental Delay, d2				1.0		0.1		0.0	0.6		1.2	
Delay (s)				24.7		22.0		1.7	5.3		5.5	
Level of Service				C		C		A	A		A	
Approach Delay (s)		0.0			24.2			4.4			5.5	
Approach LOS		A			C			A			A	






















Intersection Summary

HCM 2000 Control Delay	7.6	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.60		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	58.1%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
47: Greenville Rd & I-580 EB Ramps

BART to Livermore Extension Project
2040 BART AM

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations	 							 			 		
Traffic Volume (vph)	37	0	138	0	0	0	0	476	73	0	892	31	
Future Volume (vph)	37	0	138	0	0	0	0	476	73	0	892	31	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)	4.0		4.0					4.0	4.0		4.0	4.0	
Lane Util. Factor	0.97		1.00					0.95	1.00		0.95	1.00	
Frt	1.00		0.85					1.00	0.85		1.00	0.85	
Flt Protected	0.95		1.00					1.00	1.00		1.00	1.00	
Satd. Flow (prot)	3433		1583					3539	1583		3539	1583	
Flt Permitted	0.95		1.00					1.00	1.00		1.00	1.00	
Satd. Flow (perm)	3433		1583					3539	1583		3539	1583	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	
Adj. Flow (vph)	40	0	150	0	0	0	0	517	79	0	970	34	
RTOR Reduction (vph)	0	0	123	0	0	0	0	0	19	0	0	8	
Lane Group Flow (vph)	40	0	27	0	0	0	0	517	60	0	970	26	
Turn Type	Prot		Prot					NA	Perm		NA	Perm	
Protected Phases	7		7					2			6		
Permitted Phases									2			6	
Actuated Green, G (s)	6.1		6.1					45.9	45.9		45.9	45.9	
Effective Green, g (s)	6.1		6.1					45.9	45.9		45.9	45.9	
Actuated g/C Ratio	0.10		0.10					0.76	0.76		0.76	0.76	
Clearance Time (s)	4.0		4.0					4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0		3.0					3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	349		160					2707	1210		2707	1210	
v/s Ratio Prot	0.01		c0.02					0.15			c0.27		
v/s Ratio Perm									0.04			0.02	
v/c Ratio	0.11		0.17					0.19	0.05		0.36	0.02	
Uniform Delay, d1	24.5		24.6					1.9	1.7		2.3	1.7	
Progression Factor	1.00		1.00					1.00	1.00		0.75	0.70	
Incremental Delay, d2	0.1		0.5					0.2	0.1		0.3	0.0	
Delay (s)	24.6		25.1					2.1	1.8		2.0	1.2	
Level of Service	C		C					A	A		A	A	
Approach Delay (s)		25.0			0.0			2.1			2.0		
Approach LOS		C			A			A			A		
Intersection Summary													
HCM 2000 Control Delay			4.5									HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio			0.34										
Actuated Cycle Length (s)			60.0									Sum of lost time (s)	8.0
Intersection Capacity Utilization			39.9%									ICU Level of Service	A
Analysis Period (min)			15										

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 48: Greenville Rd & Northfront Road/Altamont Pass Road



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↑	↑	↑	↑	↑
Traffic Volume (vph)	5	652	702	508	114	62
Future Volume (vph)	5	652	702	508	114	62
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	1863	1583	1770	1863	1770	1583
Flt Permitted	1.00	1.00	0.75	1.00	0.95	1.00
Satd. Flow (perm)	1863	1583	1405	1863	1770	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	5	709	763	552	124	67
RTOR Reduction (vph)	0	243	0	0	0	55
Lane Group Flow (vph)	5	466	763	552	124	12
Turn Type	NA	Perm	Perm	NA	Prot	Perm
Protected Phases	4			8	2	
Permitted Phases		4	8			2
Actuated Green, G (s)	32.5	32.5	32.5	32.5	8.9	8.9
Effective Green, g (s)	32.5	32.5	32.5	32.5	8.9	8.9
Actuated g/C Ratio	0.66	0.66	0.66	0.66	0.18	0.18
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	1225	1041	924	1225	318	285
v/s Ratio Prot	0.00			0.30	c0.07	
v/s Ratio Perm		0.29	c0.54			0.01
v/c Ratio	0.00	0.45	0.83	0.45	0.39	0.04
Uniform Delay, d1	2.9	4.1	6.3	4.1	17.9	16.7
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.0	0.3	6.1	0.3	0.8	0.1
Delay (s)	2.9	4.4	12.4	4.4	18.6	16.8
Level of Service	A	A	B	A	B	B
Approach Delay (s)	4.4			9.0	18.0	
Approach LOS	A			A	B	

Intersection Summary

HCM 2000 Control Delay	8.3	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.73		
Actuated Cycle Length (s)	49.4	Sum of lost time (s)	8.0
Intersection Capacity Utilization	85.9%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	121	166	131	455	755	213
Future Volume (vph)	121	166	131	455	755	213
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.2	5.2	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.88	0.97	0.95	0.95	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	3433	2787	3433	3539	3539	1583
Flt Permitted	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (perm)	3433	2787	3433	3539	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	132	180	142	495	821	232
RTOR Reduction (vph)	0	159	0	0	0	115
Lane Group Flow (vph)	132	21	142	495	821	117
Turn Type	Prot	Perm	Prot	NA	NA	Perm
Protected Phases	8		1	6	2	
Permitted Phases		8				2
Actuated Green, G (s)	5.5	5.5	3.2	27.2	20.0	20.0
Effective Green, g (s)	4.9	4.9	3.2	28.9	21.7	21.7
Actuated g/C Ratio	0.11	0.11	0.07	0.67	0.50	0.50
Clearance Time (s)	4.6	4.6	4.0	5.7	5.7	5.7
Vehicle Extension (s)	5.0	5.0	6.0	2.5	2.5	2.5
Lane Grp Cap (vph)	391	317	255	2378	1785	798
v/s Ratio Prot	c0.04		c0.04	0.14	c0.23	
v/s Ratio Perm		0.01				0.07
v/c Ratio	0.34	0.06	0.56	0.21	0.46	0.15
Uniform Delay, d1	17.6	17.0	19.2	2.7	6.9	5.7
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.1	0.2	5.6	0.0	0.1	0.1
Delay (s)	18.6	17.2	24.8	2.7	7.0	5.8
Level of Service	B	B	C	A	A	A
Approach Delay (s)	17.8			7.6	6.7	
Approach LOS	B			A	A	

Intersection Summary

HCM 2000 Control Delay	8.7	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.45		
Actuated Cycle Length (s)	43.0	Sum of lost time (s)	13.2
Intersection Capacity Utilization	39.1%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
50: Greenville Rd & Patterson Pass Rd

BART to Livermore Extension Project
2040 BART AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	44	6	66	252	415	383	15	149	1	6	337	49
Future Volume (vph)	44	6	66	252	415	383	15	149	1	6	337	49
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.86		1.00	0.93		1.00	1.00		1.00	0.98	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1608		1770	1729		1770	1861		1770	1827	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	1608		1770	1729		1770	1861		1770	1827	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	48	7	72	274	451	416	16	162	1	7	366	53
RTOR Reduction (vph)	0	54	0	0	36	0	0	0	0	0	6	0
Lane Group Flow (vph)	48	25	0	274	831	0	16	163	0	7	413	0
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												
Actuated Green, G (s)	3.1	21.6		24.7	43.2		1.5	24.6		0.7	23.8	
Effective Green, g (s)	3.1	21.6		24.7	43.2		1.5	24.6		0.7	23.8	
Actuated g/C Ratio	0.04	0.25		0.28	0.49		0.02	0.28		0.01	0.27	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	62	396		499	852		30	522		14	496	
v/s Ratio Prot	0.03	0.02		c0.15	c0.48		c0.01	0.09		0.00	c0.23	
v/s Ratio Perm												
v/c Ratio	0.77	0.06		0.55	0.98		0.53	0.31		0.50	0.83	
Uniform Delay, d1	41.9	25.3		26.7	21.7		42.7	24.8		43.3	30.0	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	44.2	0.1		1.2	24.7		17.0	1.6		25.4	15.1	
Delay (s)	86.1	25.3		28.0	46.4		59.7	26.4		68.7	45.1	
Level of Service	F	C		C	D		E	C		E	D	
Approach Delay (s)		48.3			41.9			29.4			45.5	
Approach LOS		D			D			C			D	

Intersection Summary

HCM 2000 Control Delay	42.0	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.91		
Actuated Cycle Length (s)	87.6	Sum of lost time (s)	16.0
Intersection Capacity Utilization	72.6%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
1: Dougherty Rd & Amador Valley Rd



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	402	499	934	2270	1165	329
Future Volume (vph)	402	499	934	2270	1165	329
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00	0.97	0.91	0.91	
Frt	1.00	0.85	1.00	1.00	0.97	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1770	1583	3433	5085	4917	
Flt Permitted	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	1770	1583	3433	5085	4917	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	437	542	1015	2467	1266	358
RTOR Reduction (vph)	0	380	0	0	42	0
Lane Group Flow (vph)	437	162	1015	2467	1582	0
Turn Type	Perm	Perm	Prot	NA	NA	
Protected Phases			5	2	6	
Permitted Phases	4	4				
Actuated Green, G (s)	30.0	30.0	36.0	82.0	42.0	
Effective Green, g (s)	30.0	30.0	36.0	82.0	42.0	
Actuated g/C Ratio	0.25	0.25	0.30	0.68	0.35	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	442	395	1029	3474	1720	
v/s Ratio Prot			c0.30	0.49	c0.32	
v/s Ratio Perm	c0.25	0.10				
v/c Ratio	0.99	0.41	0.99	0.71	0.92	
Uniform Delay, d1	44.8	37.6	41.8	11.7	37.4	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	39.4	0.7	24.5	0.7	8.3	
Delay (s)	84.2	38.3	66.3	12.4	45.7	
Level of Service	F	D	E	B	D	
Approach Delay (s)	58.8			28.1	45.7	
Approach LOS	E			C	D	

Intersection Summary

HCM 2000 Control Delay	37.7	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.96		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	88.8%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
2: Hopyard Road/Dougherty Rd & Dublin Blvd

BART to Livermore Extension Project
2040 BART PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	106	1125	853	649	1134	1119	784	2081	292	736	1246	41
Future Volume (vph)	106	1125	853	649	1134	1119	784	2081	292	736	1246	41
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	6.0	5.0	5.0	5.5	5.0	5.0	5.5	5.0	5.0	5.5	
Lane Util. Factor	0.97	0.91	0.88	0.94	0.91	1.00	0.94	0.91	0.88	0.97	0.86	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	3433	5085	2787	4990	5085	1583	4990	5085	2787	3433	6377	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	3433	5085	2787	4990	5085	1583	4990	5085	2787	3433	6377	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	115	1223	927	705	1233	1216	852	2262	317	800	1354	45
RTOR Reduction (vph)	0	0	61	0	0	69	0	0	57	0	4	0
Lane Group Flow (vph)	115	1223	866	705	1233	1147	852	2262	260	800	1395	0
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	
Protected Phases	5	2	3	1	6	7	3	8	1	7	4	
Permitted Phases			2			6			8			
Actuated Green, G (s)	16.1	34.5	53.8	20.0	38.9	52.9	19.3	45.0	65.0	14.0	39.7	
Effective Green, g (s)	16.1	34.5	53.8	20.0	38.9	52.9	19.3	45.0	65.0	14.0	39.7	
Actuated g/C Ratio	0.12	0.26	0.40	0.15	0.29	0.39	0.14	0.33	0.48	0.10	0.29	
Clearance Time (s)	5.0	6.0	5.0	5.0	5.5	5.0	5.0	5.5	5.0	5.0	5.5	
Vehicle Extension (s)	2.0	4.5	2.0	2.0	4.5	2.0	2.0	4.5	2.0	2.0	4.5	
Lane Grp Cap (vph)	409	1299	1110	739	1465	620	713	1695	1341	356	1875	
v/s Ratio Prot	0.03	c0.24	0.11	0.14	0.24	c0.19	0.17	c0.44	0.03	c0.23	0.22	
v/s Ratio Perm			0.20			0.53			0.06			
v/c Ratio	0.28	0.94	0.78	0.95	0.84	1.85	1.19	1.33	0.19	2.25	0.74	
Uniform Delay, d1	54.2	49.3	35.4	57.0	45.2	41.0	57.9	45.0	20.0	60.5	43.1	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.1	13.6	3.3	22.2	4.9	388.9	101.1	154.7	0.0	570.2	1.9	
Delay (s)	54.3	62.9	38.8	79.2	50.1	430.0	159.0	199.7	20.0	630.7	44.9	
Level of Service	D	E	D	E	D	F	F	F	C	F	D	
Approach Delay (s)		52.6			203.1			173.0			258.0	
Approach LOS		D			F			F			F	

Intersection Summary

HCM 2000 Control Delay	173.8	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.59		
Actuated Cycle Length (s)	135.0	Sum of lost time (s)	21.5
Intersection Capacity Utilization	134.9%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
3: Dougherty Rd/Hopyard Road & I-580 WB Ramps

BART to Livermore Extension Project
2040 BART PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↔		↔		↑↑↑			↑↑↑	↔
Traffic Volume (vph)	0	0	0	324	0	658	0	2526	0	0	1655	0
Future Volume (vph)	0	0	0	324	0	658	0	2526	0	0	1655	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0		4.0		4.0			4.0	
Lane Util. Factor				0.97		0.88		0.91			0.86	
Frt				1.00		0.85		1.00			1.00	
Flt Protected				0.95		1.00		1.00			1.00	
Satd. Flow (prot)				3433		2787		5085			4806	
Flt Permitted				0.95		1.00		1.00			1.00	
Satd. Flow (perm)				3433		2787		5085			4806	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	352	0	715	0	2746	0	0	1799	0
RTOR Reduction (vph)	0	0	0	0	0	16	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	352	0	699	0	2746	0	0	1799	0
Turn Type				Prot		Prot		NA			NA	Perm
Protected Phases				4		4		2			6	
Permitted Phases												6
Actuated Green, G (s)				33.6		33.6		75.6			75.6	
Effective Green, g (s)				35.0		35.0		77.0			77.0	
Actuated g/C Ratio				0.29		0.29		0.64			0.64	
Clearance Time (s)				5.4		5.4		5.4			5.4	
Vehicle Extension (s)				3.0		3.0		3.0			3.0	
Lane Grp Cap (vph)				1001		812		3262			3083	
v/s Ratio Prot				0.10		c0.25		c0.54			0.37	
v/s Ratio Perm												
v/c Ratio				0.35		0.86		0.84			0.58	
Uniform Delay, d1				33.5		40.2		16.8			12.3	
Progression Factor				1.00		1.00		0.64			1.00	
Incremental Delay, d2				0.2		9.3		0.3			0.8	
Delay (s)				33.8		49.5		11.0			13.1	
Level of Service				C		D		B			B	
Approach Delay (s)		0.0			44.3			11.0			13.1	
Approach LOS		A			D			B			B	

Intersection Summary

HCM 2000 Control Delay	18.0	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.85		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	78.5%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 4: Hopyard Rd/Dougherty Rd & I-580 EB Ramps

BART to Livermore Extension Project
 2040 BART PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗		↖↗					↑↑↑	↖		↑↑↑	↖
Traffic Volume (vph)	1140	0	1064	0	0	0	0	2661	0	0	1310	0
Future Volume (vph)	1140	0	1064	0	0	0	0	2661	0	0	1310	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0					4.0			4.0	
Lane Util. Factor	0.97		0.88					0.91			0.86	
Frt	1.00		0.85					1.00			1.00	
Flt Protected	0.95		1.00					1.00			1.00	
Satd. Flow (prot)	3433		2787					5085			4806	
Flt Permitted	0.95		1.00					1.00			1.00	
Satd. Flow (perm)	3433		2787					5085			4806	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	1239	0	1157	0	0	0	0	2892	0	0	1424	0
RTOR Reduction (vph)	0	0	38	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	1239	0	1119	0	0	0	0	2892	0	0	1424	0
Turn Type	Prot		Prot					NA	Free		NA	Perm
Protected Phases	4		4					2			6	
Permitted Phases									Free			6
Actuated Green, G (s)	43.6		43.6					65.6			65.6	
Effective Green, g (s)	45.0		45.0					67.0			67.0	
Actuated g/C Ratio	0.38		0.38					0.56			0.56	
Clearance Time (s)	5.4		5.4					5.4			5.4	
Vehicle Extension (s)	3.0		3.0					3.0			3.0	
Lane Grp Cap (vph)	1287		1045					2839			2683	
v/s Ratio Prot	0.36		c0.40					c0.57			0.30	
v/s Ratio Perm												
v/c Ratio	0.96		1.07					1.02			0.53	
Uniform Delay, d1	36.7		37.5					26.5			16.6	
Progression Factor	1.00		1.00					0.67			1.12	
Incremental Delay, d2	16.9		48.8					20.6			0.6	
Delay (s)	53.5		86.3					38.4			19.2	
Level of Service	D		F					D			B	
Approach Delay (s)		69.4			0.0			38.4			19.2	
Approach LOS		E			A			D			B	

Intersection Summary			
HCM 2000 Control Delay	45.4	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	1.04		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	90.6%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
5: Hopyard Rd & Owens Rd



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	374	295	245	581	309	395	236	982	335	543	1620	259
Future Volume (vph)	374	295	245	581	309	395	236	982	335	543	1620	259
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	2.7	2.7		2.7	2.7	2.7	4.0	2.3	2.3	4.0	2.3	
Lane Util. Factor	0.91	0.91		1.00	0.95	0.95	1.00	0.91	1.00	0.97	0.91	
Frt	1.00	0.95		1.00	0.96	0.85	1.00	1.00	0.85	1.00	0.98	
Flt Protected	0.95	0.99		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1610	3177		1770	1694	1504	1770	5085	1583	3433	4980	
Flt Permitted	0.95	0.99		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1610	3177		1770	1694	1504	1770	5085	1583	3433	4980	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	407	321	266	632	336	429	257	1067	364	590	1761	282
RTOR Reduction (vph)	0	51	0	0	12	24	0	0	263	0	18	0
Lane Group Flow (vph)	224	719	0	632	457	272	257	1067	101	590	2025	0
Turn Type	Split	NA		Split	NA	pm+ov	Prot	NA	Perm	Prot	NA	
Protected Phases	8	8		4	4	1	5	2		1	6	
Permitted Phases						4			2			
Actuated Green, G (s)	18.0	18.0		31.0	31.0	54.3	13.0	31.7	31.7	23.3	42.0	
Effective Green, g (s)	19.3	19.3		32.3	32.3	56.9	13.0	33.4	33.4	23.3	43.7	
Actuated g/C Ratio	0.16	0.16		0.27	0.27	0.47	0.11	0.28	0.28	0.19	0.36	
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	258	510		476	455	713	191	1415	440	666	1813	
v/s Ratio Prot	0.14	c0.23		c0.36	0.27	0.08	c0.15	0.21		0.17	c0.41	
v/s Ratio Perm						0.10			0.06			
v/c Ratio	0.87	1.41		1.33	1.01	0.38	1.35	0.75	0.23	0.89	1.12	
Uniform Delay, d1	49.1	50.4		43.9	43.9	20.3	53.5	39.5	33.4	47.1	38.1	
Progression Factor	1.00	1.00		0.85	0.82	1.11	1.00	1.00	1.00	1.06	0.95	
Incremental Delay, d2	25.1	195.7		161.2	43.0	0.3	186.2	3.8	1.2	9.1	58.0	
Delay (s)	74.2	246.0		198.3	78.9	22.7	239.7	43.3	34.6	58.9	94.0	
Level of Service	E	F		F	E	C	F	D	C	E	F	
Approach Delay (s)		207.3			121.0			71.3			86.1	
Approach LOS		F			F			E			F	

Intersection Summary

HCM 2000 Control Delay	107.6	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.26		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	11.7
Intersection Capacity Utilization	113.6%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
6: Hopyard Rd & Stoneridge Dr

BART to Livermore Extension Project
2040 BART PM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	284	1119	685	116	1368	201	620	882	83	273	968	226
Future Volume (vph)	284	1119	685	116	1368	201	620	882	83	273	968	226
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.91	1.00	0.97	0.91	1.00	0.94	0.95	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5085	1583	3433	5085	1583	4990	3539	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5085	1583	3433	5085	1583	4990	3539	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	309	1216	745	126	1487	218	674	959	90	297	1052	246
RTOR Reduction (vph)	0	0	173	0	0	148	0	0	62	0	0	154
Lane Group Flow (vph)	309	1216	572	126	1487	70	674	959	28	297	1052	92
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8			2			6
Actuated Green, G (s)	9.0	34.0	34.0	4.0	29.0	29.0	13.0	27.9	27.9	8.0	22.9	22.9
Effective Green, g (s)	9.0	34.0	34.0	4.0	29.0	29.0	13.0	27.9	27.9	8.0	22.9	22.9
Actuated g/C Ratio	0.10	0.38	0.38	0.04	0.32	0.32	0.14	0.31	0.31	0.09	0.25	0.25
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	343	1923	598	152	1640	510	721	1098	491	305	1295	403
v/s Ratio Prot	c0.09	0.24		0.04	0.29		c0.14	c0.27		0.09	0.21	
v/s Ratio Perm			c0.36			0.04			0.02			0.06
v/c Ratio	0.90	0.63	0.96	0.83	0.91	0.14	0.93	0.87	0.06	0.97	0.81	0.23
Uniform Delay, d1	40.0	22.8	27.2	42.6	29.2	21.6	38.0	29.3	21.8	40.8	31.5	26.5
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	25.5	0.7	26.1	29.5	7.6	0.1	19.2	7.9	0.0	44.1	4.0	0.3
Delay (s)	65.5	23.5	53.4	72.1	36.7	21.7	57.2	37.2	21.8	84.9	35.5	26.8
Level of Service	E	C	D	E	D	C	E	D	C	F	D	C
Approach Delay (s)		39.0			37.4			44.2			43.3	
Approach LOS		D			D			D			D	

Intersection Summary		
HCM 2000 Control Delay	40.8	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.98	D
Actuated Cycle Length (s)	89.9	Sum of lost time (s)
Intersection Capacity Utilization	80.0%	16.0
Analysis Period (min)	15	ICU Level of Service
		D

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 7: Hopyard Rd & Las Positas Blvd

BART to Livermore Extension Project
 2040 BART PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↕	↖	↖↗	↕	↖	↖↗	↕↖↗	↖	↖↗	↕↖↗	↖
Traffic Volume (vph)	104	255	477	607	427	53	373	1015	259	74	1556	76
Future Volume (vph)	104	255	477	607	427	53	373	1015	259	74	1556	76
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.95	1.00	0.97	0.95	1.00	0.97	0.91	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	3433	3539	1583	3433	5085	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	3433	3539	1583	3433	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	113	277	518	660	464	58	405	1103	282	80	1691	83
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	54
Lane Group Flow (vph)	113	277	518	660	464	58	405	1103	282	80	1691	29
Turn Type	Prot	NA	Free	Prot	NA	Free	Prot	NA	Free	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1		6
Permitted Phases			Free			Free			Free			6
Actuated Green, G (s)	4.8	12.8	87.7	17.0	25.0	87.7	11.0	37.9	87.7	4.0	30.9	30.9
Effective Green, g (s)	4.8	12.8	87.7	17.0	25.0	87.7	11.0	37.9	87.7	4.0	30.9	30.9
Actuated g/C Ratio	0.05	0.15	1.00	0.19	0.29	1.00	0.13	0.43	1.00	0.05	0.35	0.35
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	187	516	1583	665	1008	1583	430	2197	1583	156	1791	557
v/s Ratio Prot	0.03	0.08		c0.19	c0.13		c0.12	0.22		0.02	c0.33	
v/s Ratio Perm			0.33			0.04			0.18			0.02
v/c Ratio	0.60	0.54	0.33	0.99	0.46	0.04	0.94	0.50	0.18	0.51	0.94	0.05
Uniform Delay, d1	40.5	34.7	0.0	35.3	25.8	0.0	38.0	18.1	0.0	40.9	27.6	18.7
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	5.4	1.1	0.6	32.8	0.3	0.0	29.0	0.2	0.2	2.8	10.8	0.0
Delay (s)	45.9	35.8	0.6	68.1	26.1	0.0	67.1	18.2	0.2	43.7	38.3	18.8
Level of Service	D	D	A	E	C	A	E	B	A	D	D	B
Approach Delay (s)		16.9			48.3			26.5			37.7	
Approach LOS		B			D			C			D	

Intersection Summary		
HCM 2000 Control Delay	33.1	HCM 2000 Level of Service C
HCM 2000 Volume to Capacity ratio	0.88	
Actuated Cycle Length (s)	87.7	Sum of lost time (s) 16.0
Intersection Capacity Utilization	78.4%	ICU Level of Service D
Analysis Period (min)	15	

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
8: Willow Rd & Owens Rd

BART to Livermore Extension Project
2040 BART PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↕↗		↖↗	↕↕↗	↖	↖	↕↕	↖	↖	↕	↖
Traffic Volume (vph)	118	886	209	104	714	83	189	80	0	224	80	178
Future Volume (vph)	118	886	209	104	714	83	189	80	0	224	80	178
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	5.3	4.0		5.3	4.0	4.0
Lane Util. Factor	0.97	0.91		0.97	0.91	1.00	1.00	0.95		1.00	1.00	1.00
Frt	1.00	0.97		1.00	1.00	0.85	1.00	1.00		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	4940		3433	5085	1583	1770	3539		1770	1863	1583
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.69	1.00		0.70	1.00	1.00
Satd. Flow (perm)	3433	4940		3433	5085	1583	1280	3539		1300	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	128	963	227	113	776	90	205	87	0	243	87	193
RTOR Reduction (vph)	0	24	0	0	0	45	0	0	0	0	0	144
Lane Group Flow (vph)	128	1166	0	113	776	45	205	87	0	243	87	49
Turn Type	Prot	NA		Prot	NA	Perm	Perm	NA	Perm	Perm	NA	Perm
Protected Phases	1	6		5	2			4				8
Permitted Phases						2	4		4	8		8
Actuated Green, G (s)	18.0	66.6		9.3	57.9	57.9	29.1	29.1		29.1	29.1	29.1
Effective Green, g (s)	18.0	68.3		9.3	59.6	59.6	29.1	30.4		29.1	30.4	30.4
Actuated g/C Ratio	0.15	0.57		0.08	0.50	0.50	0.24	0.25		0.24	0.25	0.25
Clearance Time (s)	4.0	5.7		4.0	5.7	5.7	5.3	5.3		5.3	5.3	5.3
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	514	2811		266	2525	786	310	896		315	471	401
v/s Ratio Prot	0.04	c0.24		c0.03	0.15			0.02			0.05	
v/s Ratio Perm						0.03	0.16			c0.19		0.03
v/c Ratio	0.25	0.41		0.42	0.31	0.06	0.66	0.10		0.77	0.18	0.12
Uniform Delay, d1	45.0	14.6		52.8	17.9	15.6	41.0	34.3		42.4	35.1	34.5
Progression Factor	0.56	0.28		1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	0.1	0.2		1.1	0.3	0.1	5.2	0.0		11.1	0.2	0.1
Delay (s)	25.2	4.3		53.9	18.3	15.8	46.2	34.3		53.5	35.3	34.7
Level of Service	C	A		D	B	B	D	C		D	D	C
Approach Delay (s)		6.4			22.1			42.7			43.5	
Approach LOS		A			C			D			D	

Intersection Summary

HCM 2000 Control Delay	21.0	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.51		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	54.2%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 9: Hacienda Dr & Dublin Blvd

BART to Livermore Extension Project
 2040 BART PM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	53	1021	206	250	597	25	419	649	488	30	714	210
Future Volume (vph)	53	1021	206	250	597	25	419	649	488	30	714	210
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	6.0	5.0	4.5	6.0		5.0	6.0	6.0	4.5	5.5	5.5
Lane Util. Factor	0.97	0.91	0.88	0.97	0.91		0.94	0.95	0.88	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5085	2787	3433	5055		4990	3539	2787	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5085	2787	3433	5055		4990	3539	2787	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	58	1110	224	272	649	27	455	705	530	33	776	228
RTOR Reduction (vph)	0	0	64	0	4	0	0	0	206	0	0	162
Lane Group Flow (vph)	58	1110	160	272	672	0	455	705	324	33	776	66
Turn Type	Prot	NA	pm+ov	Prot	NA		Prot	NA	Perm	Prot	NA	Perm
Protected Phases	5	2	3	1	6		3	8		7	4	
Permitted Phases			2						8			4
Actuated Green, G (s)	4.2	30.7	42.1	9.9	36.4		11.4	33.3	33.3	2.1	24.0	24.0
Effective Green, g (s)	4.2	30.7	42.1	9.9	36.4		11.4	33.3	33.3	2.1	24.0	24.0
Actuated g/C Ratio	0.04	0.32	0.43	0.10	0.38		0.12	0.34	0.34	0.02	0.25	0.25
Clearance Time (s)	4.5	6.0	5.0	4.5	6.0		5.0	6.0	6.0	4.5	5.5	5.5
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	148	1609	1353	350	1896		586	1214	956	74	1258	391
v/s Ratio Prot	0.02	c0.22	0.01	c0.08	0.13		c0.09	0.20		0.01	c0.15	
v/s Ratio Perm			0.04						0.12			0.04
v/c Ratio	0.39	0.69	0.12	0.78	0.35		0.78	0.58	0.34	0.45	0.62	0.17
Uniform Delay, d1	45.2	29.0	16.4	42.5	21.8		41.6	26.1	23.7	46.9	32.4	28.7
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.7	1.3	0.0	10.4	0.1		6.4	0.7	0.2	4.2	0.9	0.2
Delay (s)	46.9	30.2	16.4	52.8	21.9		48.0	26.8	23.9	51.1	33.3	28.9
Level of Service	D	C	B	D	C		D	C	C	D	C	C
Approach Delay (s)		28.7			30.8			31.6			32.9	
Approach LOS		C			C			C			C	
Intersection Summary												
HCM 2000 Control Delay			30.9			HCM 2000 Level of Service				C		
HCM 2000 Volume to Capacity ratio			0.69									
Actuated Cycle Length (s)			97.0			Sum of lost time (s)			21.0			
Intersection Capacity Utilization			66.1%			ICU Level of Service				C		
Analysis Period (min)			15									

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
10: Hacienda Dr & Martinelli Blvd/Hacienda Crossings



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗	↖↗	↖↗	↗		↖↗↘	↖↗↘	↗	↖↗	↖↗↘	
Traffic Volume (vph)	25	43	353	289	34	25	403	1537	466	67	1077	78
Future Volume (vph)	25	43	353	289	34	25	403	1537	466	67	1077	78
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	2.0	2.0	4.5	2.0		3.0	2.0	2.0	4.5	2.5	
Lane Util. Factor	1.00	0.91	0.91	0.97	1.00		0.94	0.91	1.00	0.97	0.86	
Frt	1.00	0.93	0.85	1.00	0.94		1.00	1.00	0.85	1.00	0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1770	1581	2882	3433	1745		4990	5085	1583	3433	6343	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1770	1581	2882	3433	1745		4990	5085	1583	3433	6343	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	27	47	384	314	37	27	438	1671	507	73	1171	85
RTOR Reduction (vph)	0	30	299	0	21	0	0	0	133	0	7	0
Lane Group Flow (vph)	27	55	47	314	43	0	438	1671	374	73	1249	0
Turn Type	Prot	NA	Perm	Prot	NA		Prot	NA	pm+ov	Prot	NA	
Protected Phases	5	2		1	6		3	8	1	7	4	
Permitted Phases			2						8			
Actuated Green, G (s)	3.6	14.4	14.4	15.0	25.8		18.8	69.6	84.6	5.0	55.8	
Effective Green, g (s)	3.1	16.4	16.4	14.5	27.8		19.8	71.6	88.6	4.5	57.3	
Actuated g/C Ratio	0.03	0.14	0.14	0.12	0.23		0.17	0.60	0.74	0.04	0.48	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	4.0	4.0	2.0	4.0		3.0	4.0	2.0	3.0	4.0	
Lane Grp Cap (vph)	45	216	393	414	404		823	3034	1168	128	3028	
v/s Ratio Prot	0.02	c0.03		c0.09	0.02		c0.09	c0.33	0.05	0.02	0.20	
v/s Ratio Perm			0.02						0.19			
v/c Ratio	0.60	0.25	0.12	0.76	0.11		0.53	0.55	0.32	0.57	0.41	
Uniform Delay, d1	57.8	46.3	45.5	51.1	36.3		45.9	14.5	5.4	56.8	20.4	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.08	1.05	2.56	1.00	1.00	
Incremental Delay, d2	19.7	0.8	0.2	6.9	0.2		0.5	0.5	0.0	6.0	0.4	
Delay (s)	77.5	47.2	45.7	58.0	36.5		50.2	15.8	13.8	62.8	20.8	
Level of Service	E	D	D	E	D		D	B	B	E	C	
Approach Delay (s)		47.8			54.3			21.2			23.1	
Approach LOS		D			D			C			C	

Intersection Summary

HCM 2000 Control Delay	26.9	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.55		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	13.0
Intersection Capacity Utilization	60.0%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 11: Hacienda Dr & I-580 WB Ramps

BART to Livermore Extension Project
 2040 BART PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↔		↔		↑↑↑			↑↑↑	↔
Traffic Volume (vph)	0	0	0	407	0	427	0	1719	811	0	887	800
Future Volume (vph)	0	0	0	407	0	427	0	1719	811	0	887	800
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				2.6		2.6		2.1			2.1	2.1
Lane Util. Factor				0.97		0.88		0.91			0.86	0.86
Frt				1.00		0.85		0.95			0.95	0.85
Flt Protected				0.95		1.00		1.00			1.00	1.00
Satd. Flow (prot)				3433		2787		4841			4582	1362
Flt Permitted				0.95		1.00		1.00			1.00	1.00
Satd. Flow (perm)				3433		2787		4841			4582	1362
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	442	0	464	0	1868	882	0	964	870
RTOR Reduction (vph)	0	0	0	0	0	32	0	135	0	0	129	138
Lane Group Flow (vph)	0	0	0	442	0	432	0	2615	0	0	1270	297
Turn Type				Prot		Prot		NA			NA	Perm
Protected Phases				4		4		2			6	
Permitted Phases												6
Actuated Green, G (s)				13.0		13.0		39.0			39.0	39.0
Effective Green, g (s)				14.4		14.4		40.9			40.9	40.9
Actuated g/C Ratio				0.24		0.24		0.68			0.68	0.68
Clearance Time (s)				4.0		4.0		4.0			4.0	4.0
Vehicle Extension (s)				3.0		3.0		3.0			3.0	3.0
Lane Grp Cap (vph)				823		668		3299			3123	928
v/s Ratio Prot				0.13		c0.16		c0.54			0.28	
v/s Ratio Perm												0.22
v/c Ratio				0.54		0.65		0.79			0.41	0.32
Uniform Delay, d1				19.9		20.5		6.6			4.2	3.9
Progression Factor				1.00		1.00		0.89			0.69	2.03
Incremental Delay, d2				0.7		2.2		1.3			0.4	0.8
Delay (s)				20.6		22.7		7.2			3.3	8.7
Level of Service				C		C		A			A	A
Approach Delay (s)		0.0			21.6			7.2			4.6	
Approach LOS		A			C			A			A	

Intersection Summary		
HCM 2000 Control Delay	8.7	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.75	A
Actuated Cycle Length (s)	60.0	Sum of lost time (s)
Intersection Capacity Utilization	73.0%	4.7
Analysis Period (min)	15	ICU Level of Service
		C

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 12: Hacienda Dr & I-580 EB Ramps

BART to Livermore Extension Project
 2040 BART PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗		↖↗					↑↑↑	↖		↑↑↑	
Traffic Volume (vph)	899	0	466	0	0	0	0	1800	582	0	950	313
Future Volume (vph)	899	0	466	0	0	0	0	1800	582	0	950	313
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0					4.0	4.0		4.0	
Lane Util. Factor	0.97		0.88					0.86	0.86		0.91	
Frt	1.00		0.85					0.99	0.85		0.96	
Flt Protected	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (prot)	3433		2787					4740	1362		4896	
Flt Permitted	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (perm)	3433		2787					4740	1362		4896	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	977	0	507	0	0	0	0	1957	633	0	1033	340
RTOR Reduction (vph)	0	0	105	0	0	0	0	8	178	0	45	0
Lane Group Flow (vph)	977	0	402	0	0	0	0	2145	259	0	1328	0
Turn Type	Prot		Prot					NA	Perm		NA	
Protected Phases	4		4					2			6	
Permitted Phases									2			
Actuated Green, G (s)	39.4		39.4					69.3	69.3		69.3	
Effective Green, g (s)	40.8		40.8					71.2	71.2		71.2	
Actuated g/C Ratio	0.34		0.34					0.59	0.59		0.59	
Clearance Time (s)	5.4		5.4					5.9	5.9		5.9	
Vehicle Extension (s)	2.0		2.0					2.0	2.0		2.0	
Lane Grp Cap (vph)	1167		947					2812	808		2904	
v/s Ratio Prot	c0.28		0.14					c0.45			0.27	
v/s Ratio Perm									0.19			
v/c Ratio	0.84		0.42					0.76	0.32		0.46	
Uniform Delay, d1	36.5		30.5					18.1	12.3		13.6	
Progression Factor	1.00		1.00					1.00	1.00		0.71	
Incremental Delay, d2	5.1		0.1					2.0	1.0		0.5	
Delay (s)	41.7		30.7					20.1	13.3		10.1	
Level of Service	D		C					C	B		B	
Approach Delay (s)		37.9			0.0			19.0			10.1	
Approach LOS		D			A			B			B	

Intersection Summary		
HCM 2000 Control Delay	21.9	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.79	C
Actuated Cycle Length (s)	120.0	Sum of lost time (s)
Intersection Capacity Utilization	71.4%	8.0
Analysis Period (min)	15	ICU Level of Service
		C

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
13: Hacienda Dr & Owens Rd

BART to Livermore Extension Project
2040 BART PM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	695	1039	58	153	381	887	29	749	290	618	507	276
Future Volume (vph)	695	1039	58	153	381	887	29	749	290	618	507	276
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	2.3	4.0	4.0	2.3	4.0	4.0	2.7	4.0	4.0	2.7
Lane Util. Factor	0.97	0.91	1.00	0.97	0.91	1.00	0.97	0.91	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5085	1583	3433	5085	1583	3433	5085	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5085	1583	3433	5085	1583	3433	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	755	1129	63	166	414	964	32	814	315	672	551	300
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	755	1129	63	166	414	964	32	814	315	672	551	300
Turn Type	Prot	NA	Free	Prot	NA	Free	Prot	NA	Free	Prot	NA	Free
Protected Phases	1	6		5	2		7	4		3	8	
Permitted Phases			Free			Free			Free			Free
Actuated Green, G (s)	32.9	34.3	115.0	13.7	15.1	115.0	2.4	24.5	115.0	23.5	45.6	115.0
Effective Green, g (s)	32.9	36.0	115.0	13.7	16.8	115.0	2.4	25.8	115.0	23.5	46.9	115.0
Actuated g/C Ratio	0.29	0.31	1.00	0.12	0.15	1.00	0.02	0.22	1.00	0.20	0.41	1.00
Clearance Time (s)	4.0	5.7		4.0	5.7		4.0	5.3		4.0	5.3	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	982	1591	1583	408	742	1583	71	1140	1583	701	2073	1583
v/s Ratio Prot	c0.22	c0.22		0.05	0.08		0.01	c0.16		c0.20	0.11	
v/s Ratio Perm			0.04			c0.61			0.20			0.19
v/c Ratio	0.77	0.71	0.04	0.41	0.56	0.61	0.45	0.71	0.20	0.96	0.27	0.19
Uniform Delay, d1	37.6	34.9	0.0	46.9	45.6	0.0	55.6	41.2	0.0	45.3	22.6	0.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	3.7	1.5	0.0	0.7	0.9	1.8	4.5	3.8	0.3	23.9	0.3	0.3
Delay (s)	41.2	36.4	0.0	47.6	46.6	1.8	60.1	45.0	0.3	69.2	22.9	0.3
Level of Service	D	D	A	D	D	A	E	D	A	E	C	A
Approach Delay (s)		37.1			18.7			33.3			38.9	
Approach LOS		D			B			C			D	

Intersection Summary		
HCM 2000 Control Delay	32.2	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.81	C
Actuated Cycle Length (s)	115.0	Sum of lost time (s)
Intersection Capacity Utilization	72.6%	16.0
Analysis Period (min)	15	ICU Level of Service
		C

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 14: Tassajara Rd & Dublin Blvd

BART to Livermore Extension Project
 2040 BART PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	249	779	437	301	352	24	420	1010	559	31	814	140
Future Volume (vph)	249	779	437	301	352	24	420	1010	559	31	814	140
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	6.0	6.0	5.0	6.0		5.0	6.0	6.0	5.0	5.7	5.7
Lane Util. Factor	0.97	0.86	0.88	0.94	0.91		0.94	0.86	1.00	0.97	0.86	0.88
Frt	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	6408	2787	4990	5037		4990	6408	1583	3433	6408	2787
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	6408	2787	4990	5037		4990	6408	1583	3433	6408	2787
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	271	847	475	327	383	26	457	1098	608	34	885	152
RTOR Reduction (vph)	0	0	304	0	5	0	0	0	235	0	0	119
Lane Group Flow (vph)	271	847	171	327	404	0	457	1098	373	34	885	33
Turn Type	Prot	NA	Perm	Prot	NA		Prot	NA	Perm	Prot	NA	Perm
Protected Phases	5	2		1	6		3	8		7		4
Permitted Phases			2						8			4
Actuated Green, G (s)	16.5	29.5	29.5	16.5	29.5		27.0	45.2	45.2	8.0	26.5	26.5
Effective Green, g (s)	16.5	29.5	29.5	16.5	29.5		27.0	45.2	45.2	8.0	26.5	26.5
Actuated g/C Ratio	0.14	0.24	0.24	0.14	0.24		0.22	0.37	0.37	0.07	0.22	0.22
Clearance Time (s)	5.0	6.0	6.0	5.0	6.0		5.0	6.0	6.0	5.0	5.7	5.7
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	467	1559	678	679	1226		1111	2389	590	226	1401	609
v/s Ratio Prot	c0.08	c0.13		0.07	0.08		c0.09	0.17		0.01	0.14	
v/s Ratio Perm			0.06						c0.24			0.01
v/c Ratio	0.58	0.54	0.25	0.48	0.33		0.41	0.46	0.63	0.15	0.63	0.05
Uniform Delay, d1	49.1	40.0	37.0	48.4	37.7		40.3	28.8	31.2	53.4	42.9	37.4
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.8	0.4	0.2	0.5	0.2		0.2	0.1	2.2	0.3	0.9	0.0
Delay (s)	50.9	40.4	37.2	48.9	37.9		40.5	28.9	33.4	53.7	43.9	37.5
Level of Service	D	D	D	D	D		D	C	C	D	D	D
Approach Delay (s)		41.2			42.8			32.6			43.3	
Approach LOS		D			D			C			D	

Intersection Summary		
HCM 2000 Control Delay	38.5	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.59	D
Actuated Cycle Length (s)	121.2	Sum of lost time (s)
Intersection Capacity Utilization	74.6%	22.0
Analysis Period (min)	15	ICU Level of Service
		D

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
15: Tassajara Rd & I-580 WB Ramps

BART to Livermore Extension Project
2040 BART PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↔↔		↔↔		↑↑	↔		↑↑↔	↔
Traffic Volume (vph)	0	0	0	574	0	239	0	1633	726	0	1228	641
Future Volume (vph)	0	0	0	574	0	239	0	1633	726	0	1228	641
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0		4.0		4.0	4.0		4.0	4.0
Lane Util. Factor				0.97		0.88		0.95	1.00		0.86	0.86
Frt				1.00		0.85		1.00	0.85		0.98	0.85
Flt Protected				0.95		1.00		1.00	1.00		1.00	1.00
Satd. Flow (prot)				3433		2787		3539	1583		4697	1362
Flt Permitted				0.95		1.00		1.00	1.00		1.00	1.00
Satd. Flow (perm)				3433		2787		3539	1583		4697	1362
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	624	0	260	0	1775	789	0	1335	697
RTOR Reduction (vph)	0	0	0	0	0	26	0	0	302	0	37	176
Lane Group Flow (vph)	0	0	0	624	0	235	0	1775	487	0	1535	284
Turn Type				Perm		Perm		NA	Perm		NA	Perm
Protected Phases								2			6	
Permitted Phases				8		8			2			6
Actuated Green, G (s)				15.0		15.0		37.0	37.0		37.0	37.0
Effective Green, g (s)				15.0		15.0		37.0	37.0		37.0	37.0
Actuated g/C Ratio				0.25		0.25		0.62	0.62		0.62	0.62
Clearance Time (s)				4.0		4.0		4.0	4.0		4.0	4.0
Vehicle Extension (s)				3.0		3.0		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)				858		696		2182	976		2896	839
v/s Ratio Prot								c0.50			0.33	
v/s Ratio Perm				c0.18		0.08			0.31			0.21
v/c Ratio				0.73		0.34		0.81	0.50		0.53	0.34
Uniform Delay, d1				20.6		18.4		8.8	6.4		6.5	5.6
Progression Factor				1.00		1.00		1.00	1.00		1.00	1.00
Incremental Delay, d2				3.1		0.3		3.5	1.8		0.7	1.1
Delay (s)				23.7		18.7		12.3	8.2		7.2	6.7
Level of Service				C		B		B	A		A	A
Approach Delay (s)		0.0			22.3			11.0			7.1	
Approach LOS		A			C			B			A	

Intersection Summary			
HCM 2000 Control Delay	11.4	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.79		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	68.2%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 16: Santa Rita Rd & I-580 EB Ramps/Pimilco Dr

BART to Livermore Extension Project
 2040 BART PM

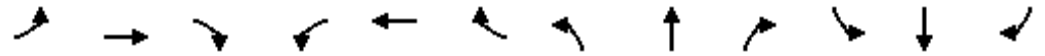


Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	432	82	256	142	0	316	0	1553	193	315	1129	0
Future Volume (vph)	432	82	256	142	0	316	0	1553	193	315	1129	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0		4.0		4.0		4.0	4.0	
Lane Util. Factor	0.97	1.00	1.00	0.97		0.88		0.86		1.00	0.95	
Frt	1.00	1.00	0.85	1.00		0.85		0.98		1.00	1.00	
Flt Protected	0.95	1.00	1.00	0.95		1.00		1.00		0.95	1.00	
Satd. Flow (prot)	3433	1863	1583	3433		2787		6301		1770	3539	
Flt Permitted	0.95	1.00	1.00	0.95		1.00		1.00		0.95	1.00	
Satd. Flow (perm)	3433	1863	1583	3433		2787		6301		1770	3539	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	470	89	278	154	0	343	0	1688	210	342	1227	0
RTOR Reduction (vph)	0	0	67	0	0	32	0	17	0	0	0	0
Lane Group Flow (vph)	470	89	211	154	0	311	0	1881	0	342	1227	0
Turn Type	Perm	NA	Perm	Prot		pm+ov		NA		Prot	NA	Perm
Protected Phases		4		3		1		2		1	6	
Permitted Phases	4		4			3						6
Actuated Green, G (s)	22.1	22.1	22.1	7.2		34.0		47.9		26.8	78.7	
Effective Green, g (s)	22.1	22.1	22.1	7.2		34.0		47.9		26.8	78.7	
Actuated g/C Ratio	0.18	0.18	0.18	0.06		0.28		0.40		0.22	0.66	
Clearance Time (s)	4.0	4.0	4.0	4.0		4.0		4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0		3.0		3.0		3.0	3.0	
Lane Grp Cap (vph)	632	343	291	205		789		2515		395	2320	
v/s Ratio Prot		0.05		c0.04		0.09		c0.30		c0.19	0.35	
v/s Ratio Perm	c0.14		0.13			0.02						
v/c Ratio	0.74	0.26	0.73	0.75		0.39		0.75		0.87	0.53	
Uniform Delay, d1	46.3	41.9	46.1	55.5		34.7		30.9		44.9	10.9	
Progression Factor	1.00	1.00	1.00	1.00		1.00		1.00		1.00	1.00	
Incremental Delay, d2	4.7	0.4	8.7	14.3		0.3		2.1		17.7	0.9	
Delay (s)	51.0	42.3	54.8	69.9		35.0		33.0		62.5	11.7	
Level of Service	D	D	D	E		D		C		E	B	
Approach Delay (s)		51.3			45.8			33.0			22.8	
Approach LOS		D			D			C			C	

Intersection Summary			
HCM 2000 Control Delay	34.2	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.78		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	65.5%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 17: Santa Rita Rd & Valley Ave


































Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↕	↖	↖	↕	↖	↖↗	↕		↖↗	↕	↖
Traffic Volume (vph)	354	687	121	139	366	794	142	631	156	1390	1113	268
Future Volume (vph)	354	687	121	139	366	794	142	631	156	1390	1113	268
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.97	0.95		0.97	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.97		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	3433	3434		3433	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	3433	3434		3433	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	385	747	132	151	398	863	154	686	170	1511	1210	291
RTOR Reduction (vph)	0	0	97	0	0	0	0	18	0	0	0	122
Lane Group Flow (vph)	385	747	35	151	398	863	154	838	0	1511	1210	169
Turn Type	Prot	NA	Perm	Prot	NA	Free	Prot	NA		Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1		6
Permitted Phases			4			Free						6
Actuated Green, G (s)	13.0	21.0	21.0	8.0	16.0	120.0	9.4	30.0		45.0	65.6	65.6
Effective Green, g (s)	13.0	21.0	21.0	8.0	16.0	120.0	9.4	30.0		45.0	65.6	65.6
Actuated g/C Ratio	0.11	0.18	0.18	0.07	0.13	1.00	0.08	0.25		0.38	0.55	0.55
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	371	619	277	118	471	1583	268	858		1287	1934	865
v/s Ratio Prot	c0.11	c0.21		c0.09	0.11		0.04	c0.24		c0.44	0.34	
v/s Ratio Perm			0.02			0.55						0.11
v/c Ratio	1.04	1.21	0.13	1.28	0.85	0.55	0.57	0.98		1.17	0.63	0.20
Uniform Delay, d1	53.5	49.5	41.8	56.0	50.8	0.0	53.4	44.7		37.5	18.7	13.8
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	56.8	107.7	0.2	175.8	13.1	1.4	3.0	24.8		86.8	0.6	0.1
Delay (s)	110.3	157.2	42.0	231.8	63.8	1.4	56.3	69.5		124.3	19.4	13.9
Level of Service	F	F	D	F	E	A	E	E		F	B	B
Approach Delay (s)		130.9			43.6			67.5			71.5	
Approach LOS		F			D			E			E	

Intersection Summary		
HCM 2000 Control Delay	76.2	HCM 2000 Level of Service E
HCM 2000 Volume to Capacity ratio	1.14	
Actuated Cycle Length (s)	120.0	Sum of lost time (s) 16.0
Intersection Capacity Utilization	102.1%	ICU Level of Service G
Analysis Period (min)	15	

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
18: Bernal Ave/Valley Ave & Stanley Blvd

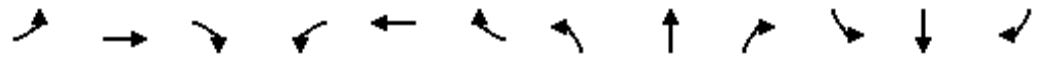
BART to Livermore Extension Project
2040 BART PM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 	 		 	 			 		 	 	
Traffic Volume (vph)	222	830	58	94	236	348	95	363	307	825	550	131
Future Volume (vph)	222	830	58	94	236	348	95	363	307	825	550	131
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.95	1.00	0.97	0.91	0.91	1.00	0.95	1.00	0.97	0.95	
Frt	1.00	1.00	0.85	1.00	0.94	0.85	1.00	1.00	0.85	1.00	0.97	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	3433	3539	1583	3433	3182	1441	1770	3539	1583	3433	3437	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	3433	3539	1583	3433	3182	1441	1770	3539	1583	3433	3437	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	241	902	63	102	257	378	103	395	334	897	598	142
RTOR Reduction (vph)	0	0	39	0	117	54	0	0	167	0	22	0
Lane Group Flow (vph)	241	902	24	102	318	146	103	395	167	897	718	0
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	
Protected Phases	7	4	5	3	8	1	5	2		1	6	
Permitted Phases			4			8			2			
Actuated Green, G (s)	10.2	24.9	32.6	3.0	17.7	43.0	7.7	16.0	16.0	25.3	33.6	
Effective Green, g (s)	10.2	24.9	32.6	3.0	17.7	43.0	7.7	16.0	16.0	25.3	33.6	
Actuated g/C Ratio	0.12	0.29	0.38	0.04	0.21	0.50	0.09	0.19	0.19	0.30	0.39	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	410	1034	680	120	661	794	159	664	297	1019	1355	
v/s Ratio Prot	c0.07	c0.25	0.00	0.03	0.10	0.05	0.06	0.11		c0.26	c0.21	
v/s Ratio Perm			0.01			0.05			0.11			
v/c Ratio	0.59	0.87	0.04	0.85	0.48	0.18	0.65	0.59	0.56	0.88	0.53	
Uniform Delay, d1	35.5	28.6	16.5	40.9	29.7	11.5	37.4	31.6	31.4	28.5	19.8	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	2.2	8.2	0.0	39.8	0.6	0.1	8.8	1.4	2.4	9.0	0.4	
Delay (s)	37.7	36.9	16.5	80.7	30.3	11.6	46.2	33.1	33.8	37.5	20.2	
Level of Service	D	D	B	F	C	B	D	C	C	D	C	
Approach Delay (s)		36.0			32.2			35.0			29.7	
Approach LOS		D			C			D			C	
Intersection Summary												
HCM 2000 Control Delay			32.8			HCM 2000 Level of Service				C		
HCM 2000 Volume to Capacity ratio			0.82									
Actuated Cycle Length (s)			85.2			Sum of lost time (s)				16.0		
Intersection Capacity Utilization			75.5%			ICU Level of Service				D		
Analysis Period (min)			15									

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
19: Fallon Rd & Dublin Blvd/Croak Rd

BART to Livermore Extension Project
2040 BART PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	148	479	396	91	25	77	255	825	255	107	681	23
Future Volume (vph)	148	479	396	91	25	77	255	825	255	107	681	23
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.91	0.88	0.94	0.91	1.00	0.94	0.91	0.88	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5085	2787	4990	5085	1583	4990	5085	2787	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5085	2787	4990	5085	1583	4990	5085	2787	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	161	521	430	99	27	84	277	897	277	116	740	25
RTOR Reduction (vph)	0	0	81	0	0	77	0	0	121	0	0	12
Lane Group Flow (vph)	161	521	349	99	27	7	277	897	156	116	740	13
Turn Type	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4	5	3	8		5	2		1	6	
Permitted Phases			4			8			2			6
Actuated Green, G (s)	17.4	19.2	35.6	7.8	9.6	9.6	16.4	67.6	67.6	9.4	60.6	60.6
Effective Green, g (s)	17.4	19.2	35.6	7.8	9.6	9.6	16.4	67.6	67.6	9.4	60.6	60.6
Actuated g/C Ratio	0.14	0.16	0.30	0.06	0.08	0.08	0.14	0.56	0.56	0.08	0.51	0.51
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	497	813	826	324	406	126	681	2864	1570	268	2567	799
v/s Ratio Prot	0.05	c0.10	c0.06	c0.02	0.01		0.06	c0.18		c0.03	0.15	
v/s Ratio Perm			0.07			0.00			0.06			0.01
v/c Ratio	0.32	0.64	0.42	0.31	0.07	0.05	0.41	0.31	0.10	0.43	0.29	0.02
Uniform Delay, d1	46.0	47.2	33.9	53.5	51.1	51.0	47.4	13.9	12.1	52.8	17.2	14.8
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	0.87	0.78	0.97	1.00	1.00	1.00
Incremental Delay, d2	0.4	1.7	0.4	0.5	0.1	0.2	0.4	0.3	0.1	1.1	0.3	0.0
Delay (s)	46.4	48.9	34.3	54.1	51.1	51.2	41.7	11.1	11.8	53.9	17.5	14.9
Level of Service	D	D	C	D	D	D	D	B	B	D	B	B
Approach Delay (s)		42.9			52.5			17.1			22.2	
Approach LOS		D			D			B			C	

Intersection Summary

HCM 2000 Control Delay	28.2	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.39		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	46.8%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
20: El Charro Rd/Fallon Rd & I-580 WB Ramps



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↙	↖	↗		↑↑↑	↗		↑↑↑	↗
Traffic Volume (vph)	0	0	0	579	0	481	0	943	245	0	856	407
Future Volume (vph)	0	0	0	579	0	481	0	943	245	0	856	407
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0	4.0	4.0		4.0	4.0		4.0	4.0
Lane Util. Factor				0.95	0.95	0.88		0.91	1.00		0.91	1.00
Frt				1.00	1.00	0.85		1.00	0.85		1.00	0.85
Flt Protected				0.95	0.95	1.00		1.00	1.00		1.00	1.00
Satd. Flow (prot)				1681	1681	2787		5085	1583		5085	1583
Flt Permitted				0.95	0.95	1.00		1.00	1.00		1.00	1.00
Satd. Flow (perm)				1681	1681	2787		5085	1583		5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	629	0	523	0	1025	266	0	930	442
RTOR Reduction (vph)	0	0	0	0	0	73	0	0	111	0	0	184
Lane Group Flow (vph)	0	0	0	321	308	450	0	1025	155	0	930	258
Turn Type				Perm	NA	Perm		NA	Perm		NA	Perm
Protected Phases					8			2			6	
Permitted Phases				8		8			2			6
Actuated Green, G (s)				17.5	17.5	17.5		35.0	35.0		35.0	35.0
Effective Green, g (s)				17.0	17.0	17.0		35.0	35.0		35.0	35.0
Actuated g/C Ratio				0.28	0.28	0.28		0.58	0.58		0.58	0.58
Clearance Time (s)				3.5	3.5	3.5		4.0	4.0		4.0	4.0
Vehicle Extension (s)				2.0	2.0	2.0		2.0	2.0		2.0	2.0
Lane Grp Cap (vph)				476	476	789		2966	923		2966	923
v/s Ratio Prot								c0.20			0.18	
v/s Ratio Perm				c0.19	0.18	0.16			0.10			0.16
v/c Ratio				0.67	0.65	0.57		0.35	0.17		0.31	0.28
Uniform Delay, d1				19.0	18.9	18.4		6.5	5.8		6.4	6.2
Progression Factor				1.00	1.00	1.00		0.95	1.37		0.56	0.38
Incremental Delay, d2				3.0	2.3	0.6		0.2	0.3		0.3	0.7
Delay (s)				22.0	21.1	19.0		6.4	8.2		3.9	3.1
Level of Service				C	C	B		A	A		A	A
Approach Delay (s)		0.0			20.4			6.7			3.6	
Approach LOS		A			C			A			A	

Intersection Summary

HCM 2000 Control Delay	9.7	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.45		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	47.9%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
21: El Charro Rd & I-580 EB Ramps

BART to Livermore Extension Project
2040 BART PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗		↖↗					↕↔	↖		↕↔	↖
Traffic Volume (vph)	336	0	457	0	0	0	0	1622	281	0	1583	0
Future Volume (vph)	336	0	457	0	0	0	0	1622	281	0	1583	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0					4.0	4.0		4.0	
Lane Util. Factor	0.97		0.88					0.91	0.91		0.91	
Frt	1.00		0.85					1.00	0.85		1.00	
Flt Protected	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (prot)	3433		2787					3380	1441		3390	
Flt Permitted	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (perm)	3433		2787					3380	1441		3390	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	365	0	497	0	0	0	0	1763	305	0	1721	0
RTOR Reduction (vph)	0	0	47	0	0	0	0	2	88	0	0	0
Lane Group Flow (vph)	365	0	450	0	0	0	0	1798	180	0	1721	0
Turn Type	Prot		Perm					NA	Perm		NA	Perm
Protected Phases	4							2			6	
Permitted Phases			4						2			6
Actuated Green, G (s)	11.7		11.7					40.3	40.3		40.3	
Effective Green, g (s)	11.7		11.7					40.3	40.3		40.3	
Actuated g/C Ratio	0.19		0.19					0.67	0.67		0.67	
Clearance Time (s)	4.0		4.0					4.0	4.0		4.0	
Vehicle Extension (s)	2.0		2.0					3.0	3.0		3.0	
Lane Grp Cap (vph)	669		543					2270	967		2276	
v/s Ratio Prot	0.11							c0.53			0.51	
v/s Ratio Perm			c0.16						0.12			
v/c Ratio	0.55		0.83					0.79	0.19		0.76	
Uniform Delay, d1	21.8		23.2					6.9	3.7		6.6	
Progression Factor	1.00		1.00					1.00	1.00		1.11	
Incremental Delay, d2	0.5		9.6					2.9	0.4		2.3	
Delay (s)	22.2		32.8					9.8	4.1		9.6	
Level of Service	C		C					A	A		A	
Approach Delay (s)		28.3			0.0			9.1			9.6	
Approach LOS		C			A			A			A	

Intersection Summary

HCM 2000 Control Delay	12.8	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.80		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	66.4%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
22: El Charro Rd & Stoneridge Dr/Jack London Blvd

BART to Livermore Extension Project
2040 BART PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔↔↔	↑↑	↔	↔	↑↑	↔↔	↔	↑↑		↔↔↔	↑	↔↔
Traffic Volume (vph)	185	536	52	97	324	720	18	539	57	770	403	71
Future Volume (vph)	185	536	52	97	324	720	18	539	57	770	403	71
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	0.94	0.95	1.00	1.00	0.95	0.88	1.00	0.95		0.94	1.00	0.88
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	4491	3185	1425	1593	3185	2508	1593	3140		4491	1676	2508
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	4491	3185	1425	1593	3185	2508	1593	3140		4491	1676	2508
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	201	583	57	105	352	783	20	586	62	837	438	77
RTOR Reduction (vph)	0	0	44	0	0	74	0	12	0	0	0	41
Lane Group Flow (vph)	201	583	13	105	352	709	20	636	0	837	438	36
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Prot	NA		Prot	NA	Perm
Protected Phases	7	4		3	8	1	5	2		1	6	
Permitted Phases			4			8						6
Actuated Green, G (s)	6.0	16.7	16.7	4.6	15.3	33.6	0.8	16.2		18.3	33.7	33.7
Effective Green, g (s)	6.0	16.7	16.7	4.6	15.3	33.6	0.8	16.2		18.3	33.7	33.7
Actuated g/C Ratio	0.08	0.23	0.23	0.06	0.21	0.47	0.01	0.23		0.25	0.47	0.47
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	375	740	331	102	678	1173	17	708		1144	786	1177
v/s Ratio Prot	0.04	c0.18		c0.07	0.11	0.15	0.01	c0.20		c0.19	0.26	
v/s Ratio Perm			0.01			0.13						0.01
v/c Ratio	0.54	0.79	0.04	1.03	0.52	0.60	1.18	0.90		0.73	0.56	0.03
Uniform Delay, d1	31.6	25.9	21.3	33.6	25.0	14.2	35.5	27.0		24.5	13.7	10.3
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	1.5	5.6	0.0	97.3	0.7	0.9	279.8	14.2		2.4	0.9	0.0
Delay (s)	33.0	31.5	21.4	130.9	25.7	15.1	315.3	41.2		26.9	14.6	10.3
Level of Service	C	C	C	F	C	B	F	D		C	B	B
Approach Delay (s)		31.1			27.9			49.4			22.0	
Approach LOS		C			C			D			C	

Intersection Summary

HCM 2000 Control Delay	30.1	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.82		
Actuated Cycle Length (s)	71.8	Sum of lost time (s)	16.0
Intersection Capacity Utilization	70.6%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
23: Stanley Blvd & El Charro Rd



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	503	2532	778	13	140	361
Future Volume (vph)	503	2532	778	13	140	361
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95	0.91	1.00	0.97	0.88
Frt	1.00	1.00	1.00	0.85	1.00	0.85
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1770	3539	5085	1583	3433	2787
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1770	3539	5085	1583	3433	2787
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	547	2752	846	14	152	392
RTOR Reduction (vph)	0	0	0	8	0	351
Lane Group Flow (vph)	547	2752	846	6	152	41
Turn Type	Prot	NA	NA	Perm	Prot	Perm
Protected Phases	7	4	8		6	
Permitted Phases				8		6
Actuated Green, G (s)	34.0	76.0	38.0	38.0	9.7	9.7
Effective Green, g (s)	34.0	76.0	38.0	38.0	9.7	9.7
Actuated g/C Ratio	0.36	0.81	0.41	0.41	0.10	0.10
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	642	2870	2062	641	355	288
v/s Ratio Prot	0.31	c0.78	0.17		c0.04	
v/s Ratio Perm				0.00		0.01
v/c Ratio	0.85	0.96	0.41	0.01	0.43	0.14
Uniform Delay, d1	27.5	7.5	19.9	16.6	39.4	38.2
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	10.6	9.0	0.1	0.0	0.8	0.2
Delay (s)	38.1	16.6	20.0	16.6	40.2	38.4
Level of Service	D	B	B	B	D	D
Approach Delay (s)		20.1	19.9		38.9	
Approach LOS		C	B		D	

Intersection Summary

HCM 2000 Control Delay	22.3	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.94		
Actuated Cycle Length (s)	93.7	Sum of lost time (s)	12.0
Intersection Capacity Utilization	80.7%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

24: Airway Blvd/Driveway & N Canyons Pkwy

BART to Livermore Extension Project
2040 BART PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑	↑	↑↑	↑	↑		↑	↑↑		↑	
Traffic Volume (vph)	0	459	319	952	75	0	53	0	750	0	0	0
Future Volume (vph)	0	459	319	952	75	0	53	0	750	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		2.0	2.0	2.0	2.0			4.2	2.0			
Lane Util. Factor		0.95	1.00	0.97	1.00			1.00	0.88			
Frt		1.00	0.85	1.00	1.00			1.00	0.85			
Flt Protected		1.00	1.00	0.95	1.00			0.95	1.00			
Satd. Flow (prot)		3539	1583	3433	1863			1770	2787			
Flt Permitted		1.00	1.00	0.95	1.00			0.95	1.00			
Satd. Flow (perm)		3539	1583	3433	1863			1770	2787			
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	499	347	1035	82	0	58	0	815	0	0	0
RTOR Reduction (vph)	0	0	199	0	0	0	0	0	388	0	0	0
Lane Group Flow (vph)	0	499	148	1035	82	0	0	58	427	0	0	0
Turn Type		NA	Perm	Prot	NA	Perm	Split	NA	pm+ov			
Protected Phases		2		1	6		8	8	1	4	4	
Permitted Phases			2			6			8			
Actuated Green, G (s)		49.1	49.1	47.7	100.8			11.2	58.9			
Effective Green, g (s)		51.1	51.1	49.7	102.8			11.0	62.9			
Actuated g/C Ratio		0.43	0.43	0.41	0.86			0.09	0.52			
Clearance Time (s)		4.0	4.0	4.0	4.0			4.0	4.0			
Vehicle Extension (s)		3.0	3.0	3.0	3.0			3.0	3.0			
Lane Grp Cap (vph)		1507	674	1421	1595			162	1507			
v/s Ratio Prot		c0.14		c0.30	0.04			c0.03	0.12			
v/s Ratio Perm			0.09						0.04			
v/c Ratio		0.33	0.22	0.73	0.05			0.36	0.28			
Uniform Delay, d1		23.0	21.8	29.5	1.3			51.2	16.0			
Progression Factor		1.00	1.00	1.00	1.00			1.00	1.00			
Incremental Delay, d2		0.6	0.7	1.9	0.1			1.4	0.1			
Delay (s)		23.6	22.6	31.4	1.4			52.5	16.1			
Level of Service		C	C	C	A			D	B			
Approach Delay (s)		23.2			29.2			18.5			0.0	
Approach LOS		C			C			B			A	

Intersection Summary

HCM 2000 Control Delay	24.1	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.52		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	12.2
Intersection Capacity Utilization	53.6%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 25: Airway Blvd & I-580 WB Ramps



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	148	49	188	0	677	306	0	706	680
Future Volume (vph)	0	0	0	148	49	188	0	677	306	0	706	680
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0	4.0	4.0		4.0	4.0		4.0	
Lane Util. Factor				0.95	0.95	0.88		0.95	1.00		0.91	
Frt				1.00	1.00	0.85		1.00	0.85		0.93	
Flt Protected				0.95	0.97	1.00		1.00	1.00		1.00	
Satd. Flow (prot)				1681	1719	2787		3539	1583		4711	
Flt Permitted				0.95	0.97	1.00		1.00	1.00		1.00	
Satd. Flow (perm)				1681	1719	2787		3539	1583		4711	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	161	53	204	0	736	333	0	767	739
RTOR Reduction (vph)	0	0	0	0	0	171	0	0	91	0	183	0
Lane Group Flow (vph)	0	0	0	85	129	33	0	736	242	0	1323	0
Turn Type				Split	NA	Perm		NA	Perm		NA	
Protected Phases				8	8			2			6	
Permitted Phases						8			2			
Actuated Green, G (s)				11.2	11.2	11.2		49.5	49.5		49.5	
Effective Green, g (s)				11.2	11.2	11.2		50.8	50.8		50.8	
Actuated g/C Ratio				0.16	0.16	0.16		0.73	0.73		0.73	
Clearance Time (s)				4.0	4.0	4.0		5.3	5.3		5.3	
Vehicle Extension (s)				2.0	2.0	2.0		4.0	4.0		4.0	
Lane Grp Cap (vph)				268	275	445		2568	1148		3418	
v/s Ratio Prot				0.05	c0.08			0.21			c0.28	
v/s Ratio Perm						0.01			0.15			
v/c Ratio				0.32	0.47	0.07		0.29	0.21		0.39	
Uniform Delay, d1				26.0	26.7	25.0		3.3	3.1		3.7	
Progression Factor				1.00	1.00	1.00		1.00	1.00		1.00	
Incremental Delay, d2				0.2	0.5	0.0		0.3	0.4		0.3	
Delay (s)				26.3	27.2	25.0		3.6	3.5		4.0	
Level of Service				C	C	C		A	A		A	
Approach Delay (s)		0.0			25.9			3.6			4.0	
Approach LOS		A			C			A			A	

Intersection Summary		
HCM 2000 Control Delay	6.9	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.40	A
Actuated Cycle Length (s)	70.0	Sum of lost time (s)
Intersection Capacity Utilization	43.9%	8.0
Analysis Period (min)	15	ICU Level of Service
		A

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

26: Airway Blvd & I-580 EB Ramps/Kitty Hawk Rd

BART to Livermore Extension Project
2040 BART PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	522	195	386	73	92	116	51	424	166	106	349	368
Future Volume (vph)	522	195	386	73	92	116	51	424	166	106	349	368
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.4	4.4	4.4	4.5	2.7		4.0	2.7	
Lane Util. Factor	0.97	1.00	1.00	1.00	1.00	1.00	1.00	0.95		1.00	0.95	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.96		1.00	0.92	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	3433	1863	1583	1770	1863	1583	1770	3390		1770	3267	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	3433	1863	1583	1770	1863	1583	1770	3390		1770	3267	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	567	212	420	79	100	126	55	461	180	115	379	400
RTOR Reduction (vph)	0	0	324	0	0	96	0	54	0	0	220	0
Lane Group Flow (vph)	567	212	96	79	100	30	55	587	0	115	559	0
Turn Type	Split	NA	Perm	Split	NA	pm+ov	Prot	NA		Prot	NA	
Protected Phases	7	7		8	8	1	5	2		1	6	
Permitted Phases			7			8						
Actuated Green, G (s)	19.4	19.4	19.4	11.2	11.2	20.9	5.2	28.7		9.7	33.2	
Effective Green, g (s)	19.4	19.4	19.4	10.8	10.8	20.1	4.7	30.0		9.7	34.5	
Actuated g/C Ratio	0.23	0.23	0.23	0.13	0.13	0.24	0.06	0.35		0.11	0.41	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Vehicle Extension (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	3.5		2.0	4.0	
Lane Grp Cap (vph)	783	425	361	224	236	456	97	1196		201	1326	
v/s Ratio Prot	c0.17	0.11		0.04	c0.05	0.01	0.03	c0.17		c0.06	0.17	
v/s Ratio Perm			0.06			0.01						
v/c Ratio	0.72	0.50	0.27	0.35	0.42	0.07	0.57	0.49		0.57	0.42	
Uniform Delay, d1	30.3	28.6	26.9	33.9	34.2	25.2	39.2	21.5		35.7	18.1	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	2.8	0.3	0.1	0.3	0.4	0.0	4.5	1.4		2.4	1.0	
Delay (s)	33.2	28.9	27.1	34.3	34.7	25.2	43.6	23.0		38.1	19.1	
Level of Service	C	C	C	C	C	C	D	C		D	B	
Approach Delay (s)		30.3			30.6			24.6			21.5	
Approach LOS		C			C			C			C	

Intersection Summary

HCM 2000 Control Delay	26.5	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.56		
Actuated Cycle Length (s)	85.0	Sum of lost time (s)	15.6
Intersection Capacity Utilization	67.4%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

27: Collier Canyon Rd & N Canyons Pkwy/Portola Ave

BART to Livermore Extension Project
2040 BART PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔↔	↑↑	↗	↖	↑↑	↗	↖	↔		↖	↑	↗
Traffic Volume (vph)	421	492	166	49	190	17	59	8	180	119	19	183
Future Volume (vph)	421	492	166	49	190	17	59	8	180	119	19	183
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	2.7	2.7	4.0	2.7	2.7	4.0	3.0		4.0	4.6	4.6
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.86		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	1770	1596		1770	1863	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	1770	1596		1770	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	458	535	180	53	207	18	64	9	196	129	21	199
RTOR Reduction (vph)	0	0	117	0	0	14	0	151	0	0	0	144
Lane Group Flow (vph)	458	535	63	53	207	4	64	54	0	129	21	55
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA		Prot	NA	Perm
Protected Phases	1	6		5	2		3	8		7	NA	4
Permitted Phases			6			2						4
Actuated Green, G (s)	13.6	21.2	21.2	4.0	11.6	11.6	4.8	13.7		9.3	18.2	18.2
Effective Green, g (s)	13.6	22.5	22.5	4.0	12.9	12.9	4.8	14.7		9.3	17.6	17.6
Actuated g/C Ratio	0.21	0.35	0.35	0.06	0.20	0.20	0.07	0.23		0.14	0.27	0.27
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	727	1240	554	110	711	318	132	365		256	510	433
v/s Ratio Prot	c0.13	c0.15		0.03	0.06		0.04	c0.03		c0.07	0.01	
v/s Ratio Perm			0.04			0.00						0.03
v/c Ratio	0.63	0.43	0.11	0.48	0.29	0.01	0.48	0.15		0.50	0.04	0.13
Uniform Delay, d1	23.0	16.0	14.1	29.1	21.8	20.5	28.5	19.8		25.3	17.1	17.5
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	1.7	0.2	0.1	3.3	0.2	0.0	2.8	0.2		1.6	0.0	0.1
Delay (s)	24.7	16.2	14.2	32.4	22.0	20.6	31.3	19.9		26.9	17.1	17.6
Level of Service	C	B	B	C	C	C	C	B		C	B	B
Approach Delay (s)		19.2			23.9			22.6			21.0	
Approach LOS		B			C			C			C	
























Intersection Summary

HCM 2000 Control Delay	20.6	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.45		
Actuated Cycle Length (s)	64.2	Sum of lost time (s)	15.3
Intersection Capacity Utilization	51.0%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

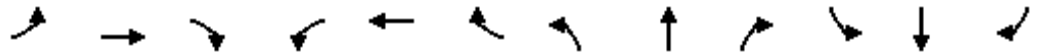
HCM Signalized Intersection Capacity Analysis
28: Isabel Ave/Campus Hill Dr & Portola Ave

BART to Livermore Extension Project
2040 BART PM

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations													
Traffic Volume (vph)	1	401	397	543	125	110	187	417	182	100	264	1	
Future Volume (vph)	1	401	397	543	125	110	187	417	182	100	264	1	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	5.8	5.8	
Lane Util. Factor	1.00	0.95	0.88	0.94	0.95		0.97	0.95	1.00	1.00	0.95	1.00	
Frt	1.00	1.00	0.85	1.00	0.93		1.00	1.00	0.85	1.00	1.00	0.85	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1770	3539	2787	4990	3290		3433	3539	1583	1770	3539	1583	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	1770	3539	2787	4990	3290		3433	3539	1583	1770	3539	1583	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	
Adj. Flow (vph)	1	436	432	590	136	120	203	453	198	109	287	1	
RTOR Reduction (vph)	0	0	309	0	74	0	0	0	145	0	0	1	
Lane Group Flow (vph)	1	436	123	590	182	0	203	453	53	109	287	0	
Turn Type	Prot	NA	Perm	Prot	NA		Prot	NA	Perm	Prot	NA	Perm	
Protected Phases	7	4		3	8		5	2		1	6		
Permitted Phases			4						2			6	
Actuated Green, G (s)	1.5	19.9	19.9	9.1	27.5		9.1	18.8	18.8	8.1	18.2	18.2	
Effective Green, g (s)	1.5	21.2	21.2	9.1	28.8		9.1	20.1	20.1	8.1	17.3	17.3	
Actuated g/C Ratio	0.02	0.28	0.28	0.12	0.39		0.12	0.27	0.27	0.11	0.23	0.23	
Clearance Time (s)	4.0	5.3	5.3	4.0	5.3		4.0	5.3	5.3	4.0	4.9	4.9	
Vehicle Extension (s)	2.0	3.0	3.0	2.0	3.0		2.0	3.0	3.0	2.0	3.0	3.0	
Lane Grp Cap (vph)	35	1007	793	609	1271		419	954	427	192	821	367	
v/s Ratio Prot	0.00	c0.12		c0.12	0.06		0.06	c0.13		c0.06	0.08		
v/s Ratio Perm			0.04						0.03			0.00	
v/c Ratio	0.03	0.43	0.16	0.97	0.14		0.48	0.47	0.13	0.57	0.35	0.00	
Uniform Delay, d1	35.8	21.7	19.9	32.6	14.8		30.5	22.8	20.6	31.5	23.9	22.0	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.1	0.3	0.1	28.3	0.1		0.3	0.4	0.1	2.3	0.3	0.0	
Delay (s)	35.9	22.0	20.0	60.8	14.9		30.8	23.2	20.7	33.8	24.2	22.0	
Level of Service	D	C	C	E	B		C	C	C	C	C	C	
Approach Delay (s)		21.1			46.9			24.4			26.8		
Approach LOS		C			D			C			C		
Intersection Summary													
HCM 2000 Control Delay			30.2	HCM 2000 Level of Service					C				
HCM 2000 Volume to Capacity ratio			0.57										
Actuated Cycle Length (s)			74.5	Sum of lost time (s)					17.8				
Intersection Capacity Utilization			53.8%	ICU Level of Service					A				
Analysis Period (min)			15										
c	Critical Lane Group												

HCM Signalized Intersection Capacity Analysis
 29: Isabel Ave & I-580 WB Ramps

BART to Livermore Extension Project
 2040 BART PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↖↗		↖		↖↖↖	↖		↖↖↖	↖
Traffic Volume (vph)	0	0	0	681	0	422	0	448	0	0	717	554
Future Volume (vph)	0	0	0	681	0	422	0	448	0	0	717	554
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0		4.0		4.8			4.8	4.8
Lane Util. Factor				0.97		1.00		0.91			0.91	1.00
Frt				1.00		0.85		1.00			1.00	0.85
Flt Protected				0.95		1.00		1.00			1.00	1.00
Satd. Flow (prot)				3433		1583		5085			5085	1583
Flt Permitted				0.95		1.00		1.00			1.00	1.00
Satd. Flow (perm)				3433		1583		5085			5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	740	0	459	0	487	0	0	779	602
RTOR Reduction (vph)	0	0	0	0	0	206	0	0	0	0	0	245
Lane Group Flow (vph)	0	0	0	740	0	253	0	487	0	0	779	357
Turn Type				Prot		Prot		NA	Free		NA	Prot
Protected Phases				8		8		2			6	6
Permitted Phases									Free			
Actuated Green, G (s)				19.7		19.7		42.3			42.3	42.3
Effective Green, g (s)				19.7		19.7		41.5			41.5	41.5
Actuated g/C Ratio				0.28		0.28		0.59			0.59	0.59
Clearance Time (s)				4.0		4.0		4.0			4.0	4.0
Vehicle Extension (s)				2.0		2.0		4.0			4.0	4.0
Lane Grp Cap (vph)				966		445		3014			3014	938
v/s Ratio Prot				c0.22		0.16		0.10			0.15	c0.23
v/s Ratio Perm												
v/c Ratio				0.77		0.57		0.16			0.26	0.38
Uniform Delay, d1				23.0		21.5		6.4			6.9	7.5
Progression Factor				1.00		1.00		0.78			1.00	1.00
Incremental Delay, d2				3.3		1.0		0.1			0.2	1.2
Delay (s)				26.4		22.5		5.1			7.1	8.7
Level of Service				C		C		A			A	A
Approach Delay (s)		0.0			24.9			5.1			7.8	
Approach LOS		A			C			A			A	

Intersection Summary		
HCM 2000 Control Delay	14.0	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.50	B
Actuated Cycle Length (s)	70.0	Sum of lost time (s)
Intersection Capacity Utilization	42.1%	8.8
Analysis Period (min)	15	ICU Level of Service
		A

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
30: Isabel Ave & I-580 EB Ramps



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗		↖↗					↑↑↑	↖		↑↑↑	↖
Traffic Volume (vph)	179	0	385	0	0	0	0	700	1276	0	926	698
Future Volume (vph)	179	0	385	0	0	0	0	700	1276	0	926	698
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0					4.0	4.0		4.0	4.0
Lane Util. Factor	0.97		0.88					0.91	1.00		0.91	1.00
Frt	1.00		0.85					1.00	0.85		1.00	0.85
Flt Protected	0.95		1.00					1.00	1.00		1.00	1.00
Satd. Flow (prot)	3433		2787					5085	1583		5085	1583
Flt Permitted	0.95		1.00					1.00	1.00		1.00	1.00
Satd. Flow (perm)	3433		2787					5085	1583		5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	195	0	418	0	0	0	0	761	1387	0	1007	759
RTOR Reduction (vph)	0	0	143	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	195	0	275	0	0	0	0	761	1387	0	1007	759
Turn Type	Prot		Perm					NA	Free		NA	Free
Protected Phases	4							2			6	
Permitted Phases			4						Free			Free
Actuated Green, G (s)	18.3		18.3					112.7	140.0		112.7	140.0
Effective Green, g (s)	18.3		18.3					113.7	140.0		113.7	140.0
Actuated g/C Ratio	0.13		0.13					0.81	1.00		0.81	1.00
Clearance Time (s)	4.0		4.0					5.0			5.0	
Vehicle Extension (s)	2.0		2.0					4.0			4.0	
Lane Grp Cap (vph)	448		364					4129	1583		4129	1583
v/s Ratio Prot	0.06							0.15			0.20	
v/s Ratio Perm			0.10						c0.88			0.48
v/c Ratio	0.44		0.76					0.18	0.88		0.24	0.48
Uniform Delay, d1	56.1		58.7					2.9	0.0		3.1	0.0
Progression Factor	1.00		1.00					1.00	1.00		0.87	1.00
Incremental Delay, d2	0.2		7.8					0.1	7.1		0.1	1.0
Delay (s)	56.3		66.5					3.0	7.1		2.8	1.0
Level of Service	E		E					A	A		A	A
Approach Delay (s)		63.2			0.0			5.7			2.0	
Approach LOS		E			A			A			A	

Intersection Summary			
HCM 2000 Control Delay	12.0	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.93		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	38.0%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
31: Isabel Ave & Airway Blvd

BART to Livermore Extension Project
2040 BART PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↑	↗	↖	↑	↗	↖	↑↑↑	↗	↖↗	↑↑↑	↗
Traffic Volume (vph)	8	110	429	269	90	851	446	1208	265	361	1352	16
Future Volume (vph)	8	110	429	269	90	851	446	1208	265	361	1352	16
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.2	5.2	5.6	5.2	5.2	5.6	4.0	4.0	4.0	4.0	4.0	5.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.91	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	1863	1583	1770	1863	1583	1770	5085	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	1863	1583	1770	1863	1583	1770	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	9	120	466	292	98	925	485	1313	288	392	1470	17
RTOR Reduction (vph)	0	0	60	0	0	41	0	0	160	0	0	10
Lane Group Flow (vph)	9	120	406	292	98	884	485	1313	128	392	1470	7
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4	5	3	8	1	5	2		1	NA	6
Permitted Phases			4			8			2			6
Actuated Green, G (s)	0.8	18.1	44.1	17.4	34.7	58.9	26.0	61.1	61.1	24.2	59.3	59.3
Effective Green, g (s)	0.2	17.5	42.9	16.8	34.1	57.7	27.0	62.1	62.1	25.2	60.3	59.3
Actuated g/C Ratio	0.00	0.12	0.31	0.12	0.24	0.41	0.19	0.44	0.44	0.18	0.43	0.42
Clearance Time (s)	4.6	4.6	5.0	4.6	4.6	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	5.0	5.0	3.0	5.0	5.0
Lane Grp Cap (vph)	2	232	485	212	453	652	341	2255	702	617	2190	670
v/s Ratio Prot	0.01	0.06	0.15	c0.17	0.05	c0.23	c0.27	0.26		0.11	c0.29	
v/s Ratio Perm			0.10			0.33			0.08			0.00
v/c Ratio	4.50	0.52	0.84	1.38	0.22	1.36	1.42	0.58	0.18	0.64	0.67	0.01
Uniform Delay, d1	69.9	57.3	45.3	61.6	42.3	41.1	56.5	29.2	23.6	53.1	31.9	23.4
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	2350.4	1.9	11.9	196.6	0.2	170.3	206.4	1.1	0.6	2.1	1.7	0.0
Delay (s)	2420.3	59.2	57.2	258.2	42.5	211.5	262.9	30.3	24.1	55.3	33.6	23.4
Level of Service	F	E	E	F	D	F	F	C	C	E	C	C
Approach Delay (s)		93.3			209.3			83.5			38.0	
Approach LOS		F			F			F			D	

Intersection Summary

HCM 2000 Control Delay	98.1	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.08		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	91.7%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
32: Isabel Ave & Jack London Blvd

BART to Livermore Extension Project
2040 BART PM

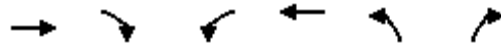


Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↕	↖	↖	↕	↖	↖↗	↕↕	↖	↖↗	↕↕	↖
Traffic Volume (vph)	130	842	332	265	214	305	155	1332	482	493	1428	79
Future Volume (vph)	130	842	332	265	214	305	155	1332	482	493	1428	79
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.97	0.91	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	3433	5085	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	3433	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	141	915	361	288	233	332	168	1448	524	536	1552	86
RTOR Reduction (vph)	0	0	156	0	0	37	0	0	169	0	0	56
Lane Group Flow (vph)	141	915	205	288	233	295	168	1448	355	536	1552	30
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8	1	5	2		1	NA	6
Permitted Phases			4			8			2			6
Actuated Green, G (s)	9.1	32.7	32.7	16.7	40.3	56.0	6.9	33.4	33.4	15.7	42.2	42.2
Effective Green, g (s)	9.1	32.7	32.7	16.7	40.3	56.0	6.9	33.4	33.4	15.7	42.2	42.2
Actuated g/C Ratio	0.08	0.27	0.27	0.14	0.34	0.47	0.06	0.28	0.28	0.13	0.35	0.35
Clearance Time (s)	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	260	966	432	246	1191	810	197	1418	441	450	1792	558
v/s Ratio Prot	0.04	c0.26		c0.16	0.07	0.05	0.05	c0.28		c0.16	0.31	
v/s Ratio Perm			0.13			0.14			0.22			0.02
v/c Ratio	0.54	0.95	0.48	1.17	0.20	0.36	0.85	1.02	0.81	1.19	0.87	0.05
Uniform Delay, d1	53.3	42.7	36.3	51.5	28.2	20.4	55.9	43.2	40.1	52.0	36.1	25.6
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	2.3	17.4	0.8	111.4	0.1	0.3	28.2	29.4	10.3	106.2	4.7	0.0
Delay (s)	55.6	60.1	37.2	162.9	28.3	20.7	84.1	72.5	50.4	158.2	40.8	25.6
Level of Service	E	E	D	F	C	C	F	E	D	F	D	C
Approach Delay (s)		53.8			70.8			68.0			69.1	
Approach LOS		D			E			E			E	

Intersection Summary

HCM 2000 Control Delay	65.7	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.05		
Actuated Cycle Length (s)	119.7	Sum of lost time (s)	21.2
Intersection Capacity Utilization	95.4%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑	↑	↑↓	↑↑	↑↓	↑↓
Traffic Volume (vph)	2029	720	791	543	159	1030
Future Volume (vph)	2029	720	791	543	159	1030
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	2.3	2.3	4.0	2.3	2.5	2.5
Lane Util. Factor	0.95	1.00	0.97	0.95	0.97	0.88
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	3539	1583	3433	3539	3433	2787
Flt Permitted	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (perm)	3539	1583	3433	3539	3433	2787
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	2205	783	860	590	173	1120
RTOR Reduction (vph)	0	0	0	0	0	2
Lane Group Flow (vph)	2205	783	860	590	173	1118
Turn Type	NA	pm+ov	Prot	NA	Prot	pm+ov
Protected Phases	2	8	1	6	8	1
Permitted Phases		2				8
Actuated Green, G (s)	57.0	67.0	21.0	82.0	10.0	31.0
Effective Green, g (s)	58.7	70.4	21.0	83.7	11.5	34.0
Actuated g/C Ratio	0.59	0.70	0.21	0.84	0.12	0.34
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Grp Cap (vph)	2077	1150	720	2962	394	1017
v/s Ratio Prot	c0.62	0.08	0.25	0.17	0.05	c0.25
v/s Ratio Perm		0.41				0.15
v/c Ratio	1.06	0.68	1.19	0.20	0.44	1.10
Uniform Delay, d1	20.6	8.4	39.5	1.6	41.2	33.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	38.5	1.3	100.8	0.0	0.3	59.4
Delay (s)	59.1	9.7	140.3	1.6	41.5	92.4
Level of Service	E	A	F	A	D	F
Approach Delay (s)	46.2			83.9	85.6	
Approach LOS	D			F	F	

Intersection Summary

HCM 2000 Control Delay	64.6	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.12		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	8.8
Intersection Capacity Utilization	98.8%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 34: Murrieta Blvd/Driveway & Portola Ave

BART to Livermore Extension Project
 2040 BART PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗		↖	↗		↖	↗	↗		↗	
Traffic Volume (vph)	0	996	183	304	892	0	264	6	421	4	7	0
Future Volume (vph)	0	996	183	304	892	0	264	6	421	4	7	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.8		4.0	5.8		5.2	5.2	5.2		4.0	
Lane Util. Factor		0.95		1.00	0.95		0.95	0.95	1.00		1.00	
Frt		0.98		1.00	1.00		1.00	1.00	0.85		1.00	
Flt Protected		1.00		0.95	1.00		0.95	0.95	1.00		0.98	
Satd. Flow (prot)		3457		1770	3539		1681	1689	1583		1832	
Flt Permitted		1.00		0.95	1.00		0.95	0.95	1.00		0.98	
Satd. Flow (perm)		3457		1770	3539		1681	1689	1583		1832	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	1083	199	330	970	0	287	7	458	4	8	0
RTOR Reduction (vph)	0	13	0	0	0	0	0	0	295	0	0	0
Lane Group Flow (vph)	0	1269	0	330	970	0	149	145	163	0	12	0
Turn Type	Prot	NA		Prot	NA		Split	NA	Perm		Split	NA
Protected Phases	5	2		1	6		8	8		4	4	
Permitted Phases									8			
Actuated Green, G (s)		36.9		17.2	58.1		14.0	14.0	14.0		0.7	
Effective Green, g (s)		36.0		17.2	57.2		13.4	13.4	13.4		0.7	
Actuated g/C Ratio		0.42		0.20	0.66		0.16	0.16	0.16		0.01	
Clearance Time (s)		4.9		4.0	4.9		4.6	4.6	4.6		4.0	
Vehicle Extension (s)		2.0		2.0	2.0		2.0	2.0	2.0		2.0	
Lane Grp Cap (vph)		1442		352	2345		261	262	245		14	
v/s Ratio Prot		c0.37		c0.19	0.27		0.09	0.09			c0.01	
v/s Ratio Perm									c0.10			
v/c Ratio		0.88		0.94	0.41		0.57	0.55	0.67		0.86	
Uniform Delay, d1		23.2		34.0	6.8		33.8	33.7	34.3		42.8	
Progression Factor		1.00		1.00	1.00		1.00	1.00	1.00		1.00	
Incremental Delay, d2		6.3		31.6	0.0		1.9	1.4	5.2		160.8	
Delay (s)		29.4		65.6	6.8		35.7	35.1	39.6		203.6	
Level of Service		C		E	A		D	D	D		F	
Approach Delay (s)		29.4			21.7			37.9			203.6	
Approach LOS		C			C			D			F	

Intersection Summary		
HCM 2000 Control Delay	29.0	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.85	C
Actuated Cycle Length (s)	86.3	Sum of lost time (s)
Intersection Capacity Utilization	76.8%	19.0
Analysis Period (min)	15	ICU Level of Service
		D

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
35: Murrieta Blvd & Jack London Blvd



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	294	1229	522	264	492	176
Future Volume (vph)	294	1229	522	264	492	176
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00	1.00	0.95	0.91	
Frt	1.00	0.85	1.00	1.00	0.96	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1770	1583	1770	3539	4885	
Flt Permitted	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	1770	1583	1770	3539	4885	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	320	1336	567	287	535	191
RTOR Reduction (vph)	0	373	0	0	53	0
Lane Group Flow (vph)	320	963	567	287	673	0
Turn Type	Prot	Perm	Prot	NA	NA	
Protected Phases	4		5	2	6	
Permitted Phases		4				
Actuated Green, G (s)	58.0	58.0	33.0	54.0	17.0	
Effective Green, g (s)	58.0	58.0	33.0	54.0	17.0	
Actuated g/C Ratio	0.48	0.48	0.28	0.45	0.14	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	855	765	486	1592	692	
v/s Ratio Prot	0.18		c0.32	0.08	c0.14	
v/s Ratio Perm		c0.61				
v/c Ratio	0.37	1.26	1.17	0.18	0.97	
Uniform Delay, d1	19.6	31.0	43.5	19.8	51.3	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.3	126.9	95.4	0.1	27.3	
Delay (s)	19.8	157.9	138.9	19.8	78.5	
Level of Service	B	F	F	B	E	
Approach Delay (s)	131.3			98.9	78.5	
Approach LOS	F			F	E	

Intersection Summary

HCM 2000 Control Delay	110.9	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.18		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	96.2%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 36: Murrieta Blvd & Stanley Blvd

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	331	1449	873	84	996	219	281	347	19	261	449	226
Future Volume (vph)	331	1449	873	84	996	219	281	347	19	261	449	226
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	5.8	5.8	4.0	5.8	4.9	4.9	5.8		4.9	5.8	4.9
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.97	0.95		1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	3433	3511		1770	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	3433	3511		1770	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	360	1575	949	91	1083	238	305	377	21	284	488	246
RTOR Reduction (vph)	0	0	223	0	0	53	0	3	0	0	0	132
Lane Group Flow (vph)	360	1575	726	91	1083	185	305	395	0	284	488	114
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Prot	NA		Prot	NA	Perm
Protected Phases	1	6		5	2	3	7	4		3	8	
Permitted Phases			6			2						8
Actuated Green, G (s)	13.0	51.4	51.4	4.0	42.4	59.5	14.5	20.4		17.1	23.0	23.0
Effective Green, g (s)	13.0	50.5	50.5	4.0	41.5	57.7	13.6	19.5		16.2	22.1	23.0
Actuated g/C Ratio	0.12	0.46	0.46	0.04	0.37	0.52	0.12	0.18		0.15	0.20	0.21
Clearance Time (s)	4.0	4.9	4.9	4.0	4.9	4.0	4.0	4.9		4.0	4.9	4.9
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	403	1614	722	63	1326	825	421	618		259	706	328
v/s Ratio Prot	c0.10	0.45		c0.05	0.31	0.03	0.09	0.11		c0.16	c0.14	
v/s Ratio Perm			c0.46			0.08						0.07
v/c Ratio	0.89	0.98	1.01	1.44	0.82	0.22	0.72	0.64		1.10	0.69	0.35
Uniform Delay, d1	48.2	29.5	30.1	53.4	31.2	14.4	46.7	42.3		47.2	41.1	37.5
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	21.3	16.8	34.9	269.0	4.0	0.1	6.1	2.2		84.2	2.9	0.6
Delay (s)	69.5	46.3	65.0	322.4	35.2	14.5	52.8	44.5		131.4	44.1	38.1
Level of Service	E	D	E	F	D	B	D	D		F	D	D
Approach Delay (s)		55.4			50.2			48.1			67.0	
Approach LOS		E			D			D			E	

Intersection Summary		
HCM 2000 Control Delay	55.3	HCM 2000 Level of Service E
HCM 2000 Volume to Capacity ratio	0.99	
Actuated Cycle Length (s)	110.7	Sum of lost time (s) 20.5
Intersection Capacity Utilization	86.4%	ICU Level of Service E
Analysis Period (min)	15	

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
37: Livermore Ave & I-580 WB Ramps

BART to Livermore Extension Project
2040 BART PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↖	↔		↗	↑			↕	
Traffic Volume (vph)	0	0	0	718	23	32	580	451	0	0	111	0
Future Volume (vph)	0	0	0	718	23	32	580	451	0	0	111	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)					4.0		4.0	4.0			4.0	
Lane Util. Factor					0.95		0.97	1.00			0.95	
Frt					0.99		1.00	1.00			1.00	
Flt Protected					0.96		0.95	1.00			1.00	
Satd. Flow (prot)					1681		3433	1863			3539	
Flt Permitted					0.96		0.95	1.00			1.00	
Satd. Flow (perm)					1681		3433	1863			3539	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	780	25	35	630	490	0	0	121	0
RTOR Reduction (vph)	0	0	0	0	1	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	0	839	0	630	490	0	0	121	0
Turn Type				Split	NA		Prot	NA			NA	
Protected Phases				8	8		5	2			6	
Permitted Phases												
Actuated Green, G (s)					78.4		29.3	51.9			19.1	
Effective Green, g (s)					78.4		28.8	53.6			20.8	
Actuated g/C Ratio					0.56		0.21	0.38			0.15	
Clearance Time (s)					4.0		3.5	5.7			5.7	
Vehicle Extension (s)					2.0		2.0	2.5			2.5	
Lane Grp Cap (vph)					941		706	713			525	
v/s Ratio Prot					c0.50		c0.18	c0.26			0.03	
v/s Ratio Perm												
v/c Ratio					0.89		0.89	0.69			0.23	
Uniform Delay, d1					27.1		54.1	36.2			52.5	
Progression Factor					1.00		0.39	0.25			1.00	
Incremental Delay, d2					10.4		1.5	0.5			1.0	
Delay (s)					37.4		22.6	9.6			53.6	
Level of Service					D		C	A			D	
Approach Delay (s)		0.0			37.4			16.9			53.6	
Approach LOS		A			D			B			D	

Intersection Summary

HCM 2000 Control Delay	27.3	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.87		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	108.5%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
38: Livermore Ave & I-580 EB Ramps



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕	↗					↕		↗	↕	
Traffic Volume (vph)	257	8	1355	0	0	0	0	791	150	91	734	0
Future Volume (vph)	257	8	1355	0	0	0	0	791	150	91	734	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0					3.0		5.0	3.0	
Lane Util. Factor		0.95	0.95					0.95		1.00	0.95	
Frt		0.89	0.85					0.98		1.00	1.00	
Flt Protected		0.99	1.00					1.00		0.95	1.00	
Satd. Flow (prot)		1558	1504					3455		1770	3539	
Flt Permitted		0.99	1.00					1.00		0.95	1.00	
Satd. Flow (perm)		1558	1504					3455		1770	3539	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	279	9	1473	0	0	0	0	860	163	99	798	0
RTOR Reduction (vph)	0	48	48	0	0	0	0	11	0	0	0	0
Lane Group Flow (vph)	0	962	703	0	0	0	0	1012	0	99	798	0
Turn Type	Prot	NA	Perm					NA		Prot	NA	
Protected Phases	7	4						2		1	6	
Permitted Phases			4									
Actuated Green, G (s)		73.1	73.1					44.5		10.4	58.9	
Effective Green, g (s)		73.1	73.1					45.5		9.4	59.9	
Actuated g/C Ratio		0.52	0.52					0.32		0.07	0.43	
Clearance Time (s)		4.0	4.0					4.0		4.0	4.0	
Vehicle Extension (s)		2.0	2.0					2.5		2.0	2.5	
Lane Grp Cap (vph)		813	785					1122		118	1514	
v/s Ratio Prot								c0.29		c0.06	0.23	
v/s Ratio Perm		0.62	0.47									
v/c Ratio		1.18	0.90					0.90		0.84	0.53	
Uniform Delay, d1		33.5	30.0					45.1		64.6	29.6	
Progression Factor		1.00	1.00					1.00		0.80	1.12	
Incremental Delay, d2		95.0	12.5					11.6		25.3	0.8	
Delay (s)		128.5	42.5					56.7		76.8	33.9	
Level of Service		F	D					E		E	C	
Approach Delay (s)		91.8			0.0			56.7			38.7	
Approach LOS		F			A			E			D	

Intersection Summary

HCM 2000 Control Delay	69.1	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.06		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	108.5%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 39: Livermore Ave & Portola Ave



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↕	↗	↖	↕	↗	↖	↕		↖	↕	↗
Traffic Volume (vph)	683	709	182	20	431	72	263	676	113	265	1002	553
Future Volume (vph)	683	709	182	20	431	72	263	676	113	265	1002	553
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	2.7	4.0	4.0	2.7	4.0	4.0	4.9		4.0	4.9	4.9
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	1.00	0.95		1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.98		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	1770	3463		1770	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	1770	3463		1770	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	742	771	198	22	468	78	286	735	123	288	1089	601
RTOR Reduction (vph)	0	0	117	0	0	63	0	9	0	0	0	44
Lane Group Flow (vph)	742	771	81	22	468	15	286	849	0	288	1089	557
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA		Prot	NA	pm+ov
Protected Phases	3	8		7	4		1	6		5	2	3
Permitted Phases			8			4						2
Actuated Green, G (s)	28.0	49.0	49.0	3.5	24.5	24.5	21.0	36.5		25.6	41.1	69.1
Effective Green, g (s)	28.0	50.3	49.0	3.5	25.8	24.5	21.0	35.6		25.6	40.2	67.3
Actuated g/C Ratio	0.21	0.39	0.38	0.03	0.20	0.19	0.16	0.27		0.20	0.31	0.52
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	736	1363	593	47	699	296	284	943		346	1089	815
v/s Ratio Prot	c0.22	0.22		0.01	c0.13		c0.16	0.25		c0.16	c0.31	0.14
v/s Ratio Perm			0.05			0.01						0.21
v/c Ratio	1.01	0.57	0.14	0.47	0.67	0.05	1.01	0.90		0.83	1.00	0.68
Uniform Delay, d1	51.3	31.6	26.9	62.6	48.5	43.5	54.8	45.8		50.4	45.2	23.7
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	35.2	0.5	0.1	7.2	2.4	0.1	55.2	11.3		15.6	27.3	2.4
Delay (s)	86.5	32.1	27.0	69.8	50.9	43.6	110.0	57.1		66.0	72.5	26.1
Level of Service	F	C	C	E	D	D	F	E		E	E	C
Approach Delay (s)		55.1			50.6			70.3			57.4	
Approach LOS		E			D			E			E	

Intersection Summary

HCM 2000 Control Delay	58.7	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	0.93		
Actuated Cycle Length (s)	130.6	Sum of lost time (s)	16.5
Intersection Capacity Utilization	87.8%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
40: First St/Springtown Blvd & I-580 WB Ramps

BART to Livermore Extension Project
2040 BART PM















Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations			↗↘			↗	↗↘	↑			↗↘	↗
Traffic Volume (vph)	0	0	262	0	0	0	385	1439	0	0	421	173
Future Volume (vph)	0	0	262	0	0	0	385	1439	0	0	421	173
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)			4.5				4.5	4.0			4.5	4.5
Lane Util. Factor			0.88				0.97	1.00			0.95	1.00
Frt			0.85				1.00	1.00			1.00	0.85
Flt Protected			1.00				0.95	1.00			1.00	1.00
Satd. Flow (prot)			2787				3433	1863			3539	1583
Flt Permitted			1.00				0.95	1.00			1.00	1.00
Satd. Flow (perm)			2787				3433	1863			3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	285	0	0	0	418	1564	0	0	458	188
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	9
Lane Group Flow (vph)	0	0	285	0	0	0	418	1564	0	0	458	179
Turn Type			Over			Free	Prot	NA			NA	Perm
Protected Phases			5				5	2			6	
Permitted Phases						Free						6
Actuated Green, G (s)			21.0				21.0	140.0			111.0	111.0
Effective Green, g (s)			20.5				20.5	140.0			110.5	110.5
Actuated g/C Ratio			0.15				0.15	1.00			0.79	0.79
Clearance Time (s)			4.0				4.0	4.0			4.0	4.0
Vehicle Extension (s)			2.0				2.0	0.2			4.0	4.0
Lane Grp Cap (vph)			408				502	1863			2793	1249
v/s Ratio Prot			0.10				0.12	c0.84			0.13	
v/s Ratio Perm												0.11
v/c Ratio			0.70				0.83	0.84			0.16	0.14
Uniform Delay, d1			56.8				58.1	0.0			3.6	3.5
Progression Factor			1.00				1.07	1.00			1.00	1.00
Incremental Delay, d2			4.2				1.1	0.5			0.1	0.2
Delay (s)			61.0				63.5	0.5			3.7	3.7
Level of Service			E				E	A			A	A
Approach Delay (s)		61.0			0.0			13.8			3.7	
Approach LOS		E			A			B			A	

Intersection Summary

HCM 2000 Control Delay	16.1	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.90		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	79.1%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 41: First St & I-580 EB Ramps

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕	↗↘					↕↕	↗	↘	↕↕	
Traffic Volume (vph)	534	3	714	0	0	0	0	1683	444	99	1258	0
Future Volume (vph)	534	3	714	0	0	0	0	1683	444	99	1258	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0					5.0	5.0	5.0	5.0	
Lane Util. Factor		1.00	0.88					0.95	1.00	1.00	0.95	
Frt		1.00	0.85					1.00	0.85	1.00	1.00	
Flt Protected		0.95	1.00					1.00	1.00	0.95	1.00	
Satd. Flow (prot)		1774	2787					3539	1583	1770	3539	
Flt Permitted		0.95	1.00					1.00	1.00	0.95	1.00	
Satd. Flow (perm)		1774	2787					3539	1583	1770	3539	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	580	3	776	0	0	0	0	1829	483	108	1367	0
RTOR Reduction (vph)	0	0	66	0	0	0	0	0	142	0	0	0
Lane Group Flow (vph)	0	583	710	0	0	0	0	1829	341	108	1367	0
Turn Type	Perm	NA	Perm					NA	Perm	Prot	NA	
Protected Phases		4						2		1	6	
Permitted Phases	4		4						2			
Actuated Green, G (s)		45.5	45.5					72.5	72.5	10.0	86.5	
Effective Green, g (s)		45.0	45.0					72.0	72.0	9.0	86.0	
Actuated g/C Ratio		0.32	0.32					0.51	0.51	0.06	0.61	
Clearance Time (s)		3.5	3.5					4.5	4.5	4.0	4.5	
Vehicle Extension (s)		2.5	2.5					4.0	4.0	2.0	4.0	
Lane Grp Cap (vph)		570	895					1820	814	113	2173	
v/s Ratio Prot								c0.52		c0.06	0.39	
v/s Ratio Perm		0.33	0.25						0.22			
v/c Ratio		1.02	0.79					1.00	0.42	0.96	0.63	
Uniform Delay, d1		47.5	43.3					34.0	21.1	65.3	17.0	
Progression Factor		1.00	1.00					1.00	1.00	0.89	0.72	
Incremental Delay, d2		43.6	4.7					22.3	1.6	69.4	1.4	
Delay (s)		91.1	48.0					56.3	22.6	127.7	13.6	
Level of Service		F	D					E	C	F	B	
Approach Delay (s)		66.5			0.0			49.3			22.0	
Approach LOS		E			A			D			C	

Intersection Summary			
HCM 2000 Control Delay	46.0	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	1.01		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	14.0
Intersection Capacity Utilization	93.4%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
42: 1st St & Mines Rd

























Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	69	262	87	452	248	278	93	1577	1025	383	1247	56
Future Volume (vph)	69	262	87	452	248	278	93	1577	1025	383	1247	56
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	0.97	1.00	1.00	1.00	0.91	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	1863	1583	3433	1863	1583	1770	5085	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	1863	1583	3433	1863	1583	1770	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	75	285	95	491	270	302	101	1714	1114	416	1355	61
RTOR Reduction (vph)	0	0	82	0	0	31	0	0	153	0	0	29
Lane Group Flow (vph)	75	285	13	491	270	271	101	1714	961	416	1355	32
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8	1	5	2		1	NA	6
Permitted Phases			4			8			2			6
Actuated Green, G (s)	6.4	16.8	16.8	14.0	24.4	36.4	11.1	62.0	62.0	12.0	62.9	62.9
Effective Green, g (s)	6.4	16.8	16.8	14.0	24.4	36.4	11.1	62.0	62.0	12.0	62.9	62.9
Actuated g/C Ratio	0.05	0.14	0.14	0.12	0.20	0.30	0.09	0.51	0.51	0.10	0.52	0.52
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	93	259	220	397	376	529	162	2609	812	341	2647	824
v/s Ratio Prot	0.04	c0.15		c0.14	0.14	0.05	0.06	0.34		c0.12	0.27	
v/s Ratio Perm			0.01			0.12			c0.61			0.02
v/c Ratio	0.81	1.10	0.06	1.24	0.72	0.51	0.62	0.66	1.18	1.22	0.51	0.04
Uniform Delay, d1	56.6	52.0	45.1	53.4	45.0	34.9	52.8	21.6	29.4	54.4	18.9	14.2
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	38.1	85.4	0.1	126.5	6.4	0.8	7.3	0.6	95.1	122.6	0.2	0.0
Delay (s)	94.7	137.4	45.3	179.9	51.4	35.7	60.1	22.2	124.5	177.0	19.1	14.2
Level of Service	F	F	D	F	D	D	E	C	F	F	B	B
Approach Delay (s)		111.2			106.3			62.4			54.8	
Approach LOS		F			F			E			D	
Intersection Summary												
HCM 2000 Control Delay			71.1		HCM 2000 Level of Service				E			
HCM 2000 Volume to Capacity ratio			1.18									
Actuated Cycle Length (s)			120.8	Sum of lost time (s)				16.0				
Intersection Capacity Utilization			98.2%	ICU Level of Service				F				
Analysis Period (min)			15									

c Critical Lane Group























HCM Unsignalized Intersection Capacity Analysis
 43: Vasco Rd & I-580 WB Ramps

BART to Livermore Extension Project
 2040 BART PM

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations								  			  		
Traffic Volume (veh/h)	0	0	0	0	0	161	0	2476	0	0	612	0	
Future Volume (Veh/h)	0	0	0	0	0	161	0	2476	0	0	612	0	
Sign Control	Stop		Stop		Free		Free						
Grade	0%		0%		0%		0%						
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	
Hourly flow rate (vph)	0	0	0	0	0	175	0	2691	0	0	665	0	
Pedestrians													
Lane Width (ft)													
Walking Speed (ft/s)													
Percent Blockage													
Right turn flare (veh)													
Median type							None						
Median storage (veh)													
Upstream signal (ft)												524	
pX, platoon unblocked													
vC, conflicting volume	1737	3356	222	2913	3356	897	665			2691			
vC1, stage 1 conf vol													
vC2, stage 2 conf vol													
vCu, unblocked vol	1737	3356	222	2913	3356	897	665			2691			
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1			
tC, 2 stage (s)													
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2			
p0 queue free %	100	100	100	100	100	38	100			100			
cM capacity (veh/h)	21	8	782	7	8	283	920			151			
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	NB 4	SB 1	SB 2	SB 3	SB 4			
Volume Total	0	175	897	897	897	0	222	222	222	0			
Volume Left	0	0	0	0	0	0	0	0	0	0			
Volume Right	0	175	0	0	0	0	0	0	0	0			
cSH	1700	283	1700	1700	1700	1700	1700	1700	1700	1700			
Volume to Capacity	0.00	0.62	0.53	0.53	0.53	0.00	0.13	0.13	0.13	0.00			
Queue Length 95th (ft)	0	95	0	0	0	0	0	0	0	0			
Control Delay (s)	0.0	36.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
Lane LOS	A	E											
Approach Delay (s)	0.0	36.4	0.0					0.0					
Approach LOS	A	E											
Intersection Summary													
Average Delay			1.8										
Intersection Capacity Utilization			64.5%		ICU Level of Service				C				
Analysis Period (min)			15										

HCM Unsignalized Intersection Capacity Analysis
 44: Vasco Rd & I-580 EB Ramps

BART to Livermore Extension Project
 2040 BART PM

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations								  			  		
Traffic Volume (veh/h)	0	0	0	0	0	0	0	2851	0	64	769	0	
Future Volume (Veh/h)	0	0	0	0	0	0	0	2851	0	64	769	0	
Sign Control		Stop			Stop			Free			Free		
Grade		0%			0%			0%			0%		
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	
Hourly flow rate (vph)	0	0	0	0	0	0	0	3099	0	70	836	0	
Pedestrians													
Lane Width (ft)													
Walking Speed (ft/s)													
Percent Blockage													
Right turn flare (veh)													
Median type							None						
Median storage veh													
Upstream signal (ft)													
pX, platoon unblocked													
vC, conflicting volume	2009	4075	279	3518	4075	1033	836					3099	
vC1, stage 1 conf vol													
vC2, stage 2 conf vol													
vCu, unblocked vol	2009	4075	279	3518	4075	1033	836					3099	
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1					4.1	
tC, 2 stage (s)													
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2					2.2	
p0 queue free %	100	100	100	100	100	100	100					32	
cM capacity (veh/h)	16	1	719	1	1	230	794					103	
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	NB 4	SB 1	SB 2	SB 3	SB 4			
Volume Total	0	0	1033	1033	1033	0	70	279	279	279			
Volume Left	0	0	0	0	0	0	70	0	0	0			
Volume Right	0	0	0	0	0	0	0	0	0	0			
cSH	1700	1700	1700	1700	1700	1700	103	1700	1700	1700			
Volume to Capacity	0.00	0.00	0.61	0.61	0.61	0.00	0.68	0.16	0.16	0.16			
Queue Length 95th (ft)	0	0	0	0	0	0	86	0	0	0			
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	93.8	0.0	0.0	0.0			
Lane LOS	A	A					F						
Approach Delay (s)	0.0	0.0	0.0					7.3					
Approach LOS	A	A											
Intersection Summary													
Average Delay			1.6										
Intersection Capacity Utilization			58.4%		ICU Level of Service				B				
Analysis Period (min)			15										

HCM Signalized Intersection Capacity Analysis
45: Vasco Rd & East Ave

BART to Livermore Extension Project
2040 BART PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	769	37	119	129	405	283	108	389	12	15	389	493
Future Volume (vph)	769	37	119	129	405	283	108	389	12	15	389	493
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	0.95		0.97	1.00	1.00
Frt	1.00	0.89		1.00	0.94		1.00	1.00		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	3134		1770	3321		1770	3523		3433	1863	1583
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1770	3134		1770	3321		1770	3523		3433	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	836	40	129	140	440	308	117	423	13	16	423	536
RTOR Reduction (vph)	0	69	0	0	105	0	0	1	0	0	0	410
Lane Group Flow (vph)	836	100	0	140	643	0	117	435	0	16	423	126
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												6
Actuated Green, G (s)	51.0	56.9		14.1	20.0		7.0	33.8		1.6	28.4	28.4
Effective Green, g (s)	51.0	56.9		14.1	20.0		7.0	33.8		1.6	28.4	28.4
Actuated g/C Ratio	0.42	0.46		0.12	0.16		0.06	0.28		0.01	0.23	0.23
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	737	1456		203	542		101	972		44	432	367
v/s Ratio Prot	c0.47	0.03		0.08	c0.19		c0.07	0.12		0.00	c0.23	
v/s Ratio Perm												0.08
v/c Ratio	1.13	0.07		0.69	1.19		1.16	0.45		0.36	0.98	0.34
Uniform Delay, d1	35.7	18.1		52.0	51.2		57.7	36.6		59.9	46.7	39.2
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	76.7	0.0		9.4	101.0		138.4	0.3		5.1	37.4	0.6
Delay (s)	112.4	18.1		61.4	152.2		196.1	36.9		64.9	84.1	39.8
Level of Service	F	B		E	F		F	D		E	F	D
Approach Delay (s)		96.5			137.9			70.6			59.4	
Approach LOS		F			F			E			E	

Intersection Summary

HCM 2000 Control Delay	92.5	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.10		
Actuated Cycle Length (s)	122.4	Sum of lost time (s)	16.0
Intersection Capacity Utilization	102.7%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
46: Greenville Rd & I-580 WB Ramps

BART to Livermore Extension Project
2040 BART PM
























Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↖↗		↖		↕↕	↖		↕↔	
Traffic Volume (vph)	0	0	0	106	0	35	0	1316	571	0	165	26
Future Volume (vph)	0	0	0	106	0	35	0	1316	571	0	165	26
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0		4.0		4.0	4.0		4.0	
Lane Util. Factor				0.97		1.00		0.95	1.00		0.95	
Frt				1.00		0.85		1.00	0.85		0.98	
Flt Protected				0.95		1.00		1.00	1.00		1.00	
Satd. Flow (prot)				3433		1583		3539	1583		3467	
Flt Permitted				0.95		1.00		1.00	1.00		1.00	
Satd. Flow (perm)				3433		1583		3539	1583		3467	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	115	0	38	0	1430	621	0	179	28
RTOR Reduction (vph)	0	0	0	0	0	35	0	0	80	0	4	0
Lane Group Flow (vph)	0	0	0	115	0	3	0	1430	541	0	203	0
Turn Type				Prot		Prot		NA	Perm		NA	
Protected Phases				3		3		2			6	
Permitted Phases									2			
Actuated Green, G (s)				10.0		10.0		122.0	122.0		122.0	
Effective Green, g (s)				10.0		10.0		122.0	122.0		122.0	
Actuated g/C Ratio				0.07		0.07		0.87	0.87		0.87	
Clearance Time (s)				4.0		4.0		4.0	4.0		4.0	
Vehicle Extension (s)				3.0		3.0		3.0	3.0		3.0	
Lane Grp Cap (vph)				245		113		3083	1379		3021	
v/s Ratio Prot				c0.03		0.00		c0.40			0.06	
v/s Ratio Perm									0.34			
v/c Ratio				0.47		0.02		0.46	0.39		0.07	
Uniform Delay, d1				62.5		60.5		1.9	1.8		1.2	
Progression Factor				1.00		1.00		0.68	0.42		1.00	
Incremental Delay, d2				1.4		0.1		0.5	0.8		0.0	
Delay (s)				63.9		60.5		1.8	1.5		1.3	
Level of Service				E		E		A	A		A	
Approach Delay (s)		0.0			63.0			1.7			1.3	
Approach LOS		A			E			A			A	

Intersection Summary			
HCM 2000 Control Delay	5.6	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.46		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	46.4%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
47: Greenville Rd & I-580 EB Ramps

BART to Livermore Extension Project
2040 BART PM

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations	 							 			 		
Traffic Volume (vph)	195	0	113	0	0	0	0	1375	431	0	201	65	
Future Volume (vph)	195	0	113	0	0	0	0	1375	431	0	201	65	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)	4.0		4.0					4.0	4.0		4.0	4.0	
Lane Util. Factor	0.97		1.00					0.95	1.00		0.95	1.00	
Frt	1.00		0.85					1.00	0.85		1.00	0.85	
Flt Protected	0.95		1.00					1.00	1.00		1.00	1.00	
Satd. Flow (prot)	3433		1583					3539	1583		3539	1583	
Flt Permitted	0.95		1.00					1.00	1.00		1.00	1.00	
Satd. Flow (perm)	3433		1583					3539	1583		3539	1583	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	
Adj. Flow (vph)	212	0	123	0	0	0	0	1495	468	0	218	71	
RTOR Reduction (vph)	0	0	111	0	0	0	0	0	73	0	0	11	
Lane Group Flow (vph)	212	0	12	0	0	0	0	1495	395	0	218	60	
Turn Type	Prot		Prot					NA	Perm		NA	Perm	
Protected Phases	7		7					2			6		
Permitted Phases									2			6	
Actuated Green, G (s)	13.9		13.9					118.1	118.1		118.1	118.1	
Effective Green, g (s)	13.9		13.9					118.1	118.1		118.1	118.1	
Actuated g/C Ratio	0.10		0.10					0.84	0.84		0.84	0.84	
Clearance Time (s)	4.0		4.0					4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0		3.0					3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	340		157					2985	1335		2985	1335	
v/s Ratio Prot	c0.06		0.01					c0.42			0.06		
v/s Ratio Perm									0.25			0.04	
v/c Ratio	0.62		0.08					0.50	0.30		0.07	0.04	
Uniform Delay, d1	60.5		57.2					3.0	2.3		1.8	1.8	
Progression Factor	1.00		1.00					0.77	0.64		0.60	0.08	
Incremental Delay, d2	3.5		0.2					0.5	0.5		0.0	0.1	
Delay (s)	64.1		57.4					2.8	1.9		1.1	0.2	
Level of Service	E		E					A	A		A	A	
Approach Delay (s)		61.6			0.0			2.6			0.9		
Approach LOS		E			A			A			A		
Intersection Summary													
HCM 2000 Control Delay			10.0									HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio			0.51										
Actuated Cycle Length (s)			140.0									Sum of lost time (s)	8.0
Intersection Capacity Utilization			50.2%									ICU Level of Service	A
Analysis Period (min)			15										

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
48: Greenville Rd & Northfront Road/Altamont Pass Road



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↗	↖	↑	↘	↗
Traffic Volume (vph)	555	180	2	73	267	1240
Future Volume (vph)	555	180	2	73	267	1240
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	1863	1583	1770	1863	1770	1583
Flt Permitted	1.00	1.00	0.11	1.00	0.95	1.00
Satd. Flow (perm)	1863	1583	196	1863	1770	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	603	196	2	79	290	1348
RTOR Reduction (vph)	0	75	0	0	0	18
Lane Group Flow (vph)	603	121	2	79	290	1330
Turn Type	NA	Perm	Perm	NA	Perm	Perm
Protected Phases	4			8		
Permitted Phases		4	8		2	2
Actuated Green, G (s)	38.0	38.0	38.0	38.0	94.0	94.0
Effective Green, g (s)	38.0	38.0	38.0	38.0	94.0	94.0
Actuated g/C Ratio	0.27	0.27	0.27	0.27	0.67	0.67
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	505	429	53	505	1188	1062
v/s Ratio Prot	c0.32			0.04		
v/s Ratio Perm		0.08	0.01		0.16	c0.84
v/c Ratio	1.19	0.28	0.04	0.16	0.24	1.25
Uniform Delay, d1	51.0	40.2	37.5	38.8	9.0	23.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	105.5	0.4	0.3	0.1	0.1	121.4
Delay (s)	156.5	40.6	37.8	39.0	9.1	144.4
Level of Service	F	D	D	D	A	F
Approach Delay (s)	128.1			38.9	120.5	
Approach LOS	F			D	F	

Intersection Summary

HCM 2000 Control Delay	120.2	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.23		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	112.7%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
49: Greenville Rd & Southfront Rd



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	404	109	230	1339	170	144
Future Volume (vph)	404	109	230	1339	170	144
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.2	5.2	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.88	0.97	0.95	0.95	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	3433	2787	3433	3539	3539	1583
Flt Permitted	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (perm)	3433	2787	3433	3539	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	439	118	250	1455	185	157
RTOR Reduction (vph)	0	95	0	0	0	83
Lane Group Flow (vph)	439	23	250	1455	185	74
Turn Type	Prot	Perm	Prot	NA	NA	Perm
Protected Phases	8		1	6	2	
Permitted Phases		8				2
Actuated Green, G (s)	14.5	14.5	10.0	45.2	31.2	31.2
Effective Green, g (s)	13.9	13.9	10.0	46.9	32.9	32.9
Actuated g/C Ratio	0.20	0.20	0.14	0.67	0.47	0.47
Clearance Time (s)	4.6	4.6	4.0	5.7	5.7	5.7
Vehicle Extension (s)	5.0	5.0	6.0	2.5	2.5	2.5
Lane Grp Cap (vph)	681	553	490	2371	1663	744
v/s Ratio Prot	c0.13		0.07	c0.41	0.05	
v/s Ratio Perm		0.01				0.05
v/c Ratio	0.64	0.04	0.51	0.61	0.11	0.10
Uniform Delay, d1	25.8	22.7	27.7	6.5	10.4	10.3
Progression Factor	1.00	1.00	1.00	1.00	0.72	0.65
Incremental Delay, d2	2.9	0.1	2.4	1.2	0.1	0.3
Delay (s)	28.6	22.7	30.1	7.7	7.6	7.0
Level of Service	C	C	C	A	A	A
Approach Delay (s)	27.4			11.0	7.3	
Approach LOS	C			B	A	

Intersection Summary

HCM 2000 Control Delay	14.0	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.66		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	13.2
Intersection Capacity Utilization	56.2%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
50: Greenville Rd & Patterson Pass Rd

BART to Livermore Extension Project
2040 BART PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	40	555	66	6	12	8	66	474	349	417	215	39
Future Volume (vph)	40	555	66	6	12	8	66	474	349	417	215	39
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.98		1.00	0.94		1.00	0.94		1.00	0.98	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1833		1770	1748		1770	1744		1770	1820	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	1833		1770	1748		1770	1744		1770	1820	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	43	603	72	7	13	9	72	515	379	453	234	42
RTOR Reduction (vph)	0	4	0	0	7	0	0	28	0	0	6	0
Lane Group Flow (vph)	43	671	0	7	15	0	72	866	0	453	270	0
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												
Actuated Green, G (s)	7.0	23.0		0.7	16.7		6.8	33.9		14.0	41.1	
Effective Green, g (s)	7.0	23.0		0.7	16.7		6.8	33.9		14.0	41.1	
Actuated g/C Ratio	0.08	0.26		0.01	0.19		0.08	0.39		0.16	0.47	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	141	481		14	333		137	674		282	853	
v/s Ratio Prot	c0.02	c0.37		0.00	0.01		0.04	c0.50		c0.26	0.15	
v/s Ratio Perm												
v/c Ratio	0.30	1.39		0.50	0.04		0.53	1.28		1.61	0.32	
Uniform Delay, d1	38.0	32.3		43.3	28.9		38.8	26.8		36.8	14.5	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	1.2	189.7		25.4	0.1		3.6	139.2		288.8	1.0	
Delay (s)	39.2	222.0		68.7	29.0		42.5	166.0		325.6	15.5	
Level of Service	D	F		E	C		D	F		F	B	
Approach Delay (s)		211.1			38.6			156.8			208.2	
Approach LOS		F			D			F			F	

Intersection Summary

HCM 2000 Control Delay	186.7	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.38		
Actuated Cycle Length (s)	87.6	Sum of lost time (s)	16.0
Intersection Capacity Utilization	112.6%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
1: Dougherty Rd & Amador Valley Rd



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	103	855	480	841	2243	130
Future Volume (vph)	103	855	480	841	2243	130
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00	0.97	0.91	0.91	
Frt	1.00	0.85	1.00	1.00	0.99	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1770	1583	3433	5085	5044	
Flt Permitted	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	1770	1583	3433	5085	5044	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	112	929	522	914	2438	141
RTOR Reduction (vph)	0	141	0	0	5	0
Lane Group Flow (vph)	112	788	522	914	2574	0
Turn Type	Perm	Perm	Prot	NA	NA	
Protected Phases			5	2	6	
Permitted Phases	4	4				
Actuated Green, G (s)	44.0	44.0	13.0	68.0	51.0	
Effective Green, g (s)	44.0	44.0	13.0	68.0	51.0	
Actuated g/C Ratio	0.37	0.37	0.11	0.57	0.42	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	649	580	371	2881	2143	
v/s Ratio Prot			c0.15	0.18	c0.51	
v/s Ratio Perm	0.06	c0.50				
v/c Ratio	0.17	1.36	1.41	0.32	1.20	
Uniform Delay, d1	25.7	38.0	53.5	13.7	34.5	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.1	172.7	198.6	0.1	95.2	
Delay (s)	25.8	210.7	252.1	13.8	129.7	
Level of Service	C	F	F	B	F	
Approach Delay (s)	190.8			100.4	129.7	
Approach LOS	F			F	F	

Intersection Summary

HCM 2000 Control Delay	134.0	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.29		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	105.8%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

2: Hopyard Road/Dougherty Rd & Dublin Blvd

BART to Livermore Extension Project
2040 DMU AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	54	540	507	326	828	481	706	1102	146	1064	2226	107
Future Volume (vph)	54	540	507	326	828	481	706	1102	146	1064	2226	107
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	6.0	5.0	5.0	5.5	5.0	5.0	5.5	5.0	5.0	5.5	
Lane Util. Factor	0.97	0.91	0.88	0.94	0.91	1.00	0.94	0.91	0.88	0.97	0.86	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	3433	5085	2787	4990	5085	1583	4990	5085	2787	3433	6364	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	3433	5085	2787	4990	5085	1583	4990	5085	2787	3433	6364	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	59	587	551	354	900	523	767	1198	159	1157	2420	116
RTOR Reduction (vph)	0	0	64	0	0	81	0	0	60	0	4	0
Lane Group Flow (vph)	59	587	487	354	900	442	767	1198	99	1157	2532	0
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	
Protected Phases	5	2	3	1	6	7	3	8	1	7	4	
Permitted Phases			2			6			8			
Actuated Green, G (s)	12.0	31.1	47.1	15.0	34.6	62.0	16.0	45.0	60.0	27.4	56.4	
Effective Green, g (s)	12.0	31.1	47.1	15.0	34.6	62.0	16.0	45.0	60.0	27.4	56.4	
Actuated g/C Ratio	0.09	0.22	0.34	0.11	0.25	0.44	0.11	0.32	0.43	0.20	0.40	
Clearance Time (s)	5.0	6.0	5.0	5.0	5.5	5.0	5.0	5.5	5.0	5.0	5.5	
Vehicle Extension (s)	2.0	4.5	2.0	2.0	4.5	2.0	2.0	4.5	2.0	2.0	4.5	
Lane Grp Cap (vph)	294	1129	937	534	1256	701	570	1634	1194	671	2563	
v/s Ratio Prot	0.02	c0.12	0.06	0.07	c0.18	0.12	c0.15	0.24	0.01	c0.34	c0.40	
v/s Ratio Perm			0.12			0.16			0.03			
v/c Ratio	0.20	0.52	0.52	0.66	0.72	0.63	1.35	0.73	0.08	1.72	0.99	
Uniform Delay, d1	59.5	47.9	37.3	60.1	48.2	30.2	62.0	42.2	23.7	56.3	41.5	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	0.82	0.74	0.69	1.00	1.00	
Incremental Delay, d2	0.1	1.7	0.2	2.4	3.5	1.4	164.7	1.6	0.0	332.2	14.9	
Delay (s)	59.7	49.6	37.6	62.5	51.7	31.5	215.3	32.6	16.3	388.5	56.4	
Level of Service	E	D	D	E	D	C	F	C	B	F	E	
Approach Delay (s)		44.5			47.9			97.3			160.4	
Approach LOS		D			D			F			F	

Intersection Summary

HCM 2000 Control Delay	106.7	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.07		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	21.5
Intersection Capacity Utilization	97.6%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 3: Dougherty Rd/Hopyard Road & I-580 WB Ramps



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↔↔		↔↔		↑↑↑			↑↑↑	↔
Traffic Volume (vph)	0	0	0	396	0	637	0	1731	0	0	2183	0
Future Volume (vph)	0	0	0	396	0	637	0	1731	0	0	2183	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0		4.0		4.0			4.0	
Lane Util. Factor				0.97		0.88		0.91			0.86	
Frt				1.00		0.85		1.00			1.00	
Flt Protected				0.95		1.00		1.00			1.00	
Satd. Flow (prot)				3433		2787		5085			4806	
Flt Permitted				0.95		1.00		1.00			1.00	
Satd. Flow (perm)				3433		2787		5085			4806	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	430	0	692	0	1882	0	0	2373	0
RTOR Reduction (vph)	0	0	0	0	0	22	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	430	0	670	0	1882	0	0	2373	0
Turn Type				Prot		Prot		NA			NA	Perm
Protected Phases				4		4		2			6	
Permitted Phases												6
Actuated Green, G (s)				39.1		39.1		90.1			90.1	
Effective Green, g (s)				40.5		40.5		91.5			91.5	
Actuated g/C Ratio				0.29		0.29		0.65			0.65	
Clearance Time (s)				5.4		5.4		5.4			5.4	
Vehicle Extension (s)				3.0		3.0		3.0			3.0	
Lane Grp Cap (vph)				993		806		3323			3141	
v/s Ratio Prot				0.13		c0.24		0.37			c0.49	
v/s Ratio Perm												
v/c Ratio				0.43		0.83		0.57			0.76	
Uniform Delay, d1				40.4		46.6		13.3			16.6	
Progression Factor				1.00		1.00		0.94			0.41	
Incremental Delay, d2				0.3		7.3		0.6			0.8	
Delay (s)				40.7		53.9		13.2			7.6	
Level of Service				D		D		B			A	
Approach Delay (s)		0.0			48.8			13.2			7.6	
Approach LOS		A			D			B			A	

Intersection Summary

HCM 2000 Control Delay	18.2	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.78		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	62.4%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
4: Hopyard Rd/Dougherty Rd & I-580 EB Ramps

BART to Livermore Extension Project
2040 DMU AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↖		↗↗					↑↑↑	↗		↑↑↑	↗
Traffic Volume (vph)	896	0	1432	0	0	0	0	927	0	0	1780	0
Future Volume (vph)	896	0	1432	0	0	0	0	927	0	0	1780	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0					4.0			4.0	
Lane Util. Factor	0.97		0.88					0.91			0.86	
Frt	1.00		0.85					1.00			1.00	
Flt Protected	0.95		1.00					1.00			1.00	
Satd. Flow (prot)	3433		2787					5085			4806	
Flt Permitted	0.95		1.00					1.00			1.00	
Satd. Flow (perm)	3433		2787					5085			4806	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	974	0	1557	0	0	0	0	1008	0	0	1935	0
RTOR Reduction (vph)	0	0	9	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	974	0	1548	0	0	0	0	1008	0	0	1935	0
Turn Type	Prot		Prot					NA	Free		NA	Perm
Protected Phases	4		4					2			6	
Permitted Phases									Free			6
Actuated Green, G (s)	72.6		72.6					56.6			56.6	
Effective Green, g (s)	74.0		74.0					58.0			58.0	
Actuated g/C Ratio	0.53		0.53					0.41			0.41	
Clearance Time (s)	5.4		5.4					5.4			5.4	
Vehicle Extension (s)	3.0		3.0					3.0			3.0	
Lane Grp Cap (vph)	1814		1473					2106			1991	
v/s Ratio Prot	0.28		c0.56					0.20			c0.40	
v/s Ratio Perm												
v/c Ratio	0.54		1.05					0.48			0.97	
Uniform Delay, d1	21.7		33.0					30.0			40.2	
Progression Factor	1.00		1.00					1.00			0.99	
Incremental Delay, d2	0.3		38.1					0.8			11.5	
Delay (s)	22.0		71.1					30.7			51.2	
Level of Service	C		E					C			D	
Approach Delay (s)		52.2			0.0			30.7			51.2	
Approach LOS		D			A			C			D	

Intersection Summary

HCM 2000 Control Delay	47.9	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	1.02		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	91.2%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
5: Hopyard Rd & Owens Rd

BART to Livermore Extension Project
2040 DMU AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	203	96	51	133	135	237	148	847	173	937	1781	544
Future Volume (vph)	203	96	51	133	135	237	148	847	173	937	1781	544
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	2.7	2.7		2.7	2.7	2.7	4.0	2.3	2.3	4.0	2.3	
Lane Util. Factor	0.91	0.91		1.00	0.95	0.95	1.00	0.91	1.00	0.97	0.91	
Frt	1.00	0.97		1.00	0.95	0.85	1.00	1.00	0.85	1.00	0.96	
Flt Protected	0.95	0.98		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1610	3220		1770	1676	1504	1770	5085	1583	3433	4907	
Flt Permitted	0.95	0.98		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1610	3220		1770	1676	1504	1770	5085	1583	3433	4907	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	221	104	55	145	147	258	161	921	188	1018	1936	591
RTOR Reduction (vph)	0	26	0	0	22	31	0	0	131	0	61	0
Lane Group Flow (vph)	122	232	0	145	205	148	161	921	57	1018	2466	0
Turn Type	Split	NA		Split	NA	pm+ov	Prot	NA	Perm	Prot	NA	
Protected Phases	8	8		4	4	1	5	2		1	6	
Permitted Phases						4			2			
Actuated Green, G (s)	6.0	6.0		10.0	10.0	42.4	9.0	25.6	25.6	32.4	49.0	
Effective Green, g (s)	7.3	7.3		11.3	11.3	45.0	9.0	27.3	27.3	32.4	50.7	
Actuated g/C Ratio	0.08	0.08		0.13	0.13	0.50	0.10	0.30	0.30	0.36	0.56	
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	130	261		222	210	797	177	1542	480	1235	2764	
v/s Ratio Prot	c0.08	0.07		0.08	c0.12	0.07	0.09	0.18		c0.30	c0.50	
v/s Ratio Perm						0.03			0.04			
v/c Ratio	0.94	0.89		0.65	0.98	0.19	0.91	0.60	0.12	0.82	0.89	
Uniform Delay, d1	41.1	41.0		37.5	39.2	12.4	40.1	26.7	22.7	26.2	17.2	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	59.5	28.6		6.7	54.9	0.1	42.2	1.7	0.5	4.6	4.9	
Delay (s)	100.7	69.5		44.2	94.1	12.5	82.3	28.4	23.2	30.8	22.1	
Level of Service	F	E		D	F	B	F	C	C	C	C	
Approach Delay (s)		79.5			54.6			34.4			24.6	
Approach LOS		E			D			C			C	

Intersection Summary

HCM 2000 Control Delay	33.3	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.92		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	11.7
Intersection Capacity Utilization	86.8%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
6: Hopyard Rd & Stoneridge Dr

BART to Livermore Extension Project
2040 DMU AM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	220	790	471	68	985	133	629	824	71	295	1024	292
Future Volume (vph)	220	790	471	68	985	133	629	824	71	295	1024	292
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.91	1.00	0.97	0.91	1.00	0.94	0.95	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5085	1583	3433	5085	1583	4990	3539	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5085	1583	3433	5085	1583	4990	3539	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	239	859	512	74	1071	145	684	896	77	321	1113	317
RTOR Reduction (vph)	0	0	202	0	0	104	0	0	54	0	0	127
Lane Group Flow (vph)	239	859	310	74	1071	41	684	896	23	321	1113	190
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8			2			6
Actuated Green, G (s)	4.0	19.1	19.1	2.4	17.5	17.5	8.0	18.0	18.0	6.0	16.0	16.0
Effective Green, g (s)	4.0	19.1	19.1	2.4	17.5	17.5	8.0	18.0	18.0	6.0	16.0	16.0
Actuated g/C Ratio	0.07	0.31	0.31	0.04	0.28	0.28	0.13	0.29	0.29	0.10	0.26	0.26
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	223	1579	491	133	1446	450	649	1035	463	334	1322	411
v/s Ratio Prot	c0.07	0.17		0.02	c0.21		c0.14	c0.25		0.09	0.22	
v/s Ratio Perm			0.20			0.03			0.01			0.12
v/c Ratio	1.07	0.54	0.63	0.56	0.74	0.09	1.05	0.87	0.05	0.96	0.84	0.46
Uniform Delay, d1	28.8	17.6	18.2	29.0	19.9	16.2	26.8	20.6	15.6	27.6	21.6	19.1
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	80.6	0.4	2.6	5.0	2.1	0.1	50.4	7.7	0.0	38.8	5.0	0.8
Delay (s)	109.3	18.0	20.8	34.0	22.0	16.3	77.1	28.3	15.7	66.4	26.6	20.0
Level of Service	F	B	C	C	C	B	E	C	B	E	C	B
Approach Delay (s)		32.4			22.1			47.9			32.7	
Approach LOS		C			C			D			C	

Intersection Summary

HCM 2000 Control Delay	34.4	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.89		
Actuated Cycle Length (s)	61.5	Sum of lost time (s)	16.0
Intersection Capacity Utilization	70.4%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
7: Hopyard Rd & Las Positas Blvd

BART to Livermore Extension Project
2040 DMU AM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	154	486	406	358	454	54	460	1209	396	114	1076	95
Future Volume (vph)	154	486	406	358	454	54	460	1209	396	114	1076	95
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.95	1.00	0.97	0.95	1.00	0.97	0.91	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	3433	3539	1583	3433	5085	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	3433	3539	1583	3433	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	167	528	441	389	493	59	500	1314	430	124	1170	103
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	73
Lane Group Flow (vph)	167	528	441	389	493	59	500	1314	430	124	1170	30
Turn Type	Prot	NA	Free	Prot	NA	Free	Prot	NA	Free	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			Free			Free			Free			6
Actuated Green, G (s)	6.9	14.5	69.4	8.0	15.6	69.4	11.0	27.7	69.4	3.2	19.9	19.9
Effective Green, g (s)	6.9	14.5	69.4	8.0	15.6	69.4	11.0	27.7	69.4	3.2	19.9	19.9
Actuated g/C Ratio	0.10	0.21	1.00	0.12	0.22	1.00	0.16	0.40	1.00	0.05	0.29	0.29
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	341	739	1583	395	795	1583	544	2029	1583	158	1458	453
v/s Ratio Prot	0.05	c0.15		c0.11	0.14		c0.15	0.26		0.04	c0.23	
v/s Ratio Perm			c0.28			0.04			0.27			0.02
v/c Ratio	0.49	0.71	0.28	0.98	0.62	0.04	0.92	0.65	0.27	0.78	0.80	0.07
Uniform Delay, d1	29.6	25.5	0.0	30.6	24.2	0.0	28.8	16.9	0.0	32.8	22.9	18.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.1	3.3	0.4	40.9	1.5	0.0	20.6	0.7	0.4	22.1	3.3	0.1
Delay (s)	30.7	28.8	0.4	71.6	25.7	0.0	49.3	17.6	0.4	54.8	26.2	18.1
Level of Service	C	C	A	E	C	A	D	B	A	D	C	B
Approach Delay (s)		18.1			43.1			21.4			28.2	
Approach LOS		B			D			C			C	

Intersection Summary

HCM 2000 Control Delay	26.0	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.84		
Actuated Cycle Length (s)	69.4	Sum of lost time (s)	16.0
Intersection Capacity Utilization	70.9%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
8: Willow Rd & Owens Rd

BART to Livermore Extension Project
2040 DMU AM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	126	456	243	110	349	81	117	98	0	106	85	88
Future Volume (vph)	126	456	243	110	349	81	117	98	0	106	85	88
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	5.3	4.0		5.3	4.0	4.0
Lane Util. Factor	0.97	0.91		0.97	0.91	1.00	1.00	0.95		1.00	1.00	1.00
Frt	1.00	0.95		1.00	1.00	0.85	1.00	1.00		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	4820		3433	5085	1583	1770	3539		1770	1863	1583
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.70	1.00		0.68	1.00	1.00
Satd. Flow (perm)	3433	4820		3433	5085	1583	1299	3539		1275	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	137	496	264	120	379	88	127	107	0	115	92	96
RTOR Reduction (vph)	0	130	0	0	0	52	0	0	0	0	0	76
Lane Group Flow (vph)	137	630	0	120	379	36	127	107	0	115	92	20
Turn Type	Prot	NA		Prot	NA	Perm	Perm	NA	Perm	Perm	NA	Perm
Protected Phases	1	6		5	2			4			8	
Permitted Phases						2	4		4	8		8
Actuated Green, G (s)	4.5	16.6		3.8	15.9	15.9	7.9	7.9		7.9	7.9	7.9
Effective Green, g (s)	4.5	18.3		3.8	17.6	17.6	7.9	9.2		7.9	9.2	9.2
Actuated g/C Ratio	0.10	0.42		0.09	0.41	0.41	0.18	0.21		0.18	0.21	0.21
Clearance Time (s)	4.0	5.7		4.0	5.7	5.7	5.3	5.3		5.3	5.3	5.3
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	356	2037		301	2066	643	237	751		232	395	336
v/s Ratio Prot	0.04	c0.13		c0.03	0.07			0.03			0.05	
v/s Ratio Perm						0.02	c0.10			0.09		0.01
v/c Ratio	0.38	0.31		0.40	0.18	0.06	0.54	0.14		0.50	0.23	0.06
Uniform Delay, d1	18.1	8.3		18.7	8.2	7.8	16.0	13.8		15.9	14.1	13.6
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	0.7	0.1		0.9	0.0	0.0	2.3	0.1		1.7	0.3	0.1
Delay (s)	18.8	8.4		19.5	8.3	7.8	18.4	13.9		17.6	14.4	13.7
Level of Service	B	A		B	A	A	B	B		B	B	B
Approach Delay (s)		10.0			10.5			16.3			15.4	
Approach LOS		A			B			B			B	

Intersection Summary		
HCM 2000 Control Delay	11.7	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.36	B
Actuated Cycle Length (s)	43.3	Sum of lost time (s)
Intersection Capacity Utilization	40.7%	12.0
Analysis Period (min)	15	ICU Level of Service
		A

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
9: Hacienda Dr & Dublin Blvd

BART to Livermore Extension Project
2040 DMU AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↑↑↑	↖↗	↖↗	↑↑↑		↖↗	↑↑	↖↗	↖↗	↑↑↑	↖↗
Traffic Volume (vph)	87	388	119	283	764	78	186	711	125	11	397	132
Future Volume (vph)	87	388	119	283	764	78	186	711	125	11	397	132
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	6.0	5.0	4.5	6.0		5.0	6.0	6.0	4.5	5.5	5.5
Lane Util. Factor	0.97	0.91	0.88	0.97	0.91		0.94	0.95	0.88	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5085	2787	3433	5014		4990	3539	2787	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5085	2787	3433	5014		4990	3539	2787	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	95	422	129	308	830	85	202	773	136	12	432	143
RTOR Reduction (vph)	0	0	53	0	8	0	0	0	98	0	0	124
Lane Group Flow (vph)	95	422	76	308	907	0	202	773	38	12	432	19
Turn Type	Prot	NA	pm+ov	Prot	NA		Prot	NA	Perm	Prot	NA	Perm
Protected Phases	5	2	3	1	6		3	8		7	NA	4
Permitted Phases			2						8			4
Actuated Green, G (s)	9.2	59.7	82.7	17.7	68.2		23.0	39.0	39.0	2.6	18.6	18.6
Effective Green, g (s)	9.2	59.7	82.7	17.7	68.2		23.0	39.0	39.0	2.6	18.6	18.6
Actuated g/C Ratio	0.07	0.43	0.59	0.13	0.49		0.16	0.28	0.28	0.02	0.13	0.13
Clearance Time (s)	4.5	6.0	5.0	4.5	6.0		5.0	6.0	6.0	4.5	5.5	5.5
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	225	2168	1646	434	2442		819	985	776	63	675	210
v/s Ratio Prot	0.03	0.08	0.01	c0.09	c0.18		0.04	c0.22		0.00	c0.08	
v/s Ratio Perm			0.02						0.01			0.01
v/c Ratio	0.42	0.19	0.05	0.71	0.37		0.25	0.78	0.05	0.19	0.64	0.09
Uniform Delay, d1	62.8	25.1	12.1	58.7	22.5		51.0	46.6	36.9	67.7	57.5	53.3
Progression Factor	1.00	1.00	1.00	1.00	1.00		0.79	0.78	0.43	1.00	1.00	1.00
Incremental Delay, d2	1.3	0.2	0.0	5.3	0.4		0.2	4.1	0.0	1.5	2.1	0.2
Delay (s)	64.1	25.3	12.1	63.9	22.9		40.5	40.3	15.9	69.1	59.6	53.5
Level of Service	E	C	B	E	C		D	D	B	E	E	D
Approach Delay (s)		28.4			33.2			37.3			58.3	
Approach LOS		C			C			D			E	

Intersection Summary

HCM 2000 Control Delay	37.8	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.58		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	21.0
Intersection Capacity Utilization	60.3%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 10: Hacienda Dr & Martinelli Blvd/Hacienda Crossings



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗	↖↗	↖↗	↗		↖↗	↑↑↑	↗	↖↗	↑↑↑	
Traffic Volume (vph)	16	11	226	107	13	9	255	979	109	17	736	54
Future Volume (vph)	16	11	226	107	13	9	255	979	109	17	736	54
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	2.0	2.0	4.5	2.0		3.0	2.0	2.0	4.5	2.5	
Lane Util. Factor	1.00	0.91	0.91	0.97	1.00		0.94	0.91	1.00	0.97	0.86	
Frt	1.00	0.90	0.85	1.00	0.94		1.00	1.00	0.85	1.00	0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1770	1523	2882	3433	1746		4990	5085	1583	3433	6342	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1770	1523	2882	3433	1746		4990	5085	1583	3433	6342	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	17	12	246	116	14	10	277	1064	118	18	800	59
RTOR Reduction (vph)	0	23	199	0	9	0	0	0	25	0	4	0
Lane Group Flow (vph)	17	15	22	116	15	0	277	1064	93	18	855	0
Turn Type	Prot	NA	Perm	Prot	NA		Prot	NA	pm+ov	Prot	NA	
Protected Phases	5	2		1	6		3	8	1	7	4	
Permitted Phases			2						8			
Actuated Green, G (s)	4.8	12.0	12.0	11.5	18.7		13.1	95.2	106.7	5.3	87.4	
Effective Green, g (s)	4.3	14.0	14.0	11.0	20.7		14.1	97.2	110.7	4.8	88.9	
Actuated g/C Ratio	0.03	0.10	0.10	0.08	0.15		0.10	0.69	0.79	0.03	0.64	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	4.0	4.0	2.0	4.0		3.0	4.0	2.0	3.0	4.0	
Lane Grp Cap (vph)	54	152	288	269	258		502	3530	1274	117	4027	
v/s Ratio Prot	0.01	c0.01		c0.03	0.01		c0.06	c0.21	0.01	0.01	c0.13	
v/s Ratio Perm			0.01						0.05			
v/c Ratio	0.31	0.10	0.08	0.43	0.06		0.55	0.30	0.07	0.15	0.21	
Uniform Delay, d1	66.4	57.2	57.1	61.5	51.3		59.9	8.3	3.3	65.6	10.8	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.01	1.05	2.05	0.77	0.15	
Incremental Delay, d2	3.3	0.4	0.2	0.4	0.1		1.2	0.2	0.0	0.6	0.1	
Delay (s)	69.7	57.6	57.3	61.9	51.4		61.9	8.9	6.7	50.8	1.7	
Level of Service	E	E	E	E	D		E	A	A	D	A	
Approach Delay (s)		58.1			60.1			18.8			2.7	
Approach LOS		E			E			B			A	

Intersection Summary		
HCM 2000 Control Delay	19.7	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.32	B
Actuated Cycle Length (s)	140.0	Sum of lost time (s)
Intersection Capacity Utilization	44.3%	13.0
Analysis Period (min)	15	ICU Level of Service
		A

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 11: Hacienda Dr & I-580 WB Ramps

BART to Livermore Extension Project
 2040 DMU AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↔↔		↔↔		↑↑↑			↑↑↑	↔
Traffic Volume (vph)	0	0	0	253	0	450	0	1255	305	0	729	416
Future Volume (vph)	0	0	0	253	0	450	0	1255	305	0	729	416
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				2.6		2.6		2.1			2.1	2.1
Lane Util. Factor				0.97		0.88		0.91			0.86	0.86
Frt				1.00		0.85		0.97			0.97	0.85
Flt Protected				0.95		1.00		1.00			1.00	1.00
Satd. Flow (prot)				3433		2787		4936			4646	1362
Flt Permitted				0.95		1.00		1.00			1.00	1.00
Satd. Flow (perm)				3433		2787		4936			4646	1362
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	275	0	489	0	1364	332	0	792	452
RTOR Reduction (vph)	0	0	0	0	0	68	0	47	0	0	54	72
Lane Group Flow (vph)	0	0	0	275	0	422	0	1649	0	0	964	154
Turn Type				Prot		Prot		NA			NA	Perm
Protected Phases				4		4		2			6	
Permitted Phases												6
Actuated Green, G (s)				16.1		16.1		45.9			45.9	45.9
Effective Green, g (s)				17.5		17.5		47.8			47.8	47.8
Actuated g/C Ratio				0.25		0.25		0.68			0.68	0.68
Clearance Time (s)				4.0		4.0		4.0			4.0	4.0
Vehicle Extension (s)				3.0		3.0		3.0			3.0	3.0
Lane Grp Cap (vph)				858		696		3370			3172	930
v/s Ratio Prot				0.08		c0.15		c0.33			0.21	
v/s Ratio Perm												0.11
v/c Ratio				0.32		0.61		0.49			0.30	0.17
Uniform Delay, d1				21.4		23.2		5.3			4.4	4.0
Progression Factor				1.00		1.00		0.65			0.48	0.82
Incremental Delay, d2				0.2		1.5		0.5			0.2	0.4
Delay (s)				21.6		24.7		3.9			2.4	3.6
Level of Service				C		C		A			A	A
Approach Delay (s)		0.0			23.6			3.9			2.6	
Approach LOS		A			C			A			A	

Intersection Summary		
HCM 2000 Control Delay	7.5	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.52	A
Actuated Cycle Length (s)	70.0	Sum of lost time (s)
Intersection Capacity Utilization	53.5%	4.7
Analysis Period (min)	15	ICU Level of Service
		A

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 12: Hacienda Dr & I-580 EB Ramps



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔↔		↔↔					↑↑↑	↔		↑↑↑	
Traffic Volume (vph)	819	0	1169	0	0	0	0	704	166	0	1037	199
Future Volume (vph)	819	0	1169	0	0	0	0	704	166	0	1037	199
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0					4.0	4.0		4.0	
Lane Util. Factor	0.97		0.88					0.86	0.86		0.91	
Frt	1.00		0.85					0.99	0.85		0.98	
Flt Protected	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (prot)	3433		2787					4757	1362		4963	
Flt Permitted	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (perm)	3433		2787					4757	1362		4963	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	890	0	1271	0	0	0	0	765	180	0	1127	216
RTOR Reduction (vph)	0	0	25	0	0	0	0	11	74	0	41	0
Lane Group Flow (vph)	890	0	1246	0	0	0	0	810	50	0	1302	0
Turn Type	Prot		Prot					NA	Perm		NA	
Protected Phases	4		4					2			6	
Permitted Phases									2			
Actuated Green, G (s)	32.5		32.5					26.2	26.2		26.2	
Effective Green, g (s)	33.9		33.9					28.1	28.1		28.1	
Actuated g/C Ratio	0.48		0.48					0.40	0.40		0.40	
Clearance Time (s)	5.4		5.4					5.9	5.9		5.9	
Vehicle Extension (s)	2.0		2.0					2.0	2.0		2.0	
Lane Grp Cap (vph)	1662		1349					1909	546		1992	
v/s Ratio Prot	0.26		c0.45					0.17			c0.26	
v/s Ratio Perm									0.04			
v/c Ratio	0.54		0.92					0.42	0.09		0.65	
Uniform Delay, d1	12.6		16.8					15.1	13.0		17.0	
Progression Factor	1.00		1.00					1.00	1.00		0.87	
Incremental Delay, d2	0.2		10.6					0.7	0.3		1.7	
Delay (s)	12.7		27.4					15.8	13.3		16.4	
Level of Service	B		C					B	B		B	
Approach Delay (s)		21.4			0.0			15.5			16.4	
Approach LOS		C			A			B			B	

Intersection Summary	
HCM 2000 Control Delay	18.6 HCM 2000 Level of Service B
HCM 2000 Volume to Capacity ratio	0.80
Actuated Cycle Length (s)	70.0 Sum of lost time (s) 8.0
Intersection Capacity Utilization	72.0% ICU Level of Service C
Analysis Period (min)	15

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 13: Hacienda Dr & Owens Rd

BART to Livermore Extension Project
 2040 DMU AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖ ↗	↑ ↑ ↑	↖	↖ ↗	↑ ↑ ↑	↖	↖ ↗	↑ ↑ ↑	↖	↖ ↗	↑ ↑ ↑	↖
Traffic Volume (vph)	154	259	24	144	430	453	26	311	136	682	919	597
Future Volume (vph)	154	259	24	144	430	453	26	311	136	682	919	597
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	2.3	4.0	4.0	2.3	4.0	4.0	2.7	4.0	4.0	2.7
Lane Util. Factor	0.97	0.91	1.00	0.97	0.91	1.00	0.97	0.91	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5085	1583	3433	5085	1583	3433	5085	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5085	1583	3433	5085	1583	3433	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	167	282	26	157	467	492	28	338	148	741	999	649
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	167	282	26	157	467	492	28	338	148	741	999	649
Turn Type	Prot	NA	Free	Prot	NA	Free	Prot	NA	Free	Prot	NA	Free
Protected Phases	1	6		5	2		7	4		3	8	
Permitted Phases			Free			Free			Free			Free
Actuated Green, G (s)	11.9	16.9	115.0	11.3	16.3	115.0	4.2	33.2	115.0	34.6	63.6	115.0
Effective Green, g (s)	11.9	18.6	115.0	11.3	18.0	115.0	4.2	34.5	115.0	34.6	64.9	115.0
Actuated g/C Ratio	0.10	0.16	1.00	0.10	0.16	1.00	0.04	0.30	1.00	0.30	0.56	1.00
Clearance Time (s)	4.0	5.7		4.0	5.7		4.0	5.3		4.0	5.3	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	355	822	1583	337	795	1583	125	1525	1583	1032	2869	1583
v/s Ratio Prot	0.05	0.06		0.05	c0.09		0.01	0.07		c0.22	0.20	
v/s Ratio Perm			0.02			0.31			0.09			c0.41
v/c Ratio	0.47	0.34	0.02	0.47	0.59	0.31	0.22	0.22	0.09	0.72	0.35	0.41
Uniform Delay, d1	48.6	42.8	0.0	49.0	45.1	0.0	53.8	30.2	0.0	35.8	13.6	0.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.0	0.3	0.0	1.0	1.1	0.5	0.9	0.3	0.1	2.4	0.3	0.8
Delay (s)	49.6	43.0	0.0	50.0	46.2	0.5	54.7	30.5	0.1	38.3	13.9	0.8
Level of Service	D	D	A	D	D	A	D	C	A	D	B	A
Approach Delay (s)		43.0			26.6			23.1			17.9	
Approach LOS		D			C			C			B	

Intersection Summary

HCM 2000 Control Delay	23.3	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.58		
Actuated Cycle Length (s)	115.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	51.5%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
14: Tassajara Rd & Dublin Blvd





















Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	102	201	143	588	1073	60	258	496	173	35	1164	312
Future Volume (vph)	102	201	143	588	1073	60	258	496	173	35	1164	312
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	6.0	6.0	5.0	6.0		5.0	6.0	6.0	5.0	5.7	5.7
Lane Util. Factor	0.97	0.86	0.88	0.94	0.91		0.94	0.86	1.00	0.97	0.86	0.88
Frt	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	6408	2787	4990	5045		4990	6408	1583	3433	6408	2787
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	6408	2787	4990	5045		4990	6408	1583	3433	6408	2787
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	111	218	155	639	1166	65	280	539	188	38	1265	339
RTOR Reduction (vph)	0	0	115	0	4	0	0	0	138	0	0	239
Lane Group Flow (vph)	111	218	40	639	1227	0	280	539	50	38	1265	100
Turn Type	Prot	NA	Perm	Prot	NA		Prot	NA	Perm	Prot	NA	Perm
Protected Phases	5	2		1	6		3	8		7	NA	4
Permitted Phases			2						8			4
Actuated Green, G (s)	16.1	36.6	36.6	22.4	42.9		18.4	37.2	37.2	22.4	41.5	41.5
Effective Green, g (s)	16.1	36.6	36.6	22.4	42.9		18.4	37.2	37.2	22.4	41.5	41.5
Actuated g/C Ratio	0.11	0.26	0.26	0.16	0.31		0.13	0.26	0.26	0.16	0.30	0.30
Clearance Time (s)	5.0	6.0	6.0	5.0	6.0		5.0	6.0	6.0	5.0	5.7	5.7
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	393	1668	725	794	1539		653	1695	418	546	1891	822
v/s Ratio Prot	0.03	0.03		c0.13	c0.24		c0.06	0.08		c0.01	c0.20	
v/s Ratio Perm			0.01						0.03			0.04
v/c Ratio	0.28	0.13	0.06	0.80	0.80		0.43	0.32	0.12	0.07	0.67	0.12
Uniform Delay, d1	57.0	39.8	39.0	57.0	44.9		56.3	41.5	39.3	50.2	43.5	36.2
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.4	0.0	0.0	6.0	3.0		0.5	0.1	0.1	0.1	0.9	0.1
Delay (s)	57.4	39.9	39.1	62.9	47.8		56.7	41.6	39.4	50.3	44.4	36.3
Level of Service	E	D	D	E	D		E	D	D	D	D	D
Approach Delay (s)		43.6			53.0			45.4			42.9	
Approach LOS		D			D			D			D	

Intersection Summary

HCM 2000 Control Delay	47.2	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.71		
Actuated Cycle Length (s)	140.6	Sum of lost time (s)	22.0
Intersection Capacity Utilization	83.7%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 15: Tassajara Rd & I-580 WB Ramps

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations													
Traffic Volume (vph)	0	0	0	586	0	295	0	1192	476	0	1035	935	
Future Volume (vph)	0	0	0	586	0	295	0	1192	476	0	1035	935	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)				4.0		4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor				0.97		0.88		0.95	1.00		0.86	0.86	
Frt				1.00		0.85		1.00	0.85		0.95	0.85	
Flt Protected				0.95		1.00		1.00	1.00		1.00	1.00	
Satd. Flow (prot)				3433		2787		3539	1583		4582	1362	
Flt Permitted				0.95		1.00		1.00	1.00		1.00	1.00	
Satd. Flow (perm)				3433		2787		3539	1583		4582	1362	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	
Adj. Flow (vph)	0	0	0	637	0	321	0	1296	517	0	1125	1016	
RTOR Reduction (vph)	0	0	0	0	0	68	0	0	196	0	103	193	
Lane Group Flow (vph)	0	0	0	637	0	253	0	1296	321	0	1530	315	
Turn Type				Perm		Perm		NA	Perm		NA	Perm	
Protected Phases								2			6		
Permitted Phases				8		8			2			6	
Actuated Green, G (s)				18.6		18.6		43.4	43.4		43.4	43.4	
Effective Green, g (s)				18.6		18.6		43.4	43.4		43.4	43.4	
Actuated g/C Ratio				0.27		0.27		0.62	0.62		0.62	0.62	
Clearance Time (s)				4.0		4.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)				3.0		3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)				912		740		2194	981		2840	844	
v/s Ratio Prot								c0.37			0.33		
v/s Ratio Perm				c0.19		0.09			0.20			0.23	
v/c Ratio				0.70		0.34		0.59	0.33		0.54	0.37	
Uniform Delay, d1				23.2		20.8		8.0	6.3		7.6	6.6	
Progression Factor				1.00		1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2				2.4		0.3		1.2	0.9		0.7	1.3	
Delay (s)				25.5		21.0		9.2	7.2		8.3	7.8	
Level of Service				C		C		A	A		A	A	
Approach Delay (s)		0.0			24.0			8.6			8.2		
Approach LOS		A			C			A			A		
Intersection Summary													
HCM 2000 Control Delay			11.4		HCM 2000 Level of Service					B			
HCM 2000 Volume to Capacity ratio			0.62										
Actuated Cycle Length (s)			70.0		Sum of lost time (s)					8.0			
Intersection Capacity Utilization			56.3%		ICU Level of Service					B			
Analysis Period (min)			15										
c Critical Lane Group													

HCM Signalized Intersection Capacity Analysis
 16: Santa Rita Rd & I-580 EB Ramps/Pimilco Dr

BART to Livermore Extension Project
 2040 DMU AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	562	119	745	187	0	187	0	891	123	185	1333	0
Future Volume (vph)	562	119	745	187	0	187	0	891	123	185	1333	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0		4.0		4.0		4.0	4.0	
Lane Util. Factor	0.97	1.00	1.00	0.97		0.88		0.86		1.00	0.95	
Frt	1.00	1.00	0.85	1.00		0.85		0.98		1.00	1.00	
Flt Protected	0.95	1.00	1.00	0.95		1.00		1.00		0.95	1.00	
Satd. Flow (prot)	3433	1863	1583	3433		2787		6291		1770	3539	
Flt Permitted	0.95	1.00	1.00	0.95		1.00		1.00		0.95	1.00	
Satd. Flow (perm)	3433	1863	1583	3433		2787		6291		1770	3539	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	611	129	810	203	0	203	0	968	134	201	1449	0
RTOR Reduction (vph)	0	0	0	0	0	71	0	42	0	0	0	0
Lane Group Flow (vph)	611	129	810	203	0	132	0	1060	0	201	1449	0
Turn Type	Perm	NA	Free	Prot		pm+ov		NA		Prot	NA	Perm
Protected Phases		4		3		1		2		1	6	
Permitted Phases	4		Free			3						6
Actuated Green, G (s)	14.9	14.9	60.0	4.6		13.0		16.1		8.4	28.5	
Effective Green, g (s)	14.9	14.9	60.0	4.6		13.0		16.1		8.4	28.5	
Actuated g/C Ratio	0.25	0.25	1.00	0.08		0.22		0.27		0.14	0.48	
Clearance Time (s)	4.0	4.0		4.0		4.0		4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0		3.0		3.0		3.0	3.0	
Lane Grp Cap (vph)	852	462	1583	263		603		1688		247	1681	
v/s Ratio Prot		0.07		0.06		0.03		0.17		0.11	c0.41	
v/s Ratio Perm	c0.18		c0.51			0.02						
v/c Ratio	0.72	0.28	0.51	0.77		0.22		0.63		0.81	0.86	
Uniform Delay, d1	20.6	18.2	0.0	27.2		19.3		19.3		25.0	14.0	
Progression Factor	1.00	1.00	1.00	1.00		1.00		1.00		1.00	1.00	
Incremental Delay, d2	2.9	0.3	1.2	13.1		0.2		1.8		18.2	6.1	
Delay (s)	23.5	18.5	1.2	40.3		19.5		21.1		43.2	20.1	
Level of Service	C	B	A	D		B		C		D	C	
Approach Delay (s)		11.4			29.9			21.1			22.9	
Approach LOS		B			C			C			C	

Intersection Summary

HCM 2000 Control Delay	19.3	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.90		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	59.5%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 17: Santa Rita Rd & Valley Ave

BART to Livermore Extension Project
 2040 DMU AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔↔	↑↑	↗	↖	↑↑	↗	↔↔	↑↑		↔↔	↑↑	↗
Traffic Volume (vph)	209	255	85	192	445	919	128	541	84	588	890	189
Future Volume (vph)	209	255	85	192	445	919	128	541	84	588	890	189
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.97	0.95		0.97	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.98		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	3433	3468		3433	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	3433	3468		3433	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	227	277	92	209	484	999	139	588	91	639	967	205
RTOR Reduction (vph)	0	0	75	0	0	0	0	17	0	0	0	123
Lane Group Flow (vph)	227	277	17	209	484	999	139	662	0	639	967	82
Turn Type	Prot	NA	Perm	Prot	NA	Free	Prot	NA		Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1		6
Permitted Phases			4			Free						6
Actuated Green, G (s)	8.6	13.2	13.2	10.1	14.7	72.2	3.9	17.9		15.0	29.0	29.0
Effective Green, g (s)	8.6	13.2	13.2	10.1	14.7	72.2	3.9	17.9		15.0	29.0	29.0
Actuated g/C Ratio	0.12	0.18	0.18	0.14	0.20	1.00	0.05	0.25		0.21	0.40	0.40
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	408	647	289	247	720	1583	185	859		713	1421	635
v/s Ratio Prot	0.07	0.08		c0.12	0.14		0.04	0.19		c0.19	c0.27	
v/s Ratio Perm			0.01			c0.63						0.05
v/c Ratio	0.56	0.43	0.06	0.85	0.67	0.63	0.75	0.77		0.90	0.68	0.13
Uniform Delay, d1	30.0	26.2	24.4	30.3	26.5	0.0	33.7	25.2		27.8	17.8	13.6
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	1.6	0.5	0.1	22.5	2.5	1.9	15.7	4.3		13.9	1.4	0.1
Delay (s)	31.6	26.6	24.5	52.8	29.0	1.9	49.4	29.6		41.7	19.1	13.7
Level of Service	C	C	C	D	C	A	D	C		D	B	B
Approach Delay (s)		28.2			16.0			32.9			26.5	
Approach LOS		C			B			C			C	

Intersection Summary

HCM 2000 Control Delay	24.1	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.85		
Actuated Cycle Length (s)	72.2	Sum of lost time (s)	16.0
Intersection Capacity Utilization	66.0%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 18: Bernal Ave/Valley Ave & Stanley Blvd

BART to Livermore Extension Project
 2040 DMU AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↗↘	↑↑	↗	↗↘	↑↑	↗	↗	↑↑	↗	↗↘	↑↑	
Traffic Volume (vph)	218	204	55	249	895	956	174	480	101	141	366	124
Future Volume (vph)	218	204	55	249	895	956	174	480	101	141	366	124
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	0.97	0.95	1.00	0.97	0.91	0.91	1.00	0.95	1.00	0.97	0.95	
Frt	1.00	1.00	0.85	1.00	0.96	0.85	1.00	1.00	0.85	1.00	0.96	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	3433	3539	1583	3433	3238	1441	1770	3539	1583	3433	3405	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	3433	3539	1583	3433	3238	1441	1770	3539	1583	3433	3405	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	237	222	60	271	973	1039	189	522	110	153	398	135
RTOR Reduction (vph)	0	0	30	0	47	28	0	0	87	0	37	0
Lane Group Flow (vph)	237	222	30	271	1342	595	189	522	23	153	496	0
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	
Protected Phases	7	4	5	3	8	1	5	2		1	6	
Permitted Phases			4			8			2			
Actuated Green, G (s)	7.0	33.0	44.6	11.1	37.1	47.0	11.6	18.1	18.1	9.9	16.4	
Effective Green, g (s)	7.0	33.0	44.6	11.1	37.1	47.0	11.6	18.1	18.1	9.9	16.4	
Actuated g/C Ratio	0.08	0.37	0.51	0.13	0.42	0.53	0.13	0.21	0.21	0.11	0.19	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	272	1325	873	432	1363	834	233	727	325	385	633	
v/s Ratio Prot	c0.07	0.06	0.00	c0.08	c0.41	0.08	c0.11	c0.15		0.04	0.15	
v/s Ratio Perm			0.01			0.33			0.01			
v/c Ratio	0.87	0.17	0.03	0.63	0.98	0.71	0.81	0.72	0.07	0.40	0.78	
Uniform Delay, d1	40.1	18.4	10.9	36.5	25.2	15.5	37.2	32.6	28.2	36.3	34.2	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	24.8	0.1	0.0	2.8	20.6	2.9	18.9	3.4	0.1	0.7	6.3	
Delay (s)	64.9	18.4	10.9	39.4	45.8	18.4	56.1	36.0	28.3	37.0	40.4	
Level of Service	E	B	B	D	D	B	E	D	C	D	D	
Approach Delay (s)		38.8			37.6			39.6			39.7	
Approach LOS		D			D			D			D	

Intersection Summary

HCM 2000 Control Delay	38.4	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.90		
Actuated Cycle Length (s)	88.1	Sum of lost time (s)	16.0
Intersection Capacity Utilization	78.2%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
19: Fallon Rd & Dublin Blvd/Croak Rd



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔↔	↑↑↑	↔↔	↔↔↔	↑↑↑	↔	↔↔↔	↑↑↑	↔↔	↔↔	↑↑↑	↔
Traffic Volume (vph)	49	76	93	342	1197	405	812	283	42	77	725	315
Future Volume (vph)	49	76	93	342	1197	405	812	283	42	77	725	315
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.91	0.88	0.94	0.91	1.00	0.94	0.91	0.88	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5085	2787	4990	5085	1583	4990	5085	2787	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5085	2787	4990	5085	1583	4990	5085	2787	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	53	83	101	372	1301	440	883	308	46	84	788	342
RTOR Reduction (vph)	0	0	71	0	0	289	0	0	25	0	0	71
Lane Group Flow (vph)	53	83	30	372	1301	151	883	308	21	84	788	271
Turn Type	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4	5	3	8		5	2		1	6	
Permitted Phases			4			8			2			6
Actuated Green, G (s)	4.6	12.0	41.9	40.7	48.1	48.1	29.9	64.3	64.3	7.0	41.4	41.4
Effective Green, g (s)	4.6	12.0	41.9	40.7	48.1	48.1	29.9	64.3	64.3	7.0	41.4	41.4
Actuated g/C Ratio	0.03	0.09	0.30	0.29	0.34	0.34	0.21	0.46	0.46	0.05	0.30	0.30
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	112	435	913	1450	1747	543	1065	2335	1280	171	1503	468
v/s Ratio Prot	c0.02	0.02	0.01	0.07	c0.26		c0.18	0.06		0.02	0.15	
v/s Ratio Perm			0.00			0.10			0.01			c0.17
v/c Ratio	0.47	0.19	0.03	0.26	0.74	0.28	0.83	0.13	0.02	0.49	0.52	0.58
Uniform Delay, d1	66.5	59.5	34.7	38.1	40.5	33.4	52.6	21.8	20.6	64.8	41.1	41.9
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	0.89	0.86	1.00	1.00	1.00	1.00
Incremental Delay, d2	3.1	0.2	0.0	0.1	1.8	0.3	5.1	0.1	0.0	2.2	1.3	5.1
Delay (s)	69.6	59.7	34.7	38.1	42.3	33.6	51.7	18.9	20.6	67.0	42.4	47.0
Level of Service	E	E	C	D	D	C	D	B	C	E	D	D
Approach Delay (s)		51.3			39.8			42.4			45.4	
Approach LOS		D			D			D			D	

Intersection Summary

HCM 2000 Control Delay	42.4	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.70		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	68.1%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
20: El Charro Rd/Fallon Rd & I-580 WB Ramps



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↙	↖	↗		↑↑↑	↗		↑↑↑	↗
Traffic Volume (vph)	0	0	0	200	0	614	0	815	478	0	650	399
Future Volume (vph)	0	0	0	200	0	614	0	815	478	0	650	399
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0	4.0	4.0		4.0	4.0		4.0	4.0
Lane Util. Factor				0.95	0.95	0.88		0.91	1.00		0.91	1.00
Frt				1.00	1.00	0.85		1.00	0.85		1.00	0.85
Flt Protected				0.95	0.95	1.00		1.00	1.00		1.00	1.00
Satd. Flow (prot)				1681	1681	2787		5085	1583		5085	1583
Flt Permitted				0.95	0.95	1.00		1.00	1.00		1.00	1.00
Satd. Flow (perm)				1681	1681	2787		5085	1583		5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	217	0	667	0	886	520	0	707	434
RTOR Reduction (vph)	0	0	0	0	0	137	0	0	192	0	0	160
Lane Group Flow (vph)	0	0	0	111	106	530	0	886	328	0	707	274
Turn Type				Perm	NA	Perm		NA	Perm		NA	Perm
Protected Phases					8			2			6	
Permitted Phases				8		8			2			6
Actuated Green, G (s)				18.3	18.3	18.3		44.2	44.2		44.2	44.2
Effective Green, g (s)				17.8	17.8	17.8		44.2	44.2		44.2	44.2
Actuated g/C Ratio				0.25	0.25	0.25		0.63	0.63		0.63	0.63
Clearance Time (s)				3.5	3.5	3.5		4.0	4.0		4.0	4.0
Vehicle Extension (s)				2.0	2.0	2.0		2.0	2.0		2.0	2.0
Lane Grp Cap (vph)				427	427	708		3210	999		3210	999
v/s Ratio Prot								0.17			0.14	
v/s Ratio Perm				0.07	0.06	c0.19			c0.21			0.17
v/c Ratio				0.26	0.25	0.75		0.28	0.33		0.22	0.27
Uniform Delay, d1				20.8	20.8	24.0		5.8	6.0		5.5	5.8
Progression Factor				1.00	1.00	1.00		0.79	0.60		0.51	2.33
Incremental Delay, d2				0.1	0.1	3.8		0.2	0.7		0.1	0.6
Delay (s)				21.0	20.9	27.8		4.7	4.4		2.9	14.1
Level of Service				C	C	C		A	A		A	B
Approach Delay (s)		0.0			26.1			4.6			7.2	
Approach LOS		A			C			A			A	

Intersection Summary

HCM 2000 Control Delay	11.0	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.45		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	43.9%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
21: El Charro Rd & I-580 EB Ramps

BART to Livermore Extension Project
2040 DMU AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗		↖↗					↕↔	↖		↕↔	↖
Traffic Volume (vph)	278	0	629	0	0	0	0	1317	434	0	499	0
Future Volume (vph)	278	0	629	0	0	0	0	1317	434	0	499	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0					4.0	4.0		4.0	
Lane Util. Factor	0.97		0.88					0.91	0.91		0.91	
Frt	1.00		0.85					0.99	0.85		1.00	
Flt Protected	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (prot)	3433		2787					3371	1441		3390	
Flt Permitted	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (perm)	3433		2787					3371	1441		3390	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	302	0	684	0	0	0	0	1432	472	0	542	0
RTOR Reduction (vph)	0	0	535	0	0	0	0	3	110	0	0	0
Lane Group Flow (vph)	302	0	149	0	0	0	0	1486	305	0	542	0
Turn Type	Prot		Perm					NA	Perm		NA	Perm
Protected Phases	4							2			6	
Permitted Phases			4						2			6
Actuated Green, G (s)	10.5		10.5					51.5	51.5		51.5	
Effective Green, g (s)	10.5		10.5					51.5	51.5		51.5	
Actuated g/C Ratio	0.15		0.15					0.74	0.74		0.74	
Clearance Time (s)	4.0		4.0					4.0	4.0		4.0	
Vehicle Extension (s)	2.0		2.0					3.0	3.0		3.0	
Lane Grp Cap (vph)	514		418					2480	1060		2494	
v/s Ratio Prot	c0.09							c0.44			0.16	
v/s Ratio Perm			0.05						0.21			
v/c Ratio	0.59		0.36					0.60	0.29		0.22	
Uniform Delay, d1	27.7		26.7					4.4	3.1		2.9	
Progression Factor	1.00		1.00					1.00	1.00		1.04	
Incremental Delay, d2	1.1		0.2					1.1	0.7		0.2	
Delay (s)	28.8		26.9					5.5	3.8		3.2	
Level of Service	C		C					A	A		A	
Approach Delay (s)		27.5			0.0			5.1			3.2	
Approach LOS		C			A			A			A	

Intersection Summary

HCM 2000 Control Delay	11.2	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.60		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	55.6%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 22: El Charro Rd & Stoneridge Dr/Jack London Blvd

BART to Livermore Extension Project
 2040 DMU AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔↔↔	↑↑	↗	↖	↑↑	↗↗	↖	↑↑		↖↖↖	↑	↗↗
Traffic Volume (vph)	91	133	16	64	617	760	32	544	29	327	211	109
Future Volume (vph)	91	133	16	64	617	760	32	544	29	327	211	109
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	0.94	0.95	1.00	1.00	0.95	0.88	1.00	0.95		0.94	1.00	0.88
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	4491	3185	1425	1593	3185	2508	1593	3161		4491	1676	2508
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	4491	3185	1425	1593	3185	2508	1593	3161		4491	1676	2508
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	99	145	17	70	671	826	35	591	32	355	229	118
RTOR Reduction (vph)	0	0	13	0	0	57	0	4	0	0	0	63
Lane Group Flow (vph)	99	145	4	70	671	769	35	619	0	355	229	55
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Prot	NA		Prot	NA	Perm
Protected Phases	7	4		3	8	1	5	2		1	6	
Permitted Phases			4			8						6
Actuated Green, G (s)	2.9	20.0	20.0	6.7	23.8	44.3	3.1	22.4		20.5	39.8	39.8
Effective Green, g (s)	2.9	20.0	20.0	6.7	23.8	44.3	3.1	22.4		20.5	39.8	39.8
Actuated g/C Ratio	0.03	0.23	0.23	0.08	0.28	0.52	0.04	0.26		0.24	0.46	0.46
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	152	744	332	124	885	1297	57	827		1075	779	1166
v/s Ratio Prot	0.02	0.05		c0.04	c0.21	c0.14	0.02	c0.20		0.08	0.14	
v/s Ratio Perm			0.00			0.16						0.02
v/c Ratio	0.65	0.19	0.01	0.56	0.76	0.59	0.61	0.75		0.33	0.29	0.05
Uniform Delay, d1	40.9	26.3	25.2	38.0	28.3	14.4	40.7	29.0		26.9	14.2	12.5
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	9.6	0.1	0.0	5.8	3.8	0.7	18.0	3.7		0.2	0.2	0.0
Delay (s)	50.4	26.5	25.2	43.8	32.0	15.1	58.7	32.8		27.1	14.4	12.5
Level of Service	D	C	C	D	C	B	E	C		C	B	B
Approach Delay (s)		35.5			23.6			34.1			20.5	
Approach LOS		D			C			C			C	

Intersection Summary		
HCM 2000 Control Delay	26.1	HCM 2000 Level of Service C
HCM 2000 Volume to Capacity ratio	0.71	
Actuated Cycle Length (s)	85.6	Sum of lost time (s) 16.0
Intersection Capacity Utilization	60.6%	ICU Level of Service B
Analysis Period (min)	15	

c Critical Lane Group



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	395	464	2688	100	25	120
Future Volume (vph)	395	464	2688	100	25	120
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95	0.91	1.00	0.97	0.88
Frt	1.00	1.00	1.00	0.85	1.00	0.85
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1770	3539	5085	1583	3433	2787
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1770	3539	5085	1583	3433	2787
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	429	504	2922	109	27	130
RTOR Reduction (vph)	0	0	0	25	0	122
Lane Group Flow (vph)	429	504	2922	84	27	8
Turn Type	Prot	NA	NA	Perm	Prot	Perm
Protected Phases	7	4	8		6	
Permitted Phases				8		6
Actuated Green, G (s)	27.0	96.0	65.0	65.0	6.6	6.6
Effective Green, g (s)	27.0	96.0	65.0	65.0	6.6	6.6
Actuated g/C Ratio	0.24	0.87	0.59	0.59	0.06	0.06
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	432	3071	2988	930	204	166
v/s Ratio Prot	c0.24	0.14	c0.57		c0.01	
v/s Ratio Perm				0.05		0.00
v/c Ratio	0.99	0.16	0.98	0.09	0.13	0.05
Uniform Delay, d1	41.7	1.1	22.1	9.9	49.3	49.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	41.3	0.0	11.7	0.0	0.3	0.1
Delay (s)	83.0	1.1	33.8	10.0	49.6	49.2
Level of Service	F	A	C	A	D	D
Approach Delay (s)		38.8	32.9		49.2	
Approach LOS		D	C		D	

Intersection Summary

HCM 2000 Control Delay	34.9	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.93		
Actuated Cycle Length (s)	110.6	Sum of lost time (s)	12.0
Intersection Capacity Utilization	87.2%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
24: Airway Blvd/Driveway & N Canyons Pkwy

BART to Livermore Extension Project
2040 DMU AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑	↑	↑↑	↑	↑		↑	↑↑		↑	
Traffic Volume (vph)	0	82	62	713	815	0	1055	0	966	0	0	0
Future Volume (vph)	0	82	62	713	815	0	1055	0	966	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		2.0	2.0	2.0	2.0			4.2	2.0			
Lane Util. Factor		0.95	1.00	0.97	1.00			1.00	0.88			
Frt		1.00	0.85	1.00	1.00			1.00	0.85			
Flt Protected		1.00	1.00	0.95	1.00			0.95	1.00			
Satd. Flow (prot)		3539	1583	3433	1863			1770	2787			
Flt Permitted		1.00	1.00	0.95	1.00			0.95	1.00			
Satd. Flow (perm)		3539	1583	3433	1863			1770	2787			
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	89	67	775	886	0	1147	0	1050	0	0	0
RTOR Reduction (vph)	0	0	60	0	0	0	0	0	68	0	0	0
Lane Group Flow (vph)	0	89	7	775	886	0	0	1147	982	0	0	0
Turn Type		NA	Perm	Prot	NA	Perm	Split	NA	pm+ov			
Protected Phases		2		1	6		8	8	1	4	4	
Permitted Phases			2			6			8			
Actuated Green, G (s)		10.1	10.1	33.9	48.0			64.0	97.9			
Effective Green, g (s)		12.1	12.1	35.9	50.0			63.8	101.9			
Actuated g/C Ratio		0.10	0.10	0.30	0.42			0.53	0.85			
Clearance Time (s)		4.0	4.0	4.0	4.0			4.0	4.0			
Vehicle Extension (s)		3.0	3.0	3.0	3.0			3.0	3.0			
Lane Grp Cap (vph)		356	159	1027	776			941	2413			
v/s Ratio Prot		0.03		0.23	c0.48			c0.65	0.12			
v/s Ratio Perm			0.00						0.23			
v/c Ratio		0.25	0.04	0.75	1.14			1.22	0.41			
Uniform Delay, d1		49.8	48.7	38.1	35.0			28.1	2.1			
Progression Factor		1.00	1.00	1.00	1.00			1.00	1.00			
Incremental Delay, d2		1.7	0.5	3.2	78.9			108.2	0.1			
Delay (s)		51.4	49.2	41.3	113.9			136.3	2.2			
Level of Service		D	D	D	F			F	A			
Approach Delay (s)		50.5			80.0			72.2			0.0	
Approach LOS		D			F			E			A	

Intersection Summary

HCM 2000 Control Delay	74.6	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.25		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	12.2
Intersection Capacity Utilization	108.2%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
25: Airway Blvd & I-580 WB Ramps



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↙	↖	↗		↕	↘		↕	↘
Traffic Volume (vph)	0	0	0	76	46	919	0	1209	343	0	311	550
Future Volume (vph)	0	0	0	76	46	919	0	1209	343	0	311	550
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0	4.0	4.0		4.0	4.0		4.0	
Lane Util. Factor				0.95	0.95	0.88		0.95	1.00		0.91	
Frt				1.00	1.00	0.85		1.00	0.85		0.90	
Flt Protected				0.95	0.98	1.00		1.00	1.00		1.00	
Satd. Flow (prot)				1681	1732	2787		3539	1583		4598	
Flt Permitted				0.95	0.98	1.00		1.00	1.00		1.00	
Satd. Flow (perm)				1681	1732	2787		3539	1583		4598	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	83	50	999	0	1314	373	0	338	598
RTOR Reduction (vph)	0	0	0	0	0	31	0	0	176	0	282	0
Lane Group Flow (vph)	0	0	0	44	89	968	0	1314	197	0	654	0
Turn Type				Split	NA	Perm		NA	Perm		NA	
Protected Phases				8	8			2			6	
Permitted Phases						8			2			
Actuated Green, G (s)				39.2	39.2	39.2		51.5	51.5		51.5	
Effective Green, g (s)				39.2	39.2	39.2		52.8	52.8		52.8	
Actuated g/C Ratio				0.39	0.39	0.39		0.53	0.53		0.53	
Clearance Time (s)				4.0	4.0	4.0		5.3	5.3		5.3	
Vehicle Extension (s)				2.0	2.0	2.0		4.0	4.0		4.0	
Lane Grp Cap (vph)				658	678	1092		1868	835		2427	
v/s Ratio Prot				0.03	0.05			c0.37			0.14	
v/s Ratio Perm						c0.35			0.12			
v/c Ratio				0.07	0.13	0.89		0.70	0.24		0.27	
Uniform Delay, d1				19.0	19.5	28.3		17.7	12.7		13.0	
Progression Factor				1.00	1.00	1.00		1.00	1.00		1.00	
Incremental Delay, d2				0.0	0.0	8.6		2.2	0.7		0.3	
Delay (s)				19.0	19.5	37.0		20.0	13.4		13.3	
Level of Service				B	B	D		B	B		B	
Approach Delay (s)		0.0			34.9			18.5			13.3	
Approach LOS		A			C			B			B	


























Intersection Summary

HCM 2000 Control Delay	22.1	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.78		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	72.2%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

26: Airway Blvd & I-580 EB Ramps/Kitty Hawk Rd



























												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 							 			 	
Traffic Volume (vph)	660	204	350	37	38	82	37	510	165	63	182	158
Future Volume (vph)	660	204	350	37	38	82	37	510	165	63	182	158
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.4	4.4	4.4	4.5	2.7		4.0	2.7	
Lane Util. Factor	0.97	1.00	1.00	1.00	1.00	1.00	1.00	0.95		1.00	0.95	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.96		1.00	0.93	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	3433	1863	1583	1770	1863	1583	1770	3410		1770	3292	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	3433	1863	1583	1770	1863	1583	1770	3410		1770	3292	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	717	222	380	40	41	89	40	554	179	68	198	172
RTOR Reduction (vph)	0	0	279	0	0	68	0	43	0	0	106	0
Lane Group Flow (vph)	717	222	101	40	41	21	40	690	0	68	264	0
Turn Type	Split	NA	Perm	Split	NA	pm+ov	Prot	NA		Prot	NA	
Protected Phases	7	7		8	8	1	5	2		1	6	
Permitted Phases			7			8						
Actuated Green, G (s)	22.7	22.7	22.7	11.2	11.2	20.7	3.6	25.6		9.5	31.5	
Effective Green, g (s)	22.7	22.7	22.7	10.8	10.8	19.9	3.1	26.9		9.5	32.8	
Actuated g/C Ratio	0.27	0.27	0.27	0.13	0.13	0.23	0.04	0.32		0.11	0.39	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Vehicle Extension (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	3.5		2.0	4.0	
Lane Grp Cap (vph)	916	497	422	224	236	452	64	1079		197	1270	
v/s Ratio Prot	c0.21	0.12		c0.02	0.02	0.00	0.02	c0.20		c0.04	0.08	
v/s Ratio Perm			0.06			0.01						
v/c Ratio	0.78	0.45	0.24	0.18	0.17	0.05	0.62	0.64		0.35	0.21	
Uniform Delay, d1	28.9	25.9	24.4	33.1	33.1	25.2	40.4	24.9		34.9	17.4	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	4.1	0.2	0.1	0.1	0.1	0.0	12.9	2.9		0.4	0.4	
Delay (s)	32.9	26.2	24.5	33.3	33.2	25.2	53.3	27.8		35.3	17.8	
Level of Service	C	C	C	C	C	C	D	C		D	B	
Approach Delay (s)		29.4			29.0			29.1			20.5	
Approach LOS		C			C			C			C	

Intersection Summary		
HCM 2000 Control Delay	27.8	HCM 2000 Level of Service C
HCM 2000 Volume to Capacity ratio	0.58	
Actuated Cycle Length (s)	85.0	Sum of lost time (s) 15.6
Intersection Capacity Utilization	63.9%	ICU Level of Service B
Analysis Period (min)	15	

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
27: Collier Canyon Rd & N Canyons Pkwy/Portola Ave

BART to Livermore Extension Project
2040 DMU AM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 	 			 							
Traffic Volume (vph)	267	188	99	150	843	57	73	8	100	58	14	201
Future Volume (vph)	267	188	99	150	843	57	73	8	100	58	14	201
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	2.7	2.7	4.0	2.7	2.7	4.0	3.0		4.0	4.6	4.6
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.86		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	1770	1605		1770	1863	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	1770	1605		1770	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	290	204	108	163	916	62	79	9	109	63	15	218
RTOR Reduction (vph)	0	0	70	0	0	37	0	84	0	0	0	176
Lane Group Flow (vph)	290	204	38	163	916	25	79	34	0	63	15	42
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA		Prot	NA	Perm
Protected Phases	1	6		5	2		3	8		7		4
Permitted Phases			6			2						4
Actuated Green, G (s)	7.0	21.0	21.0	10.1	24.1	24.1	4.0	13.9		3.1	13.0	13.0
Effective Green, g (s)	7.0	22.3	22.3	10.1	25.4	25.4	4.0	14.9		3.1	12.4	12.4
Actuated g/C Ratio	0.11	0.35	0.35	0.16	0.40	0.40	0.06	0.23		0.05	0.19	0.19
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	374	1231	550	278	1402	627	110	373		85	360	306
v/s Ratio Prot	c0.08	0.06		0.09	c0.26		c0.04	0.02		0.04	0.01	
v/s Ratio Perm			0.02			0.02						c0.03
v/c Ratio	0.78	0.17	0.07	0.59	0.65	0.04	0.72	0.09		0.74	0.04	0.14
Uniform Delay, d1	27.8	14.5	14.0	25.1	15.8	11.9	29.5	19.3		30.1	21.0	21.4
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	9.7	0.1	0.1	3.1	1.1	0.0	20.0	0.1		28.9	0.0	0.2
Delay (s)	37.5	14.5	14.0	28.2	16.9	11.9	49.5	19.4		59.1	21.1	21.6
Level of Service	D	B	B	C	B	B	D	B		E	C	C
Approach Delay (s)		25.5			18.2			31.5			29.6	
Approach LOS		C			B			C			C	

Intersection Summary

HCM 2000 Control Delay	22.8	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.54		
Actuated Cycle Length (s)	64.1	Sum of lost time (s)	15.3
Intersection Capacity Utilization	51.6%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
28: Isabel Ave/Campus Hill Dr & Portola Ave

BART to Livermore Extension Project
2040 DMU AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	1	199	223	504	565	137	494	304	87	70	208	2
Future Volume (vph)	1	199	223	504	565	137	494	304	87	70	208	2
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	5.8	5.8
Lane Util. Factor	1.00	0.95	0.88	0.94	0.95		0.97	0.95	1.00	1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	0.97		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3539	2787	4990	3436		3433	3539	1583	1770	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	3539	2787	4990	3436		3433	3539	1583	1770	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	1	216	242	548	614	149	537	330	95	76	226	2
RTOR Reduction (vph)	0	0	187	0	15	0	0	0	65	0	0	2
Lane Group Flow (vph)	1	216	55	548	748	0	537	330	30	76	226	0
Turn Type	Prot	NA	Perm	Prot	NA		Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4						2			6
Actuated Green, G (s)	1.5	17.7	17.7	14.6	30.8		20.0	25.4	25.4	7.6	13.4	13.4
Effective Green, g (s)	1.5	19.0	19.0	14.6	32.1		20.0	26.7	26.7	7.6	12.5	12.5
Actuated g/C Ratio	0.02	0.23	0.23	0.17	0.38		0.24	0.32	0.32	0.09	0.15	0.15
Clearance Time (s)	4.0	5.3	5.3	4.0	5.3		4.0	5.3	5.3	4.0	4.9	4.9
Vehicle Extension (s)	2.0	3.0	3.0	2.0	3.0		2.0	3.0	3.0	2.0	3.0	3.0
Lane Grp Cap (vph)	31	801	631	868	1314		818	1126	503	160	527	235
v/s Ratio Prot	0.00	0.06		c0.11	c0.22		c0.16	0.09		0.04	c0.06	
v/s Ratio Perm			0.02						0.02			0.00
v/c Ratio	0.03	0.27	0.09	0.63	0.57		0.66	0.29	0.06	0.47	0.43	0.00
Uniform Delay, d1	40.5	26.7	25.6	32.2	20.4		28.8	21.5	19.9	36.3	32.5	30.4
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.2	0.2	0.1	1.1	0.6		1.5	0.1	0.1	0.8	0.6	0.0
Delay (s)	40.6	26.9	25.7	33.3	21.0		30.3	21.6	19.9	37.1	33.0	30.4
Level of Service	D	C	C	C	C		C	C	B	D	C	C
Approach Delay (s)		26.3			26.1			26.3			34.0	
Approach LOS		C			C			C			C	

Intersection Summary

HCM 2000 Control Delay	27.0	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.60		
Actuated Cycle Length (s)	83.9	Sum of lost time (s)	17.8
Intersection Capacity Utilization	66.4%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
29: Isabel Ave & I-580 WB Ramps

BART to Livermore Extension Project
2040 DMU AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↔↔		↗		↑↑↑	↗		↑↑↑	↗
Traffic Volume (vph)	0	0	0	969	0	447	0	502	0	0	676	439
Future Volume (vph)	0	0	0	969	0	447	0	502	0	0	676	439
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0		4.0		4.8			4.8	4.8
Lane Util. Factor				0.97		1.00		0.91			0.91	1.00
Frt				1.00		0.85		1.00			1.00	0.85
Flt Protected				0.95		1.00		1.00			1.00	1.00
Satd. Flow (prot)				3433		1583		5085			5085	1583
Flt Permitted				0.95		1.00		1.00			1.00	1.00
Satd. Flow (perm)				3433		1583		5085			5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	1053	0	486	0	546	0	0	735	477
RTOR Reduction (vph)	0	0	0	0	0	104	0	0	0	0	0	267
Lane Group Flow (vph)	0	0	0	1053	0	382	0	546	0	0	735	210
Turn Type				Prot		Prot		NA	Free		NA	Prot
Protected Phases				8		8		2			6	6
Permitted Phases									Free			
Actuated Green, G (s)				19.2		19.2		22.8			22.8	22.8
Effective Green, g (s)				19.2		19.2		22.0			22.0	22.0
Actuated g/C Ratio				0.38		0.38		0.44			0.44	0.44
Clearance Time (s)				4.0		4.0		4.0			4.0	4.0
Vehicle Extension (s)				2.0		2.0		4.0			4.0	4.0
Lane Grp Cap (vph)				1318		607		2237			2237	696
v/s Ratio Prot				c0.31		0.24		0.11			c0.14	0.13
v/s Ratio Perm												
v/c Ratio				0.80		0.63		0.24			0.33	0.30
Uniform Delay, d1				13.7		12.5		8.8			9.2	9.0
Progression Factor				1.00		1.00		0.86			1.00	1.00
Incremental Delay, d2				3.2		1.5		0.3			0.4	1.1
Delay (s)				16.9		14.0		7.8			9.6	10.2
Level of Service				B		B		A			A	B
Approach Delay (s)		0.0			16.0			7.8			9.8	
Approach LOS		A			B			A			A	

























Intersection Summary

HCM 2000 Control Delay	12.4	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.55		
Actuated Cycle Length (s)	50.0	Sum of lost time (s)	8.8
Intersection Capacity Utilization	48.0%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 30: Isabel Ave & I-580 EB Ramps

BART to Livermore Extension Project
 2040 DMU AM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	218	0	386	0	0	0	0	728	534	0	1381	360
Future Volume (vph)	218	0	386	0	0	0	0	728	534	0	1381	360
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0					4.0	4.0		4.0	4.0
Lane Util. Factor	0.97		0.88					0.91	1.00		0.91	1.00
Frt	1.00		0.85					1.00	0.85		1.00	0.85
Flt Protected	0.95		1.00					1.00	1.00		1.00	1.00
Satd. Flow (prot)	3433		2787					5085	1583		5085	1583
Flt Permitted	0.95		1.00					1.00	1.00		1.00	1.00
Satd. Flow (perm)	3433		2787					5085	1583		5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	237	0	420	0	0	0	0	791	580	0	1501	391
RTOR Reduction (vph)	0	0	60	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	237	0	360	0	0	0	0	791	580	0	1501	391
Turn Type	Prot		Perm					NA	Free		NA	Free
Protected Phases	4							2			6	
Permitted Phases			4						Free			Free
Actuated Green, G (s)	9.6		9.6					31.4	50.0		31.4	50.0
Effective Green, g (s)	9.6		9.6					32.4	50.0		32.4	50.0
Actuated g/C Ratio	0.19		0.19					0.65	1.00		0.65	1.00
Clearance Time (s)	4.0		4.0					5.0			5.0	
Vehicle Extension (s)	2.0		2.0					4.0			4.0	
Lane Grp Cap (vph)	659		535					3295	1583		3295	1583
v/s Ratio Prot	0.07							0.16			c0.30	
v/s Ratio Perm			c0.13						0.37			0.25
v/c Ratio	0.36		0.67					0.24	0.37		0.46	0.25
Uniform Delay, d1	17.5		18.7					3.7	0.0		4.4	0.0
Progression Factor	1.00		1.00					1.00	1.00		0.39	1.00
Incremental Delay, d2	0.1		2.6					0.2	0.7		0.4	0.3
Delay (s)	17.7		21.4					3.8	0.7		2.1	0.3
Level of Service	B		C					A	A		A	A
Approach Delay (s)		20.0			0.0			2.5			1.7	
Approach LOS		C			A			A			A	

Intersection Summary			
HCM 2000 Control Delay	5.1	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.51		
Actuated Cycle Length (s)	50.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	46.9%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
31: Isabel Ave & Airway Blvd

BART to Livermore Extension Project
2040 DMU AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↑	↗	↖	↑	↗	↖	↑↑↑	↗	↖↗	↑↑↑	↗
Traffic Volume (vph)	0	133	380	255	344	170	318	1075	280	699	1236	18
Future Volume (vph)	0	133	380	255	344	170	318	1075	280	699	1236	18
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.2	5.6	5.2	5.2	5.6	4.0	4.0	4.0	4.0	4.0	5.0
Lane Util. Factor		1.00	1.00	1.00	1.00	1.00	1.00	0.91	1.00	0.97	0.91	1.00
Frt		1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1863	1583	1770	1863	1583	1770	5085	1583	3433	5085	1583
Flt Permitted		1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)		1863	1583	1770	1863	1583	1770	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	145	413	277	374	185	346	1168	304	760	1343	20
RTOR Reduction (vph)	0	0	103	0	0	80	0	0	212	0	0	14
Lane Group Flow (vph)	0	145	310	277	374	105	346	1168	92	760	1343	6
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4	5	3	8	1	5	2		1	NA	6
Permitted Phases			4			8			2			6
Actuated Green, G (s)		12.3	28.3	14.4	31.3	49.3	16.0	26.4	26.4	18.0	28.4	28.4
Effective Green, g (s)		11.7	27.1	13.8	30.7	48.1	17.0	27.4	27.4	19.0	29.4	28.4
Actuated g/C Ratio		0.13	0.30	0.15	0.34	0.53	0.19	0.30	0.30	0.21	0.33	0.31
Clearance Time (s)		4.6	5.0	4.6	4.6	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Extension (s)		3.0	3.0	3.0	3.0	3.0	3.0	5.0	5.0	3.0	5.0	5.0
Lane Grp Cap (vph)		241	475	270	633	843	333	1542	480	722	1655	497
v/s Ratio Prot		0.08	0.11	c0.16	c0.20	0.02	c0.20	0.23		c0.22	c0.26	
v/s Ratio Perm			0.08			0.04			0.06			0.00
v/c Ratio		0.60	0.65	1.03	0.59	0.12	1.04	0.76	0.19	1.05	0.81	0.01
Uniform Delay, d1		37.1	27.5	38.2	24.6	10.6	36.6	28.4	23.3	35.6	27.9	21.3
Progression Factor		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2		4.2	3.2	61.6	1.5	0.1	59.8	2.6	0.4	48.2	3.6	0.0
Delay (s)		41.3	30.7	99.9	26.1	10.6	96.5	31.0	23.7	83.8	31.5	21.3
Level of Service		D	C	F	C	B	F	C	C	F	C	C
Approach Delay (s)		33.5			47.1			42.3			50.1	
Approach LOS		C			D			D			D	



































Intersection Summary		
HCM 2000 Control Delay	45.2	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.96	D
Actuated Cycle Length (s)	90.3	Sum of lost time (s)
Intersection Capacity Utilization	78.3%	20.0
Analysis Period (min)	15	ICU Level of Service
		D

c Critical Lane Group

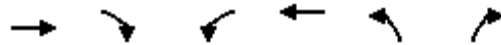
HCM Signalized Intersection Capacity Analysis

32: Isabel Ave & Jack London Blvd

BART to Livermore Extension Project
2040 DMU AM

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations	 	 			 		 	  		  	  		
Traffic Volume (vph)	24	55	61	321	957	374	416	981	125	169	1373	278	
Future Volume (vph)	24	55	61	321	957	374	416	981	125	169	1373	278	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.97	0.91	1.00	0.97	0.91	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	3433	5085	1583	3433	5085	1583	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	3433	5085	1583	3433	5085	1583	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	
Adj. Flow (vph)	26	60	66	349	1040	407	452	1066	136	184	1492	302	
RTOR Reduction (vph)	0	0	54	0	0	66	0	0	88	0	0	112	
Lane Group Flow (vph)	26	60	12	349	1040	341	452	1066	48	184	1492	190	
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	Perm	
Protected Phases	7	4		3	8	1	5	2		1	NA	6	
Permitted Phases			4			8			2			6	
Actuated Green, G (s)	3.8	19.6	19.6	20.8	36.6	45.8	12.9	38.7	38.7	9.2	35.0	35.0	
Effective Green, g (s)	3.8	19.6	19.6	20.8	36.6	45.8	12.9	38.7	38.7	9.2	35.0	35.0	
Actuated g/C Ratio	0.03	0.18	0.18	0.19	0.33	0.42	0.12	0.35	0.35	0.08	0.32	0.32	
Clearance Time (s)	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	119	633	283	336	1182	738	404	1797	559	288	1625	505	
v/s Ratio Prot	0.01	0.02		c0.20	c0.29	0.04	c0.13	c0.21		0.05	c0.29		
v/s Ratio Perm			0.01			0.18			0.03			0.12	
v/c Ratio	0.22	0.09	0.04	1.04	0.88	0.46	1.12	0.59	0.09	0.64	0.92	0.38	
Uniform Delay, d1	51.4	37.5	37.2	44.4	34.4	23.0	48.3	29.0	23.6	48.5	35.9	28.8	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.9	0.1	0.1	59.5	7.7	0.5	81.1	0.5	0.1	4.6	8.6	0.5	
Delay (s)	52.3	37.6	37.2	103.8	42.1	23.4	129.4	29.5	23.7	53.1	44.5	29.3	
Level of Service	D	D	D	F	D	C	F	C	C	D	D	C	
Approach Delay (s)		40.0			49.9			56.3			43.0		
Approach LOS		D			D			E			D		
Intersection Summary													
HCM 2000 Control Delay			49.1		HCM 2000 Level of Service				D				
HCM 2000 Volume to Capacity ratio			0.99										
Actuated Cycle Length (s)			109.5		Sum of lost time (s)				21.2				
Intersection Capacity Utilization			78.1%		ICU Level of Service				D				
Analysis Period (min)			15										

c Critical Lane Group



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑	↑	↔	↑↑	↔	↔
Traffic Volume (vph)	346	145	815	2447	534	668
Future Volume (vph)	346	145	815	2447	534	668
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	2.3	2.3	4.0	2.3	2.5	2.5
Lane Util. Factor	0.95	1.00	0.97	0.95	0.97	0.88
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	3539	1583	3433	3539	3433	2787
Flt Permitted	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (perm)	3539	1583	3433	3539	3433	2787
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	376	158	886	2660	580	726
RTOR Reduction (vph)	0	20	0	0	0	95
Lane Group Flow (vph)	376	138	886	2660	580	631
Turn Type	NA	pm+ov	Prot	NA	Prot	pm+ov
Protected Phases	2	8	1	6	8	1
Permitted Phases		2				8
Actuated Green, G (s)	16.5	39.7	61.6	82.1	23.2	84.8
Effective Green, g (s)	18.2	43.1	61.6	83.8	24.7	87.8
Actuated g/C Ratio	0.16	0.38	0.54	0.74	0.22	0.77
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Grp Cap (vph)	568	634	1866	2617	748	2221
v/s Ratio Prot	0.11	0.05	0.26	c0.75	c0.17	0.16
v/s Ratio Perm		0.04				0.07
v/c Ratio	0.66	0.22	0.47	1.02	0.78	0.28
Uniform Delay, d1	44.7	23.7	15.9	14.8	41.7	3.7
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	2.3	0.1	0.1	21.8	4.6	0.0
Delay (s)	46.9	23.8	16.0	36.6	46.3	3.7
Level of Service	D	C	B	D	D	A
Approach Delay (s)	40.1			31.4	22.6	
Approach LOS	D			C	C	

Intersection Summary

HCM 2000 Control Delay	30.1	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	1.00		
Actuated Cycle Length (s)	113.3	Sum of lost time (s)	8.8
Intersection Capacity Utilization	89.5%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 34: Murrieta Blvd/Driveway & Portola Ave



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗		↖	↗		↖	↗	↗		↗	
Traffic Volume (vph)	0	626	132	252	1004	1	173	6	177	1	3	0
Future Volume (vph)	0	626	132	252	1004	1	173	6	177	1	3	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.8		4.0	5.8		5.2	5.2	5.2		4.0	
Lane Util. Factor		0.95		1.00	0.95		0.95	0.95	1.00		1.00	
Frt		0.97		1.00	1.00		1.00	1.00	0.85		1.00	
Flt Protected		1.00		0.95	1.00		0.95	0.96	1.00		0.99	
Satd. Flow (prot)		3447		1770	3539		1681	1691	1583		1840	
Flt Permitted		1.00		0.95	1.00		0.95	0.96	1.00		0.99	
Satd. Flow (perm)		3447		1770	3539		1681	1691	1583		1840	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	680	143	274	1091	1	188	7	192	1	3	0
RTOR Reduction (vph)	0	20	0	0	0	0	0	0	168	0	0	0
Lane Group Flow (vph)	0	803	0	274	1092	0	98	97	24	0	4	0
Turn Type	Prot	NA		Prot	NA		Split	NA	Perm		Split	NA
Protected Phases	5	2		1	6		8	8		4	4	
Permitted Phases									8			
Actuated Green, G (s)		18.9		14.5	37.4		8.2	8.2	8.2		0.6	
Effective Green, g (s)		18.0		14.5	36.5		7.6	7.6	7.6		0.6	
Actuated g/C Ratio		0.30		0.24	0.61		0.13	0.13	0.13		0.01	
Clearance Time (s)		4.9		4.0	4.9		4.6	4.6	4.6		4.0	
Vehicle Extension (s)		2.0		2.0	2.0		2.0	2.0	2.0		2.0	
Lane Grp Cap (vph)		1039		429	2163		213	215	201		18	
v/s Ratio Prot		c0.23		c0.15	0.31		c0.06	0.06			c0.00	
v/s Ratio Perm									0.02			
v/c Ratio		0.77		0.64	0.50		0.46	0.45	0.12		0.22	
Uniform Delay, d1		19.0		20.3	6.5		24.1	24.1	23.1		29.3	
Progression Factor		1.00		1.00	1.00		1.00	1.00	1.00		1.00	
Incremental Delay, d2		3.3		2.3	0.1		0.6	0.5	0.1		2.3	
Delay (s)		22.3		22.5	6.6		24.7	24.7	23.2		31.6	
Level of Service		C		C	A		C	C	C		C	
Approach Delay (s)		22.3			9.8			23.9			31.6	
Approach LOS		C			A			C			C	

Intersection Summary

HCM 2000 Control Delay	15.9	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.66		
Actuated Cycle Length (s)	59.7	Sum of lost time (s)	19.0
Intersection Capacity Utilization	59.6%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
35: Murrieta Blvd & Jack London Blvd



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	75	297	989	284	250	168
Future Volume (vph)	75	297	989	284	250	168
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00	1.00	0.95	0.91	
Frt	1.00	0.85	1.00	1.00	0.94	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1770	1583	1770	3539	4778	
Flt Permitted	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	1770	1583	1770	3539	4778	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	82	323	1075	309	272	183
RTOR Reduction (vph)	0	287	0	0	126	0
Lane Group Flow (vph)	82	36	1075	309	329	0
Turn Type	Prot	Perm	Prot	NA	NA	
Protected Phases	4		5	2	6	
Permitted Phases		4				
Actuated Green, G (s)	9.9	9.9	56.3	71.9	11.6	
Effective Green, g (s)	9.9	9.9	56.3	71.9	11.6	
Actuated g/C Ratio	0.11	0.11	0.63	0.80	0.13	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	195	174	1109	2833	617	
v/s Ratio Prot	c0.05		c0.61	0.09	c0.07	
v/s Ratio Perm		0.02				
v/c Ratio	0.42	0.20	0.97	0.11	0.53	
Uniform Delay, d1	37.3	36.4	15.9	2.0	36.6	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	1.5	0.6	19.8	0.0	0.9	
Delay (s)	38.7	37.0	35.7	2.0	37.5	
Level of Service	D	D	D	A	D	
Approach Delay (s)	37.3			28.2	37.5	
Approach LOS	D			C	D	

Intersection Summary

HCM 2000 Control Delay	31.7	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.83		
Actuated Cycle Length (s)	89.8	Sum of lost time (s)	12.0
Intersection Capacity Utilization	77.5%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
36: Murrieta Blvd & Stanley Blvd

BART to Livermore Extension Project
2040 DMU AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	235	800	253	25	1409	163	689	446	18	213	192	453
Future Volume (vph)	235	800	253	25	1409	163	689	446	18	213	192	453
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	5.8	5.8	4.0	5.8	4.9	4.9	5.8		4.9	5.8	4.9
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.97	0.95		1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	3433	3518		1770	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	3433	3518		1770	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	255	870	275	27	1532	177	749	485	20	232	209	492
RTOR Reduction (vph)	0	0	122	0	0	27	0	2	0	0	0	62
Lane Group Flow (vph)	255	870	153	27	1532	150	749	503	0	232	209	430
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Prot	NA		Prot	NA	Perm
Protected Phases	1	6		5	2	3	7	4		3	8	
Permitted Phases			6			2						8
Actuated Green, G (s)	8.0	63.1	63.1	3.6	58.7	80.2	25.0	35.6		21.5	32.1	32.1
Effective Green, g (s)	8.0	62.2	62.2	3.6	57.8	78.4	24.1	34.7		20.6	31.2	32.1
Actuated g/C Ratio	0.06	0.44	0.44	0.03	0.41	0.55	0.17	0.25		0.15	0.22	0.23
Clearance Time (s)	4.0	4.9	4.9	4.0	4.9	4.0	4.0	4.9		4.0	4.9	4.9
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	193	1554	695	45	1444	876	584	862		257	779	358
v/s Ratio Prot	c0.07	0.25		0.02	c0.43	0.02	c0.22	c0.14		0.13	0.06	
v/s Ratio Perm			0.10			0.07						c0.27
v/c Ratio	1.32	0.56	0.22	0.60	1.06	0.17	1.28	0.58		0.90	0.27	1.20
Uniform Delay, d1	66.8	29.5	24.6	68.3	41.9	15.6	58.8	47.1		59.5	45.7	54.7
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	176.1	0.4	0.2	19.7	41.7	0.1	139.9	1.0		31.7	0.2	114.4
Delay (s)	242.9	30.0	24.8	88.0	83.6	15.7	198.6	48.1		91.2	45.9	169.2
Level of Service	F	C	C	F	F	B	F	D		F	D	F
Approach Delay (s)		67.7			76.7			138.0			122.2	
Approach LOS		E			E			F			F	

Intersection Summary

HCM 2000 Control Delay	96.8	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.16		
Actuated Cycle Length (s)	141.6	Sum of lost time (s)	20.5
Intersection Capacity Utilization	99.7%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
37: Livermore Ave & I-580 WB Ramps



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↵	↔		↵↵	↑			↕↔	
Traffic Volume (vph)	0	0	0	344	89	27	481	80	0	0	151	0
Future Volume (vph)	0	0	0	344	89	27	481	80	0	0	151	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)					4.0		4.0	4.0			4.0	
Lane Util. Factor					0.95		0.97	1.00			0.95	
Frt					0.99		1.00	1.00			1.00	
Flt Protected					0.96		0.95	1.00			1.00	
Satd. Flow (prot)					1691		3433	1863			3539	
Flt Permitted					0.96		0.95	1.00			1.00	
Satd. Flow (perm)					1691		3433	1863			3539	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	374	97	29	523	87	0	0	164	0
RTOR Reduction (vph)	0	0	0	0	3	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	0	497	0	523	87	0	0	164	0
Turn Type				Split	NA		Prot	NA			NA	
Protected Phases				8	8		5	2			6	
Permitted Phases												
Actuated Green, G (s)					35.4		19.6	54.9			31.8	
Effective Green, g (s)					35.4		19.1	56.6			33.5	
Actuated g/C Ratio					0.35		0.19	0.57			0.34	
Clearance Time (s)					4.0		3.5	5.7			5.7	
Vehicle Extension (s)					2.0		2.0	2.5			2.5	
Lane Grp Cap (vph)					598		655	1054			1185	
v/s Ratio Prot					c0.29		c0.15	0.05			c0.05	
v/s Ratio Perm												
v/c Ratio					0.83		0.80	0.08			0.14	
Uniform Delay, d1					29.6		38.6	9.9			23.2	
Progression Factor					1.00		0.88	0.76			1.00	
Incremental Delay, d2					9.2		5.3	0.1			0.2	
Delay (s)					38.8		39.3	7.7			23.4	
Level of Service					D		D	A			C	
Approach Delay (s)		0.0			38.8			34.8			23.4	
Approach LOS		A			D			C			C	

Intersection Summary

HCM 2000 Control Delay	34.9	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.56		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	61.0%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
38: Livermore Ave & I-580 EB Ramps



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕	↗					↕		↗	↕	
Traffic Volume (vph)	11	2	665	0	0	0	0	546	539	26	475	0
Future Volume (vph)	11	2	665	0	0	0	0	546	539	26	475	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0					3.0		5.0	3.0	
Lane Util. Factor		0.95	0.95					0.95		1.00	0.95	
Frt		0.86	0.85					0.93		1.00	1.00	
Flt Protected		1.00	1.00					1.00		0.95	1.00	
Satd. Flow (prot)		1512	1504					3275		1770	3539	
Flt Permitted		1.00	1.00					1.00		0.95	1.00	
Satd. Flow (perm)		1512	1504					3275		1770	3539	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	12	2	723	0	0	0	0	593	586	28	516	0
RTOR Reduction (vph)	0	226	226	0	0	0	0	271	0	0	0	0
Lane Group Flow (vph)	0	142	143	0	0	0	0	908	0	28	516	0
Turn Type	Prot	NA	Perm					NA		Prot	NA	
Protected Phases	7	4						2		1	6	
Permitted Phases			4									
Actuated Green, G (s)		12.4	12.4					24.8		0.8	29.6	
Effective Green, g (s)		12.4	12.4					25.8		0.0	30.6	
Actuated g/C Ratio		0.25	0.25					0.52		0.00	0.61	
Clearance Time (s)		4.0	4.0					4.0		4.0	4.0	
Vehicle Extension (s)		2.0	2.0					2.5		2.0	2.5	
Lane Grp Cap (vph)		374	372					1689		0	2165	
v/s Ratio Prot								c0.28			c0.15	
v/s Ratio Perm		0.09	c0.09									
v/c Ratio		0.38	0.38					0.54		no cap	0.24	
Uniform Delay, d1		15.6	15.6					8.1		Error	4.4	
Progression Factor		1.00	1.00					1.00			0.83	
Incremental Delay, d2		0.2	0.2					1.2		Error	0.2	
Delay (s)		15.8	15.9					9.3		Error	3.9	
Level of Service		B	B					A		F	A	
Approach Delay (s)		15.9			0.0			9.3			Error	
Approach LOS		B			A			A			F	

Intersection Summary

HCM 2000 Control Delay	Error	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	0.50		
Actuated Cycle Length (s)	50.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	61.0%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

39: Livermore Ave & Portola Ave



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	406	290	123	28	571	90	222	536	62	126	784	405
Future Volume (vph)	406	290	123	28	571	90	222	536	62	126	784	405
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	2.7	4.0	4.0	2.7	4.0	4.0	4.9		4.0	4.9	4.9
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	1.00	0.95		1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.98		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	1770	3484		1770	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	1770	3484		1770	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	441	315	134	30	621	98	241	583	67	137	852	440
RTOR Reduction (vph)	0	0	101	0	0	74	0	6	0	0	0	49
Lane Group Flow (vph)	441	315	33	30	621	24	241	644	0	137	852	391
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA		Prot	NA	pm+ov
Protected Phases	3	8		7	4		1	6		5	2	3
Permitted Phases			8			4						2
Actuated Green, G (s)	17.3	29.4	29.4	17.4	29.5	29.5	18.6	43.3		13.9	38.6	55.9
Effective Green, g (s)	17.3	30.7	29.4	17.4	30.8	29.5	18.6	42.4		13.9	37.7	54.1
Actuated g/C Ratio	0.14	0.26	0.24	0.14	0.26	0.25	0.16	0.35		0.12	0.31	0.45
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	494	905	387	256	908	389	274	1231		205	1111	713
v/s Ratio Prot	c0.13	0.09		0.02	c0.18		c0.14	0.18		0.08	c0.24	0.07
v/s Ratio Perm			0.02			0.02						0.17
v/c Ratio	0.89	0.35	0.08	0.12	0.68	0.06	0.88	0.52		0.67	0.77	0.55
Uniform Delay, d1	50.4	36.5	34.9	44.6	40.2	34.7	49.6	30.8		50.8	37.2	24.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	18.2	0.2	0.1	0.2	2.1	0.1	25.8	1.6		8.0	5.1	0.9
Delay (s)	68.6	36.7	35.0	44.8	42.4	34.7	75.4	32.4		58.8	42.3	24.9
Level of Service	E	D	D	D	D	C	E	C		E	D	C
Approach Delay (s)		52.3			41.5			44.0			38.5	
Approach LOS		D			D			D			D	

Intersection Summary

HCM 2000 Control Delay	43.4	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.79		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	16.5
Intersection Capacity Utilization	75.4%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
40: First St/Springtown Blvd & I-580 WB Ramps

BART to Livermore Extension Project
2040 DMU AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations			↗↗			↗	↗↗	↑			↖↖	↖
Traffic Volume (vph)	0	0	443	0	0	0	341	375	0	0	875	530
Future Volume (vph)	0	0	443	0	0	0	341	375	0	0	875	530
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)			4.5				4.5	4.0			4.5	4.5
Lane Util. Factor			0.88				0.97	1.00			0.95	1.00
Frt			0.85				1.00	1.00			1.00	0.85
Flt Protected			1.00				0.95	1.00			1.00	1.00
Satd. Flow (prot)			2787				3433	1863			3539	1583
Flt Permitted			1.00				0.95	1.00			1.00	1.00
Satd. Flow (perm)			2787				3433	1863			3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	482	0	0	0	371	408	0	0	951	576
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	71
Lane Group Flow (vph)	0	0	482	0	0	0	371	408	0	0	951	505
Turn Type			Over			Free	Prot	NA			NA	Perm
Protected Phases			5				5	2			6	
Permitted Phases						Free						6
Actuated Green, G (s)			21.8				21.8	100.0			70.2	70.2
Effective Green, g (s)			21.3				21.3	100.0			69.7	69.7
Actuated g/C Ratio			0.21				0.21	1.00			0.70	0.70
Clearance Time (s)			4.0				4.0	4.0			4.0	4.0
Vehicle Extension (s)			2.0				2.0	0.2			4.0	4.0
Lane Grp Cap (vph)			593				731	1863			2466	1103
v/s Ratio Prot			c0.17				0.11	0.22			0.27	
v/s Ratio Perm												c0.32
v/c Ratio			0.81				0.51	0.22			0.39	0.46
Uniform Delay, d1			37.5				34.7	0.0			6.3	6.7
Progression Factor			1.00				0.99	1.00			1.00	1.00
Incremental Delay, d2			7.9				0.2	0.3			0.5	1.4
Delay (s)			45.4				34.6	0.3			6.7	8.1
Level of Service			D				C	A			A	A
Approach Delay (s)		45.4			0.0			16.6			7.3	
Approach LOS		D			A			B			A	

Intersection Summary

HCM 2000 Control Delay	16.5	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.54		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	50.0%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
41: First St & I-580 EB Ramps

BART to Livermore Extension Project
2040 DMU AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕	↗↘					↕↕	↗	↘	↕↕	
Traffic Volume (vph)	73	2	371	0	0	0	0	905	875	91	1200	0
Future Volume (vph)	73	2	371	0	0	0	0	905	875	91	1200	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0					5.0	5.0	5.0	5.0	
Lane Util. Factor		1.00	0.88					0.95	1.00	1.00	0.95	
Frt		1.00	0.85					1.00	0.85	1.00	1.00	
Flt Protected		0.95	1.00					1.00	1.00	0.95	1.00	
Satd. Flow (prot)		1776	2787					3539	1583	1770	3539	
Flt Permitted		0.95	1.00					1.00	1.00	0.95	1.00	
Satd. Flow (perm)		1776	2787					3539	1583	1770	3539	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	79	2	403	0	0	0	0	984	951	99	1304	0
RTOR Reduction (vph)	0	0	175	0	0	0	0	0	248	0	0	0
Lane Group Flow (vph)	0	81	228	0	0	0	0	984	703	99	1304	0
Turn Type	Perm	NA	Perm					NA	Perm	Prot	NA	
Protected Phases		4						2		1	6	
Permitted Phases	4		4						2			
Actuated Green, G (s)		12.1	12.1					67.9	67.9	8.0	79.9	
Effective Green, g (s)		11.6	11.6					67.4	67.4	7.0	79.4	
Actuated g/C Ratio		0.12	0.12					0.67	0.67	0.07	0.79	
Clearance Time (s)		3.5	3.5					4.5	4.5	4.0	4.5	
Vehicle Extension (s)		2.5	2.5					4.0	4.0	2.0	4.0	
Lane Grp Cap (vph)		206	323					2385	1066	123	2809	
v/s Ratio Prot								0.28		c0.06	0.37	
v/s Ratio Perm		0.05	c0.08						c0.44			
v/c Ratio		0.39	0.71					0.41	0.66	0.80	0.46	
Uniform Delay, d1		40.9	42.6					7.4	9.6	45.8	3.4	
Progression Factor		1.00	1.00					1.00	1.00	0.84	0.95	
Incremental Delay, d2		0.9	6.4					0.5	3.2	27.0	0.5	
Delay (s)		41.8	48.9					7.9	12.8	65.7	3.7	
Level of Service		D	D					A	B	E	A	
Approach Delay (s)		47.7			0.0			10.3			8.1	
Approach LOS		D			A			B			A	

Intersection Summary

HCM 2000 Control Delay	14.2	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.68		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	14.0
Intersection Capacity Utilization	75.0%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
42: 1st St & Mines Rd

BART to Livermore Extension Project
2040 DMU AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	41	58	46	522	99	360	26	1413	343	174	1354	21
Future Volume (vph)	41	58	46	522	99	360	26	1413	343	174	1354	21
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		0.97	1.00	1.00	1.00	0.91		0.97	0.91	
Frt	1.00	0.93		1.00	1.00	0.85	1.00	0.97		1.00	1.00	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1739		3433	1863	1583	1770	4936		3433	5074	
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	1739		3433	1863	1583	1770	4936		3433	5074	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	45	63	50	567	108	391	28	1536	373	189	1472	23
RTOR Reduction (vph)	0	35	0	0	0	48	0	41	0	0	1	0
Lane Group Flow (vph)	45	78	0	567	108	343	28	1868	0	189	1494	0
Turn Type	Prot	NA		Prot	NA	pm+ov	Prot	NA		Prot	NA	
Protected Phases	7	4		3	8	1	5	2		1	6	
Permitted Phases						8						
Actuated Green, G (s)	3.4	8.4		15.8	20.8	26.8	1.9	38.8		6.0	42.9	
Effective Green, g (s)	3.4	8.4		15.8	20.8	26.8	1.9	38.8		6.0	42.9	
Actuated g/C Ratio	0.04	0.10		0.19	0.24	0.32	0.02	0.46		0.07	0.50	
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	70	171		638	455	573	39	2253		242	2560	
v/s Ratio Prot	0.03	0.04		c0.17	0.06	c0.04	0.02	c0.38		c0.06	0.29	
v/s Ratio Perm						0.17						
v/c Ratio	0.64	0.46		0.89	0.24	0.60	0.72	0.83		0.78	0.58	
Uniform Delay, d1	40.2	36.1		33.7	25.7	24.6	41.3	20.2		38.9	14.8	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	18.4	1.9		14.2	0.3	1.7	47.4	2.7		15.0	0.3	
Delay (s)	58.6	38.1		47.9	26.0	26.3	88.7	22.9		53.9	15.1	
Level of Service	E	D		D	C	C	F	C		D	B	
Approach Delay (s)		43.9			37.8			23.8			19.5	
Approach LOS		D			D			C			B	

Intersection Summary

HCM 2000 Control Delay	26.0	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.86		
Actuated Cycle Length (s)	85.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	71.5%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group























HCM Unsignalized Intersection Capacity Analysis

43: Vasco Rd & I-580 WB Ramps

BART to Livermore Extension Project
2040 DMU AM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations			↗			↗		↑↑↑	↗		↑↑↑	↗
Traffic Volume (veh/h)	0	0	0	0	0	166	0	1044	0	0	1894	0
Future Volume (Veh/h)	0	0	0	0	0	166	0	1044	0	0	1894	0
Sign Control	Stop			Stop			Free			Free		
Grade	0%			0%			0%			0%		
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	0	0	0	180	0	1135	0	0	2059	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type												
Median storage veh												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	2617	3194	686	1821	3194	378	2059			1135		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	2617	3194	686	1821	3194	378	2059			1135		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	100	100	71	100			100		
cM capacity (veh/h)	8	10	390	48	10	619	268			611		
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	NB 4	SB 1	SB 2	SB 3	SB 4		
Volume Total	0	180	378	378	378	0	686	686	686	0		
Volume Left	0	0	0	0	0	0	0	0	0	0		
Volume Right	0	180	0	0	0	0	0	0	0	0		
cSH	1700	619	1700	1700	1700	1700	1700	1700	1700	1700		
Volume to Capacity	0.00	0.29	0.22	0.22	0.22	0.00	0.40	0.40	0.40	0.00		
Queue Length 95th (ft)	0	30	0	0	0	0	0	0	0	0		
Control Delay (s)	0.0	13.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
Lane LOS	A	B										
Approach Delay (s)	0.0	13.2	0.0				0.0					
Approach LOS	A	B										
Intersection Summary												
Average Delay			0.7									
Intersection Capacity Utilization			39.9%		ICU Level of Service					A		
Analysis Period (min)			15									

HCM Unsignalized Intersection Capacity Analysis
 44: Vasco Rd & I-580 EB Ramps

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations								  			  	
Traffic Volume (veh/h)	0	0	0	0	0	0	0	1030	0	73	2018	0
Future Volume (Veh/h)	0	0	0	0	0	0	0	1030	0	73	2018	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	0	0	0	0	0	1120	0	79	2193	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	2724	3471	731	2009	3471	373	2193			1120		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	2724	3471	731	2009	3471	373	2193			1120		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	100	100	100	100			87		
cM capacity (veh/h)	9	6	364	31	6	624	238			619		
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	NB 4	SB 1	SB 2	SB 3	SB 4		
Volume Total	0	0	373	373	373	0	79	731	731	731		
Volume Left	0	0	0	0	0	0	79	0	0	0		
Volume Right	0	0	0	0	0	0	0	0	0	0		
cSH	1700	1700	1700	1700	1700	1700	619	1700	1700	1700		
Volume to Capacity	0.00	0.00	0.22	0.22	0.22	0.00	0.13	0.43	0.43	0.43		
Queue Length 95th (ft)	0	0	0	0	0	0	11	0	0	0		
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	11.7	0.0	0.0	0.0		
Lane LOS	A	A					B					
Approach Delay (s)	0.0	0.0	0.0				0.4					
Approach LOS	A	A										
Intersection Summary												
Average Delay			0.3									
Intersection Capacity Utilization			42.3%		ICU Level of Service				A			
Analysis Period (min)			15									

HCM Signalized Intersection Capacity Analysis
45: Vasco Rd & East Ave

BART to Livermore Extension Project
2040 DMU AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	295	366	52	10	27	20	68	253	195	260	291	314
Future Volume (vph)	295	366	52	10	27	20	68	253	195	260	291	314
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	0.95		0.97	1.00	1.00
Frt	1.00	0.98		1.00	0.94		1.00	0.93		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	3473		1770	3310		1770	3308		3433	1863	1583
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1770	3473		1770	3310		1770	3308		3433	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	321	398	57	11	29	22	74	275	212	283	316	341
RTOR Reduction (vph)	0	19	0	0	20	0	0	156	0	0	0	236
Lane Group Flow (vph)	321	436	0	11	31	0	74	331	0	283	316	105
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												6
Actuated Green, G (s)	11.5	16.2		0.6	5.3		3.1	13.8		5.2	15.9	15.9
Effective Green, g (s)	11.5	16.2		0.6	5.3		3.1	13.8		5.2	15.9	15.9
Actuated g/C Ratio	0.22	0.31		0.01	0.10		0.06	0.27		0.10	0.31	0.31
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	392	1086		20	338		105	881		344	571	485
v/s Ratio Prot	c0.18	c0.13		0.01	0.01		0.04	0.10		c0.08	c0.17	
v/s Ratio Perm												0.07
v/c Ratio	0.82	0.40		0.55	0.09		0.70	0.38		0.82	0.55	0.22
Uniform Delay, d1	19.2	14.0		25.5	21.1		23.9	15.5		22.8	15.0	13.3
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	12.5	0.2		28.9	0.1		19.3	0.3		14.6	1.2	0.2
Delay (s)	31.7	14.2		54.3	21.2		43.2	15.8		37.5	16.2	13.5
Level of Service	C	B		D	C		D	B		D	B	B
Approach Delay (s)		21.5			27.1			19.4			21.6	
Approach LOS		C			C			B			C	

Intersection Summary

HCM 2000 Control Delay	21.2	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.70		
Actuated Cycle Length (s)	51.8	Sum of lost time (s)	16.0
Intersection Capacity Utilization	53.7%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
46: Greenville Rd & I-580 WB Ramps

BART to Livermore Extension Project
2040 DMU AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↔		↔		↕	↔		↕	↔
Traffic Volume (vph)	0	0	0	247	0	43	0	123	365	0	941	564
Future Volume (vph)	0	0	0	247	0	43	0	123	365	0	941	564
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0		4.0		4.0	4.0		4.0	
Lane Util. Factor				0.97		1.00		0.95	1.00		0.95	
Frt				1.00		0.85		1.00	0.85		0.94	
Flt Protected				0.95		1.00		1.00	1.00		1.00	
Satd. Flow (prot)				3433		1583		3539	1583		3340	
Flt Permitted				0.95		1.00		1.00	1.00		1.00	
Satd. Flow (perm)				3433		1583		3539	1583		3340	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	268	0	47	0	134	397	0	1023	613
RTOR Reduction (vph)	0	0	0	0	0	39	0	0	127	0	178	0
Lane Group Flow (vph)	0	0	0	268	0	8	0	134	270	0	1458	0
Turn Type				Prot		Prot		NA	Perm		NA	
Protected Phases				3		3		2			6	
Permitted Phases									2			
Actuated Green, G (s)				8.0		8.0		34.0	34.0		34.0	
Effective Green, g (s)				8.0		8.0		34.0	34.0		34.0	
Actuated g/C Ratio				0.16		0.16		0.68	0.68		0.68	
Clearance Time (s)				4.0		4.0		4.0	4.0		4.0	
Vehicle Extension (s)				3.0		3.0		3.0	3.0		3.0	
Lane Grp Cap (vph)				549		253		2406	1076		2271	
v/s Ratio Prot				c0.08		0.00		0.04			c0.44	
v/s Ratio Perm									0.17			
v/c Ratio				0.49		0.03		0.06	0.25		0.64	
Uniform Delay, d1				19.1		17.7		2.7	3.1		4.5	
Progression Factor				1.00		1.00		0.95	4.25		1.00	
Incremental Delay, d2				0.7		0.0		0.0	0.6		1.4	
Delay (s)				19.8		17.8		2.6	13.7		6.0	
Level of Service				B		B		A	B		A	
Approach Delay (s)		0.0			19.5			10.9			6.0	
Approach LOS		A			B			B			A	






















Intersection Summary

HCM 2000 Control Delay	8.7	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.61		
Actuated Cycle Length (s)	50.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	57.8%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
47: Greenville Rd & I-580 EB Ramps

BART to Livermore Extension Project
2040 DMU AM

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations	 							 			 		
Traffic Volume (vph)	37	0	140	0	0	0	0	460	73	0	892	31	
Future Volume (vph)	37	0	140	0	0	0	0	460	73	0	892	31	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)	4.0		4.0					4.0	4.0		4.0	4.0	
Lane Util. Factor	0.97		1.00					0.95	1.00		0.95	1.00	
Frt	1.00		0.85					1.00	0.85		1.00	0.85	
Flt Protected	0.95		1.00					1.00	1.00		1.00	1.00	
Satd. Flow (prot)	3433		1583					3539	1583		3539	1583	
Flt Permitted	0.95		1.00					1.00	1.00		1.00	1.00	
Satd. Flow (perm)	3433		1583					3539	1583		3539	1583	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	
Adj. Flow (vph)	40	0	152	0	0	0	0	500	79	0	970	34	
RTOR Reduction (vph)	0	0	105	0	0	0	0	0	22	0	0	10	
Lane Group Flow (vph)	40	0	47	0	0	0	0	500	57	0	970	24	
Turn Type	Prot		Prot					NA	Perm		NA	Perm	
Protected Phases	7		7					2			6		
Permitted Phases									2			6	
Actuated Green, G (s)	6.2		6.2					35.8	35.8		35.8	35.8	
Effective Green, g (s)	6.2		6.2					35.8	35.8		35.8	35.8	
Actuated g/C Ratio	0.12		0.12					0.72	0.72		0.72	0.72	
Clearance Time (s)	4.0		4.0					4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0		3.0					3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	425		196					2533	1133		2533	1133	
v/s Ratio Prot	0.01		c0.03					0.14			c0.27		
v/s Ratio Perm									0.04			0.02	
v/c Ratio	0.09		0.24					0.20	0.05		0.38	0.02	
Uniform Delay, d1	19.4		19.8					2.3	2.1		2.8	2.0	
Progression Factor	1.00		1.00					0.75	0.45		0.77	0.63	
Incremental Delay, d2	0.1		0.6					0.2	0.1		0.3	0.0	
Delay (s)	19.5		20.4					1.9	1.0		2.5	1.3	
Level of Service	B		C					A	A		A	A	
Approach Delay (s)		20.2			0.0			1.8			2.5		
Approach LOS		C			A			A			A		
Intersection Summary													
HCM 2000 Control Delay			4.2									HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio			0.36										
Actuated Cycle Length (s)			50.0									Sum of lost time (s)	8.0
Intersection Capacity Utilization			40.0%									ICU Level of Service	A
Analysis Period (min)			15										

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 48: Greenville Rd & Northfront Road/Altamont Pass Road



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↑	↑	↑	↑	↑
Traffic Volume (vph)	6	651	686	507	97	61
Future Volume (vph)	6	651	686	507	97	61
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	1863	1583	1770	1863	1770	1583
Flt Permitted	1.00	1.00	0.75	1.00	0.95	1.00
Satd. Flow (perm)	1863	1583	1403	1863	1770	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	7	708	746	551	105	66
RTOR Reduction (vph)	0	241	0	0	0	54
Lane Group Flow (vph)	7	467	746	551	105	12
Turn Type	NA	Perm	Perm	NA	Prot	Perm
Protected Phases	4			8	2	
Permitted Phases		4	8			2
Actuated Green, G (s)	31.8	31.8	31.8	31.8	8.4	8.4
Effective Green, g (s)	31.8	31.8	31.8	31.8	8.4	8.4
Actuated g/C Ratio	0.66	0.66	0.66	0.66	0.17	0.17
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	1229	1044	925	1229	308	275
v/s Ratio Prot	0.00			0.30	c0.06	
v/s Ratio Perm		0.30	c0.53			0.01
v/c Ratio	0.01	0.45	0.81	0.45	0.34	0.04
Uniform Delay, d1	2.8	4.0	6.0	4.0	17.5	16.6
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.0	0.3	5.2	0.3	0.7	0.1
Delay (s)	2.8	4.3	11.2	4.2	18.1	16.6
Level of Service	A	A	B	A	B	B
Approach Delay (s)	4.3			8.2	17.5	
Approach LOS	A			A	B	

Intersection Summary

HCM 2000 Control Delay	7.6	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.71		
Actuated Cycle Length (s)	48.2	Sum of lost time (s)	8.0
Intersection Capacity Utilization	85.0%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
49: Greenville Rd & Southfront Rd



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	121	166	130	439	755	217
Future Volume (vph)	121	166	130	439	755	217
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.2	5.2	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.88	0.97	0.95	0.95	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	3433	2787	3433	3539	3539	1583
Flt Permitted	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (perm)	3433	2787	3433	3539	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	132	180	141	477	821	236
RTOR Reduction (vph)	0	161	0	0	0	85
Lane Group Flow (vph)	132	19	141	477	821	151
Turn Type	Prot	Perm	Prot	NA	NA	Perm
Protected Phases	8		1	6	2	
Permitted Phases		8				2
Actuated Green, G (s)	11.3	11.3	12.3	78.4	62.1	62.1
Effective Green, g (s)	10.7	10.7	12.3	80.1	63.8	63.8
Actuated g/C Ratio	0.11	0.11	0.12	0.80	0.64	0.64
Clearance Time (s)	4.6	4.6	4.0	5.7	5.7	5.7
Vehicle Extension (s)	5.0	5.0	6.0	2.5	2.5	2.5
Lane Grp Cap (vph)	367	298	422	2834	2257	1009
v/s Ratio Prot	c0.04		c0.04	0.13	c0.23	
v/s Ratio Perm		0.01				0.10
v/c Ratio	0.36	0.06	0.33	0.17	0.36	0.15
Uniform Delay, d1	41.5	40.2	40.1	2.3	8.5	7.2
Progression Factor	1.00	1.00	1.00	1.00	0.88	0.85
Incremental Delay, d2	1.3	0.2	1.3	0.1	0.4	0.3
Delay (s)	42.7	40.3	41.4	2.4	7.9	6.5
Level of Service	D	D	D	A	A	A
Approach Delay (s)	41.4			11.3	7.6	
Approach LOS	D			B	A	

Intersection Summary

HCM 2000 Control Delay	14.1	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.36		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	13.2
Intersection Capacity Utilization	39.0%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
50: Greenville Rd & Patterson Pass Rd

BART to Livermore Extension Project
2040 DMU AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗		↖	↗		↖	↗		↖	↗	
Traffic Volume (vph)	43	6	68	256	430	369	16	146	1	6	337	50
Future Volume (vph)	43	6	68	256	430	369	16	146	1	6	337	50
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.86		1.00	0.93		1.00	1.00		1.00	0.98	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1607		1770	1734		1770	1861		1770	1827	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	1607		1770	1734		1770	1861		1770	1827	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	47	7	74	278	467	401	17	159	1	7	366	54
RTOR Reduction (vph)	0	56	0	0	33	0	0	0	0	0	6	0
Lane Group Flow (vph)	47	25	0	278	835	0	17	160	0	7	414	0
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												
Actuated Green, G (s)	2.3	20.9		24.7	43.3		1.5	24.6		0.7	23.8	
Effective Green, g (s)	2.3	20.9		24.7	43.3		1.5	24.6		0.7	23.8	
Actuated g/C Ratio	0.03	0.24		0.28	0.50		0.02	0.28		0.01	0.27	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	46	386		503	864		30	526		14	500	
v/s Ratio Prot	c0.03	0.02		0.16	c0.48		c0.01	0.09		0.00	c0.23	
v/s Ratio Perm												
v/c Ratio	1.02	0.06		0.55	0.97		0.57	0.30		0.50	0.83	
Uniform Delay, d1	42.3	25.5		26.4	21.1		42.4	24.4		42.9	29.6	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	139.1	0.1		1.3	22.5		22.3	1.5		25.4	14.6	
Delay (s)	181.4	25.5		27.7	43.6		64.6	25.9		68.3	44.2	
Level of Service	F	C		C	D		E	C		E	D	
Approach Delay (s)		82.8			39.8			29.6			44.6	
Approach LOS		F			D			C			D	

Intersection Summary

HCM 2000 Control Delay	42.8	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.91		
Actuated Cycle Length (s)	86.9	Sum of lost time (s)	16.0
Intersection Capacity Utilization	72.6%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
1: Dougherty Rd & Amador Valley Rd



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	396	489	911	2224	1144	323
Future Volume (vph)	396	489	911	2224	1144	323
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00	0.97	0.91	0.91	
Frt	1.00	0.85	1.00	1.00	0.97	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1770	1583	3433	5085	4917	
Flt Permitted	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	1770	1583	3433	5085	4917	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	430	532	990	2417	1243	351
RTOR Reduction (vph)	0	341	0	0	48	0
Lane Group Flow (vph)	430	191	990	2417	1546	0
Turn Type	Perm	Perm	Prot	NA	NA	
Protected Phases			5	2	6	
Permitted Phases	4	4				
Actuated Green, G (s)	27.6	27.6	27.0	67.8	36.8	
Effective Green, g (s)	27.6	27.6	27.0	67.8	36.8	
Actuated g/C Ratio	0.27	0.27	0.26	0.66	0.36	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	472	422	896	3334	1749	
v/s Ratio Prot			c0.29	0.48	c0.31	
v/s Ratio Perm	c0.24	0.12				
v/c Ratio	0.91	0.45	1.10	0.72	0.88	
Uniform Delay, d1	36.7	31.6	38.2	11.7	31.3	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	21.7	0.8	63.1	0.8	5.7	
Delay (s)	58.4	32.4	101.3	12.5	37.0	
Level of Service	E	C	F	B	D	
Approach Delay (s)	44.0			38.3	37.0	
Approach LOS	D			D	D	

Intersection Summary

HCM 2000 Control Delay	38.9	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.96		
Actuated Cycle Length (s)	103.4	Sum of lost time (s)	12.0
Intersection Capacity Utilization	87.2%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
2: Hopyard Road/Dougherty Rd & Dublin Blvd



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔↔	↑↑↑	↔↔	↔↔↔	↑↑↑	↔	↔↔↔	↑↑↑	↔↔	↔↔	↑↑↑	↔↔
Traffic Volume (vph)	104	1122	874	637	1106	1058	804	2067	293	713	1240	41
Future Volume (vph)	104	1122	874	637	1106	1058	804	2067	293	713	1240	41
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	6.0	5.0	5.0	5.5	5.0	5.0	5.5	5.0	5.0	5.5	
Lane Util. Factor	0.97	0.91	0.88	0.94	0.91	1.00	0.94	0.91	0.88	0.97	0.86	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	3433	5085	2787	4990	5085	1583	4990	5085	2787	3433	6377	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	3433	5085	2787	4990	5085	1583	4990	5085	2787	3433	6377	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	113	1220	950	692	1202	1150	874	2247	318	775	1348	45
RTOR Reduction (vph)	0	0	60	0	0	69	0	0	57	0	4	0
Lane Group Flow (vph)	113	1220	890	692	1202	1081	874	2247	261	775	1389	0
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	
Protected Phases	5	2	3	1	6	7	3	8	1	7	4	
Permitted Phases			2			6			8			
Actuated Green, G (s)	16.5	35.5	54.9	19.0	38.5	52.5	19.4	45.0	64.0	14.0	39.6	
Effective Green, g (s)	16.5	35.5	54.9	19.0	38.5	52.5	19.4	45.0	64.0	14.0	39.6	
Actuated g/C Ratio	0.12	0.26	0.41	0.14	0.29	0.39	0.14	0.33	0.47	0.10	0.29	
Clearance Time (s)	5.0	6.0	5.0	5.0	5.5	5.0	5.0	5.5	5.0	5.0	5.5	
Vehicle Extension (s)	2.0	4.5	2.0	2.0	4.5	2.0	2.0	4.5	2.0	2.0	4.5	
Lane Grp Cap (vph)	419	1337	1133	702	1450	615	717	1695	1321	356	1870	
v/s Ratio Prot	0.03	c0.24	0.11	0.14	0.24	c0.18	0.18	c0.44	0.03	c0.23	0.22	
v/s Ratio Perm			0.21			0.50			0.07			
v/c Ratio	0.27	0.91	0.79	0.99	0.83	1.76	1.22	1.33	0.20	2.18	0.74	
Uniform Delay, d1	53.8	48.2	34.9	57.9	45.2	41.2	57.8	45.0	20.6	60.5	43.1	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.1	10.0	3.4	30.1	4.5	347.6	110.9	150.8	0.0	538.8	1.9	
Delay (s)	53.9	58.2	38.3	87.9	49.6	388.8	168.7	195.8	20.6	599.3	45.0	
Level of Service	D	E	D	F	D	F	F	F	C	F	D	
Approach Delay (s)		49.7			186.5			172.7			243.1	
Approach LOS		D			F			F			F	

Intersection Summary

HCM 2000 Control Delay	164.8	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.53		
Actuated Cycle Length (s)	135.0	Sum of lost time (s)	21.5
Intersection Capacity Utilization	130.9%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 3: Dougherty Rd/Hopyard Road & I-580 WB Ramps



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↔↔		↔↔		↑↑↑			↑↑↑	↔
Traffic Volume (vph)	0	0	0	324	0	666	0	2524	0	0	1658	0
Future Volume (vph)	0	0	0	324	0	666	0	2524	0	0	1658	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0		4.0		4.0			4.0	
Lane Util. Factor				0.97		0.88		0.91			0.86	
Frt				1.00		0.85		1.00			1.00	
Flt Protected				0.95		1.00		1.00			1.00	
Satd. Flow (prot)				3433		2787		5085			4806	
Flt Permitted				0.95		1.00		1.00			1.00	
Satd. Flow (perm)				3433		2787		5085			4806	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	352	0	724	0	2743	0	0	1802	0
RTOR Reduction (vph)	0	0	0	0	0	17	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	352	0	707	0	2743	0	0	1802	0
Turn Type				Prot		Prot		NA			NA	Perm
Protected Phases				4		4		2			6	
Permitted Phases												6
Actuated Green, G (s)				31.0		31.0		68.2			68.2	
Effective Green, g (s)				32.4		32.4		69.6			69.6	
Actuated g/C Ratio				0.29		0.29		0.63			0.63	
Clearance Time (s)				5.4		5.4		5.4			5.4	
Vehicle Extension (s)				3.0		3.0		3.0			3.0	
Lane Grp Cap (vph)				1011		820		3217			3040	
v/s Ratio Prot				0.10		c0.25		c0.54			0.37	
v/s Ratio Perm												
v/c Ratio				0.35		0.86		0.85			0.59	
Uniform Delay, d1				30.5		36.7		16.1			11.9	
Progression Factor				1.00		1.00		0.87			1.00	
Incremental Delay, d2				0.2		9.3		0.3			0.9	
Delay (s)				30.7		46.0		14.2			12.7	
Level of Service				C		D		B			B	
Approach Delay (s)		0.0			41.0			14.2			12.7	
Approach LOS		A			D			B			B	

Intersection Summary

HCM 2000 Control Delay	18.9	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.86		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	78.7%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
4: Hopyard Rd/Dougherty Rd & I-580 EB Ramps

BART to Livermore Extension Project
2040 DMU PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗		↖↗					↑↑↑	↖		↑↑↑	↖
Traffic Volume (vph)	1141	0	1040	0	0	0	0	2647	0	0	1316	0
Future Volume (vph)	1141	0	1040	0	0	0	0	2647	0	0	1316	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0					4.0			4.0	
Lane Util. Factor	0.97		0.88					0.91			0.86	
Frt	1.00		0.85					1.00			1.00	
Flt Protected	0.95		1.00					1.00			1.00	
Satd. Flow (prot)	3433		2787					5085			4806	
Flt Permitted	0.95		1.00					1.00			1.00	
Satd. Flow (perm)	3433		2787					5085			4806	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	1240	0	1130	0	0	0	0	2877	0	0	1430	0
RTOR Reduction (vph)	0	0	35	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	1240	0	1095	0	0	0	0	2877	0	0	1430	0
Turn Type	Prot		Prot					NA	Free		NA	Perm
Protected Phases	4		4					2			6	
Permitted Phases									Free			6
Actuated Green, G (s)	40.2		40.2					59.0			59.0	
Effective Green, g (s)	41.6		41.6					60.4			60.4	
Actuated g/C Ratio	0.38		0.38					0.55			0.55	
Clearance Time (s)	5.4		5.4					5.4			5.4	
Vehicle Extension (s)	3.0		3.0					3.0			3.0	
Lane Grp Cap (vph)	1298		1053					2792			2638	
v/s Ratio Prot	0.36		c0.39					c0.57			0.30	
v/s Ratio Perm												
v/c Ratio	0.96		1.04					1.03			0.54	
Uniform Delay, d1	33.3		34.2					24.8			15.9	
Progression Factor	1.00		1.00					0.53			1.60	
Incremental Delay, d2	15.4		38.5					24.4			0.7	
Delay (s)	48.7		72.7					37.4			26.2	
Level of Service	D		E					D			C	
Approach Delay (s)		60.2			0.0			37.4			26.2	
Approach LOS		E			A			D			C	

Intersection Summary

HCM 2000 Control Delay	43.1	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	1.03		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	90.4%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
5: Hopyard Rd & Owens Rd

BART to Livermore Extension Project
2040 DMU PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↔↗		↖	↗	↗	↖	↑↑↑	↗	↖↗	↑↑↗	
Traffic Volume (vph)	379	290	246	549	300	377	239	980	324	528	1611	264
Future Volume (vph)	379	290	246	549	300	377	239	980	324	528	1611	264
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	2.7	2.7		2.7	2.7	2.7	4.0	2.3	2.3	4.0	2.3	
Lane Util. Factor	0.91	0.91		1.00	0.95	0.95	1.00	0.91	1.00	0.97	0.91	
Frt	1.00	0.95		1.00	0.96	0.85	1.00	1.00	0.85	1.00	0.98	
Flt Protected	0.95	0.99		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1610	3175		1770	1695	1504	1770	5085	1583	3433	4978	
Flt Permitted	0.95	0.99		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1610	3175		1770	1695	1504	1770	5085	1583	3433	4978	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	412	315	267	597	326	410	260	1065	352	574	1751	287
RTOR Reduction (vph)	0	56	0	0	13	27	0	0	252	0	20	0
Lane Group Flow (vph)	227	711	0	597	440	256	260	1065	100	574	2018	0
Turn Type	Split	NA		Split	NA	pm+ov	Prot	NA	Perm	Prot	NA	
Protected Phases	8	8		4	4	1	5	2		1	6	
Permitted Phases						4			2			
Actuated Green, G (s)	16.0	16.0		27.0	27.0	48.6	12.0	29.4	29.4	21.6	39.0	
Effective Green, g (s)	17.3	17.3		28.3	28.3	51.2	12.0	31.1	31.1	21.6	40.7	
Actuated g/C Ratio	0.16	0.16		0.26	0.26	0.47	0.11	0.28	0.28	0.20	0.37	
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	253	499		455	436	736	193	1437	447	674	1841	
v/s Ratio Prot	0.14	c0.22		c0.34	0.26	0.07	c0.15	0.21		0.17	c0.41	
v/s Ratio Perm						0.10			0.06			
v/c Ratio	0.90	1.42		1.31	1.01	0.35	1.35	0.74	0.22	0.85	1.10	
Uniform Delay, d1	45.5	46.4		40.9	40.9	18.8	49.0	35.8	30.2	42.7	34.6	
Progression Factor	1.00	1.00		0.94	0.92	0.81	1.00	1.00	1.00	0.98	0.64	
Incremental Delay, d2	30.7	202.2		155.3	45.3	0.3	186.5	3.5	1.1	6.8	49.5	
Delay (s)	76.2	248.5		193.5	82.9	15.6	235.5	39.3	31.3	48.5	71.6	
Level of Service	E	F		F	F	B	F	D	C	D	E	
Approach Delay (s)		209.2			118.2			68.0			66.5	
Approach LOS		F			F			E			E	

Intersection Summary

HCM 2000 Control Delay	98.7	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.24		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	11.7
Intersection Capacity Utilization	111.9%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
6: Hopyard Rd & Stoneridge Dr

BART to Livermore Extension Project
2040 DMU PM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	277	1135	688	118	1369	200	619	874	86	268	944	216
Future Volume (vph)	277	1135	688	118	1369	200	619	874	86	268	944	216
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.91	1.00	0.97	0.91	1.00	0.94	0.95	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5085	1583	3433	5085	1583	4990	3539	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5085	1583	3433	5085	1583	4990	3539	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	301	1234	748	128	1488	217	673	950	93	291	1026	235
RTOR Reduction (vph)	0	0	186	0	0	157	0	0	67	0	0	124
Lane Group Flow (vph)	301	1234	562	128	1488	60	673	950	26	291	1026	111
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8			2			6
Actuated Green, G (s)	5.0	18.6	18.6	3.2	16.8	16.8	7.0	17.0	17.0	6.0	16.0	16.0
Effective Green, g (s)	5.0	18.6	18.6	3.2	16.8	16.8	7.0	17.0	17.0	6.0	16.0	16.0
Actuated g/C Ratio	0.08	0.31	0.31	0.05	0.28	0.28	0.12	0.28	0.28	0.10	0.26	0.26
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	282	1555	484	180	1405	437	574	989	442	338	1338	416
v/s Ratio Prot	c0.09	0.24		0.04	0.29		c0.13	c0.27		0.08	0.20	
v/s Ratio Perm			c0.35			0.04			0.02			0.07
v/c Ratio	1.07	0.79	1.16	0.71	1.06	0.14	1.17	0.96	0.06	0.86	0.77	0.27
Uniform Delay, d1	27.9	19.3	21.1	28.3	22.0	16.5	26.9	21.6	16.0	27.0	20.7	17.8
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	72.6	2.9	93.3	12.4	41.3	0.1	95.0	19.7	0.1	19.5	2.7	0.3
Delay (s)	100.5	22.2	114.4	40.8	63.3	16.7	121.9	41.2	16.1	46.5	23.4	18.1
Level of Service	F	C	F	D	E	B	F	D	B	D	C	B
Approach Delay (s)		62.7			56.3			71.5			26.9	
Approach LOS		E			E			E			C	

Intersection Summary

HCM 2000 Control Delay	55.6	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.14		
Actuated Cycle Length (s)	60.8	Sum of lost time (s)	16.0
Intersection Capacity Utilization	79.5%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
7: Hopyard Rd & Las Positas Blvd

BART to Livermore Extension Project
2040 DMU PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↖↖	↖	↖↗	↖↖	↖	↖↗	↖↖↖	↖	↖↗	↖↖↖	↖
Traffic Volume (vph)	105	257	488	596	422	51	379	1006	258	72	1544	76
Future Volume (vph)	105	257	488	596	422	51	379	1006	258	72	1544	76
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.95	1.00	0.97	0.95	1.00	0.97	0.91	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	3433	3539	1583	3433	5085	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	3433	3539	1583	3433	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	114	279	530	648	459	55	412	1093	280	78	1678	83
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	54
Lane Group Flow (vph)	114	279	530	648	459	55	412	1093	280	78	1678	29
Turn Type	Prot	NA	Free	Prot	NA	Free	Prot	NA	Free	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1		6
Permitted Phases			Free			Free			Free			6
Actuated Green, G (s)	4.8	12.9	87.8	17.0	25.1	87.8	11.0	37.9	87.8	4.0	30.9	30.9
Effective Green, g (s)	4.8	12.9	87.8	17.0	25.1	87.8	11.0	37.9	87.8	4.0	30.9	30.9
Actuated g/C Ratio	0.05	0.15	1.00	0.19	0.29	1.00	0.13	0.43	1.00	0.05	0.35	0.35
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	187	519	1583	664	1011	1583	430	2195	1583	156	1789	557
v/s Ratio Prot	0.03	0.08		c0.19	c0.13		c0.12	0.21		0.02	c0.33	
v/s Ratio Perm			0.33			0.03			0.18			0.02
v/c Ratio	0.61	0.54	0.33	0.98	0.45	0.03	0.96	0.50	0.18	0.50	0.94	0.05
Uniform Delay, d1	40.6	34.7	0.0	35.2	25.7	0.0	38.2	18.1	0.0	40.9	27.5	18.8
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	5.5	1.1	0.6	28.7	0.3	0.0	32.4	0.2	0.2	2.5	10.0	0.0
Delay (s)	46.1	35.8	0.6	63.9	26.1	0.0	70.6	18.2	0.2	43.4	37.5	18.8
Level of Service	D	D	A	E	C	A	E	B	A	D	D	B
Approach Delay (s)		16.8			45.9			27.5			36.9	
Approach LOS		B			D			C			D	

Intersection Summary

HCM 2000 Control Delay	32.5	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.88		
Actuated Cycle Length (s)	87.8	Sum of lost time (s)	16.0
Intersection Capacity Utilization	78.1%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
8: Willow Rd & Owens Rd

BART to Livermore Extension Project
2040 DMU PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	95	886	200	115	697	78	189	76	0	198	67	131
Future Volume (vph)	95	886	200	115	697	78	189	76	0	198	67	131
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	5.3	4.0		5.3	4.0	4.0
Lane Util. Factor	0.97	0.91		0.97	0.91	1.00	1.00	0.95		1.00	1.00	1.00
Frt	1.00	0.97		1.00	1.00	0.85	1.00	1.00		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	4945		3433	5085	1583	1770	3539		1770	1863	1583
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.71	1.00		0.70	1.00	1.00
Satd. Flow (perm)	3433	4945		3433	5085	1583	1322	3539		1304	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	103	963	217	125	758	85	205	83	0	215	73	142
RTOR Reduction (vph)	0	24	0	0	0	36	0	0	0	0	0	109
Lane Group Flow (vph)	103	1156	0	125	758	49	205	83	0	215	73	33
Turn Type	Prot	NA		Prot	NA	Perm	Perm	NA	Perm	Perm	NA	Perm
Protected Phases	1	6		5	2			4				8
Permitted Phases						2	4		4	8		8
Actuated Green, G (s)	8.7	61.4		9.4	62.1	62.1	24.2	24.2		24.2	24.2	24.2
Effective Green, g (s)	8.7	63.1		9.4	63.8	63.8	24.2	25.5		24.2	25.5	25.5
Actuated g/C Ratio	0.08	0.57		0.09	0.58	0.58	0.22	0.23		0.22	0.23	0.23
Clearance Time (s)	4.0	5.7		4.0	5.7	5.7	5.3	5.3		5.3	5.3	5.3
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	271	2836		293	2949	918	290	820		286	431	366
v/s Ratio Prot	0.03	c0.23		c0.04	0.15			0.02			0.04	
v/s Ratio Perm						0.03	0.16			c0.16		0.02
v/c Ratio	0.38	0.41		0.43	0.26	0.05	0.71	0.10		0.75	0.17	0.09
Uniform Delay, d1	48.1	13.0		47.7	11.4	10.0	39.6	33.2		40.1	33.8	33.1
Progression Factor	0.91	0.89		1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	0.4	0.2		1.0	0.2	0.1	7.6	0.1		10.6	0.2	0.1
Delay (s)	44.0	11.8		48.7	11.6	10.1	47.3	33.3		50.7	34.0	33.3
Level of Service	D	B		D	B	B	D	C		D	C	C
Approach Delay (s)		14.4			16.3			43.2			42.1	
Approach LOS		B			B			D			D	

Intersection Summary

HCM 2000 Control Delay	21.8	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.49		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	52.5%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
9: Hacienda Dr & Dublin Blvd

BART to Livermore Extension Project
2040 DMU PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	50	1025	174	241	603	26	402	655	530	35	701	216
Future Volume (vph)	50	1025	174	241	603	26	402	655	530	35	701	216
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	6.0	5.0	4.5	6.0		5.0	6.0	6.0	4.5	5.5	5.5
Lane Util. Factor	0.97	0.91	0.88	0.97	0.91		0.94	0.95	0.88	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5085	2787	3433	5054		4990	3539	2787	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5085	2787	3433	5054		4990	3539	2787	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	54	1114	189	262	655	28	437	712	576	38	762	235
RTOR Reduction (vph)	0	0	63	0	4	0	0	0	202	0	0	159
Lane Group Flow (vph)	54	1114	126	262	679	0	437	712	374	38	762	76
Turn Type	Prot	NA	pm+ov	Prot	NA		Prot	NA	Perm	Prot	NA	Perm
Protected Phases	5	2	3	1	6		3	8		7	4	
Permitted Phases			2						8			4
Actuated Green, G (s)	4.1	31.2	43.3	10.1	37.2		12.1	33.9	33.9	2.2	24.0	24.0
Effective Green, g (s)	4.1	31.2	43.3	10.1	37.2		12.1	33.9	33.9	2.2	24.0	24.0
Actuated g/C Ratio	0.04	0.32	0.44	0.10	0.38		0.12	0.34	0.34	0.02	0.24	0.24
Clearance Time (s)	4.5	6.0	5.0	4.5	6.0		5.0	6.0	6.0	4.5	5.5	5.5
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	143	1612	1368	352	1910		613	1219	960	76	1240	386
v/s Ratio Prot	0.02	c0.22	0.01	c0.08	0.13		c0.09	0.20		0.01	c0.15	
v/s Ratio Perm			0.03						0.13			0.05
v/c Ratio	0.38	0.69	0.09	0.74	0.36		0.71	0.58	0.39	0.50	0.61	0.20
Uniform Delay, d1	45.9	29.4	16.1	42.9	22.0		41.5	26.5	24.4	47.6	33.1	29.5
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.7	1.3	0.0	8.3	0.1		3.9	0.7	0.3	5.1	0.9	0.3
Delay (s)	47.6	30.7	16.1	51.2	22.1		45.4	27.2	24.7	52.7	34.0	29.8
Level of Service	D	C	B	D	C		D	C	C	D	C	C
Approach Delay (s)		29.3			30.2			31.0			33.7	
Approach LOS		C			C			C			C	

Intersection Summary

HCM 2000 Control Delay	30.9	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.68		
Actuated Cycle Length (s)	98.4	Sum of lost time (s)	21.0
Intersection Capacity Utilization	65.6%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 10: Hacienda Dr & Martinelli Blvd/Hacienda Crossings

BART to Livermore Extension Project
 2040 DMU PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗	↘	↙	↘		↖↗↘	↖↗↘	↗	↖↗	↖↗↘	
Traffic Volume (vph)	33	57	476	289	33	25	397	1560	457	63	1033	73
Future Volume (vph)	33	57	476	289	33	25	397	1560	457	63	1033	73
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	2.0	2.0	4.5	2.0		3.0	2.0	2.0	4.5	2.5	
Lane Util. Factor	1.00	0.91	0.91	0.97	1.00		0.94	0.91	1.00	0.97	0.86	
Frt	1.00	0.93	0.85	1.00	0.94		1.00	1.00	0.85	1.00	0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1770	1579	2882	3433	1743		4990	5085	1583	3433	6345	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1770	1579	2882	3433	1743		4990	5085	1583	3433	6345	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	36	62	517	314	36	27	432	1696	497	68	1123	79
RTOR Reduction (vph)	0	35	265	0	20	0	0	0	158	0	7	0
Lane Group Flow (vph)	36	79	200	314	43	0	432	1696	339	68	1195	0
Turn Type	Prot	NA	Perm	Prot	NA		Prot	NA	pm+ov	Prot	NA	
Protected Phases	5	2		1	6		3	8	1	7	4	
Permitted Phases			2						8			
Actuated Green, G (s)	3.6	16.6	16.6	14.1	27.1		13.4	56.9	71.0	6.4	49.9	
Effective Green, g (s)	3.1	18.6	18.6	13.6	29.1		14.4	58.9	75.0	5.9	51.4	
Actuated g/C Ratio	0.03	0.17	0.17	0.12	0.26		0.13	0.54	0.68	0.05	0.47	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	4.0	4.0	2.0	4.0		3.0	4.0	2.0	3.0	4.0	
Lane Grp Cap (vph)	49	266	487	424	461		653	2722	1108	184	2964	
v/s Ratio Prot	0.02	0.05		c0.09	0.02		0.09	c0.33	0.04	0.02	c0.19	
v/s Ratio Perm			c0.07						0.17			
v/c Ratio	0.73	0.30	0.41	0.74	0.09		0.66	0.62	0.31	0.37	0.40	
Uniform Delay, d1	53.0	40.0	40.8	46.5	30.5		45.5	17.8	7.0	50.3	19.2	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.03	1.07	2.20	1.00	1.00	
Incremental Delay, d2	43.4	0.9	0.8	6.0	0.1		1.8	0.8	0.0	1.3	0.4	
Delay (s)	96.5	40.8	41.6	52.5	30.6		48.7	19.8	15.6	51.5	19.6	
Level of Service	F	D	D	D	C		D	B	B	D	B	
Approach Delay (s)		44.7			48.8			23.7			21.3	
Approach LOS		D			D			C			C	

Intersection Summary		
HCM 2000 Control Delay	27.7	HCM 2000 Level of Service C
HCM 2000 Volume to Capacity ratio	0.59	
Actuated Cycle Length (s)	110.0	Sum of lost time (s) 13.0
Intersection Capacity Utilization	67.6%	ICU Level of Service C
Analysis Period (min)	15	

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 11: Hacienda Dr & I-580 WB Ramps

BART to Livermore Extension Project
 2040 DMU PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↔↔		↔↔		↑↑↑			↑↑↑	↔
Traffic Volume (vph)	0	0	0	408	0	415	0	1739	808	0	964	803
Future Volume (vph)	0	0	0	408	0	415	0	1739	808	0	964	803
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				2.6		2.6		2.1			2.1	2.1
Lane Util. Factor				0.97		0.88		0.91			0.86	0.86
Frt				1.00		0.85		0.95			0.96	0.85
Flt Protected				0.95		1.00		1.00			1.00	1.00
Satd. Flow (prot)				3433		2787		4843			4594	1362
Flt Permitted				0.95		1.00		1.00			1.00	1.00
Satd. Flow (perm)				3433		2787		4843			4594	1362
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	443	0	451	0	1890	878	0	1048	873
RTOR Reduction (vph)	0	0	0	0	0	32	0	147	0	0	132	139
Lane Group Flow (vph)	0	0	0	443	0	419	0	2621	0	0	1353	297
Turn Type				Prot		Prot		NA			NA	Perm
Protected Phases				4		4		2			6	
Permitted Phases												6
Actuated Green, G (s)				11.4		11.4		35.6			35.6	35.6
Effective Green, g (s)				12.8		12.8		37.5			37.5	37.5
Actuated g/C Ratio				0.23		0.23		0.68			0.68	0.68
Clearance Time (s)				4.0		4.0		4.0			4.0	4.0
Vehicle Extension (s)				3.0		3.0		3.0			3.0	3.0
Lane Grp Cap (vph)				798		648		3302			3132	928
v/s Ratio Prot				0.13		c0.15		c0.54			0.29	
v/s Ratio Perm												0.22
v/c Ratio				0.56		0.65		0.79			0.43	0.32
Uniform Delay, d1				18.6		19.1		6.1			3.9	3.6
Progression Factor				1.00		1.00		0.79			0.61	1.43
Incremental Delay, d2				0.8		2.2		1.3			0.4	0.8
Delay (s)				19.4		21.3		6.1			2.8	5.9
Level of Service				B		C		A			A	A
Approach Delay (s)		0.0			20.4			6.1			3.5	
Approach LOS		A			C			A			A	

Intersection Summary			
HCM 2000 Control Delay	7.5	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.75		
Actuated Cycle Length (s)	55.0	Sum of lost time (s)	4.7
Intersection Capacity Utilization	72.9%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 12: Hacienda Dr & I-580 EB Ramps






































Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗		↖↗					↖↗↘	↖		↖↗↘	
Traffic Volume (vph)	904	0	463	0	0	0	0	1812	582	0	953	313
Future Volume (vph)	904	0	463	0	0	0	0	1812	582	0	953	313
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0					4.0	4.0		4.0	
Lane Util. Factor	0.97		0.88					0.86	0.86		0.91	
Frt	1.00		0.85					0.99	0.85		0.96	
Flt Protected	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (prot)	3433		2787					4741	1362		4897	
Flt Permitted	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (perm)	3433		2787					4741	1362		4897	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	983	0	503	0	0	0	0	1970	633	0	1036	340
RTOR Reduction (vph)	0	0	106	0	0	0	0	9	181	0	50	0
Lane Group Flow (vph)	983	0	397	0	0	0	0	2157	256	0	1326	0
Turn Type	Prot		Prot					NA	Perm		NA	
Protected Phases	4		4					2			6	
Permitted Phases									2			
Actuated Green, G (s)	36.1		36.1					62.6	62.6		62.6	
Effective Green, g (s)	37.5		37.5					64.5	64.5		64.5	
Actuated g/C Ratio	0.34		0.34					0.59	0.59		0.59	
Clearance Time (s)	5.4		5.4					5.9	5.9		5.9	
Vehicle Extension (s)	2.0		2.0					2.0	2.0		2.0	
Lane Grp Cap (vph)	1170		950					2779	798		2871	
v/s Ratio Prot	c0.29		0.14					c0.45			0.27	
v/s Ratio Perm									0.19			
v/c Ratio	0.84		0.42					0.78	0.32		0.46	
Uniform Delay, d1	33.5		27.9					17.3	11.6		12.9	
Progression Factor	1.00		1.00					1.00	1.00		0.68	
Incremental Delay, d2	5.4		0.1					2.2	1.1		0.5	
Delay (s)	38.8		28.0					19.5	12.7		9.3	
Level of Service	D		C					B	B		A	
Approach Delay (s)		35.2			0.0			18.3			9.3	
Approach LOS		D			A			B			A	

Intersection Summary		
HCM 2000 Control Delay	20.6	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.80	C
Actuated Cycle Length (s)	110.0	Sum of lost time (s)
Intersection Capacity Utilization	71.8%	8.0
Analysis Period (min)	15	ICU Level of Service
		C

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
13: Hacienda Dr & Owens Rd

BART to Livermore Extension Project
2040 DMU PM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 	  		 	  		 	  		  		
Traffic Volume (vph)	662	978	56	150	371	866	27	708	270	612	513	276
Future Volume (vph)	662	978	56	150	371	866	27	708	270	612	513	276
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	2.3	4.0	4.0	2.3	4.0	4.0	2.7	4.0	4.0	2.7
Lane Util. Factor	0.97	0.91	1.00	0.97	0.91	1.00	0.97	0.91	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5085	1583	3433	5085	1583	3433	5085	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5085	1583	3433	5085	1583	3433	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	720	1063	61	163	403	941	29	770	293	665	558	300
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	720	1063	61	163	403	941	29	770	293	665	558	300
Turn Type	Prot	NA	Free	Prot	NA	Free	Prot	NA	Free	Prot	NA	Free
Protected Phases	1	6		5	2		7	4		3	8	
Permitted Phases			Free			Free			Free			Free
Actuated Green, G (s)	32.4	37.5	115.0	9.5	14.6	115.0	2.4	23.2	115.0	25.8	46.6	115.0
Effective Green, g (s)	32.4	39.2	115.0	9.5	16.3	115.0	2.4	24.5	115.0	25.8	47.9	115.0
Actuated g/C Ratio	0.28	0.34	1.00	0.08	0.14	1.00	0.02	0.21	1.00	0.22	0.42	1.00
Clearance Time (s)	4.0	5.7		4.0	5.7		4.0	5.3		4.0	5.3	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	967	1733	1583	283	720	1583	71	1083	1583	770	2118	1583
v/s Ratio Prot	c0.21	0.21		0.05	0.08		0.01	c0.15		c0.19	0.11	
v/s Ratio Perm			0.04			c0.59			0.19			0.19
v/c Ratio	0.74	0.61	0.04	0.58	0.56	0.59	0.41	0.71	0.19	0.86	0.26	0.19
Uniform Delay, d1	37.5	31.6	0.0	50.8	46.0	0.0	55.6	42.0	0.0	42.9	22.0	0.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	3.1	0.7	0.0	2.8	0.9	1.7	3.8	4.0	0.3	9.9	0.3	0.3
Delay (s)	40.7	32.2	0.0	53.6	47.0	1.7	59.4	45.9	0.3	52.8	22.3	0.3
Level of Service	D	C	A	D	D	A	E	D	A	D	C	A
Approach Delay (s)		34.5			19.4			34.0			31.3	
Approach LOS		C			B			C			C	

Intersection Summary

HCM 2000 Control Delay	29.8	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.78		
Actuated Cycle Length (s)	115.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	70.5%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
14: Tassajara Rd & Dublin Blvd

BART to Livermore Extension Project
2040 DMU PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	256	865	441	298	354	25	412	996	593	34	814	142
Future Volume (vph)	256	865	441	298	354	25	412	996	593	34	814	142
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	6.0	6.0	5.0	6.0		5.0	6.0	6.0	5.0	5.7	5.7
Lane Util. Factor	0.97	0.86	0.88	0.94	0.91		0.94	0.86	1.00	0.97	0.86	0.88
Frt	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	6408	2787	4990	5035		4990	6408	1583	3433	6408	2787
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	6408	2787	4990	5035		4990	6408	1583	3433	6408	2787
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	278	940	479	324	385	27	448	1083	645	37	885	154
RTOR Reduction (vph)	0	0	295	0	6	0	0	0	229	0	0	120
Lane Group Flow (vph)	278	940	184	324	406	0	448	1083	416	37	885	34
Turn Type	Prot	NA	Perm	Prot	NA		Prot	NA	Perm	Prot	NA	Perm
Protected Phases	5	2		1	6		3	8		7		4
Permitted Phases			2						8			4
Actuated Green, G (s)	16.5	33.3	33.3	16.5	33.3		28.1	47.6	47.6	7.9	27.7	27.7
Effective Green, g (s)	16.5	33.3	33.3	16.5	33.3		28.1	47.6	47.6	7.9	27.7	27.7
Actuated g/C Ratio	0.13	0.26	0.26	0.13	0.26		0.22	0.37	0.37	0.06	0.22	0.22
Clearance Time (s)	5.0	6.0	6.0	5.0	6.0		5.0	6.0	6.0	5.0	5.7	5.7
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	444	1676	729	646	1317		1101	2396	591	213	1394	606
v/s Ratio Prot	c0.08	c0.15		0.06	0.08		c0.09	0.17		0.01	0.14	
v/s Ratio Perm			0.07						c0.26			0.01
v/c Ratio	0.63	0.56	0.25	0.50	0.31		0.41	0.45	0.70	0.17	0.63	0.06
Uniform Delay, d1	52.5	40.7	37.2	51.6	37.8		42.5	30.0	33.9	56.6	45.2	39.4
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	2.8	0.4	0.2	0.6	0.1		0.2	0.1	3.8	0.4	1.0	0.0
Delay (s)	55.2	41.1	37.3	52.2	37.9		42.7	30.2	37.7	57.0	46.2	39.5
Level of Service	E	D	D	D	D		D	C	D	E	D	D
Approach Delay (s)		42.4			44.2			35.0			45.6	
Approach LOS		D			D			C			D	

Intersection Summary

HCM 2000 Control Delay	40.4	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.63		
Actuated Cycle Length (s)	127.3	Sum of lost time (s)	22.0
Intersection Capacity Utilization	76.7%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 15: Tassajara Rd & I-580 WB Ramps

BART to Livermore Extension Project
 2040 DMU PM






























Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↔↔		↔↔		↑↑	↔		↑↑↑	↔
Traffic Volume (vph)	0	0	0	579	0	232	0	1645	725	0	1307	641
Future Volume (vph)	0	0	0	579	0	232	0	1645	725	0	1307	641
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0		4.0		4.0	4.0		4.0	4.0
Lane Util. Factor				0.97		0.88		0.95	1.00		0.86	0.86
Frt				1.00		0.85		1.00	0.85		0.98	0.85
Flt Protected				0.95		1.00		1.00	1.00		1.00	1.00
Satd. Flow (prot)				3433		2787		3539	1583		4708	1362
Flt Permitted				0.95		1.00		1.00	1.00		1.00	1.00
Satd. Flow (perm)				3433		2787		3539	1583		4708	1362
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	629	0	252	0	1788	788	0	1421	697
RTOR Reduction (vph)	0	0	0	0	0	18	0	0	322	0	33	194
Lane Group Flow (vph)	0	0	0	629	0	234	0	1788	466	0	1611	280
Turn Type				Perm		Perm		NA	Perm		NA	Perm
Protected Phases								2			6	
Permitted Phases				8		8			2			6
Actuated Green, G (s)				14.5		14.5		32.5	32.5		32.5	32.5
Effective Green, g (s)				14.5		14.5		32.5	32.5		32.5	32.5
Actuated g/C Ratio				0.26		0.26		0.59	0.59		0.59	0.59
Clearance Time (s)				4.0		4.0		4.0	4.0		4.0	4.0
Vehicle Extension (s)				3.0		3.0		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)				905		734		2091	935		2782	804
v/s Ratio Prot								c0.51			0.34	
v/s Ratio Perm				c0.18		0.08			0.29			0.21
v/c Ratio				0.70		0.32		0.86	0.50		0.58	0.35
Uniform Delay, d1				18.3		16.3		9.3	6.5		7.0	5.8
Progression Factor				1.00		1.00		1.00	1.00		1.00	1.00
Incremental Delay, d2				2.3		0.3		4.7	1.9		0.9	1.2
Delay (s)				20.6		16.5		14.0	8.4		7.9	7.0
Level of Service				C		B		B	A		A	A
Approach Delay (s)		0.0			19.4			12.3			7.7	
Approach LOS		A			B			B			A	

Intersection Summary	
HCM 2000 Control Delay	11.7 HCM 2000 Level of Service B
HCM 2000 Volume to Capacity ratio	0.81
Actuated Cycle Length (s)	55.0 Sum of lost time (s) 8.0
Intersection Capacity Utilization	68.7% ICU Level of Service C
Analysis Period (min)	15

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 16: Santa Rita Rd & I-580 EB Ramps/Pimilco Dr































BART to Livermore Extension Project
 2040 DMU PM

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations	 			 		 		  			 		
Traffic Volume (vph)	437	82	257	141	0	317	0	1566	192	315	1136	0	
Future Volume (vph)	437	82	257	141	0	317	0	1566	192	315	1136	0	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)	4.0	4.0	4.0	4.0		4.0		4.0		4.0	4.0		
Lane Util. Factor	0.97	1.00	1.00	0.97		0.88		0.86		1.00	0.95		
Frt	1.00	1.00	0.85	1.00		0.85		0.98		1.00	1.00		
Flt Protected	0.95	1.00	1.00	0.95		1.00		1.00		0.95	1.00		
Satd. Flow (prot)	3433	1863	1583	3433		2787		6303		1770	3539		
Flt Permitted	0.95	1.00	1.00	0.95		1.00		1.00		0.95	1.00		
Satd. Flow (perm)	3433	1863	1583	3433		2787		6303		1770	3539		
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	
Adj. Flow (vph)	475	89	279	153	0	345	0	1702	209	342	1235	0	
RTOR Reduction (vph)	0	0	73	0	0	35	0	19	0	0	0	0	
Lane Group Flow (vph)	475	89	206	153	0	310	0	1892	0	342	1235	0	
Turn Type	Perm	NA	Perm	Prot		pm+ov		NA		Prot	NA	Perm	
Protected Phases		4		3		1		2		1	6		
Permitted Phases	4		4			3						6	
Actuated Green, G (s)	19.9	19.9	19.9	7.6		32.2		41.9		24.6	70.5		
Effective Green, g (s)	19.9	19.9	19.9	7.6		32.2		41.9		24.6	70.5		
Actuated g/C Ratio	0.18	0.18	0.18	0.07		0.29		0.38		0.22	0.64		
Clearance Time (s)	4.0	4.0	4.0	4.0		4.0		4.0		4.0	4.0		
Vehicle Extension (s)	3.0	3.0	3.0	3.0		3.0		3.0		3.0	3.0		
Lane Grp Cap (vph)	621	337	286	237		815		2400		395	2268		
v/s Ratio Prot		0.05		c0.04		0.08		c0.30		c0.19	0.35		
v/s Ratio Perm	c0.14		0.13			0.03							
v/c Ratio	0.76	0.26	0.72	0.65		0.38		0.79		0.87	0.54		
Uniform Delay, d1	42.8	38.8	42.4	49.9		31.0		30.1		41.1	10.9		
Progression Factor	1.00	1.00	1.00	1.00		1.00		1.00		1.00	1.00		
Incremental Delay, d2	5.6	0.4	8.6	5.9		0.3		2.7		17.7	0.9		
Delay (s)	48.4	39.2	51.1	55.8		31.3		32.8		58.8	11.8		
Level of Service	D	D	D	E		C		C		E	B		
Approach Delay (s)		48.3			38.8			32.8			22.0		
Approach LOS		D			D			C			C		
Intersection Summary													
HCM 2000 Control Delay			32.6									HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio			0.79										
Actuated Cycle Length (s)			110.0									Sum of lost time (s)	16.0
Intersection Capacity Utilization			65.8%									ICU Level of Service	C
Analysis Period (min)			15										

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 17: Santa Rita Rd & Valley Ave

BART to Livermore Extension Project
 2040 DMU PM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 	 			 		 	 		 	 	
Traffic Volume (vph)	366	717	125	137	375	780	147	626	156	1376	1094	274
Future Volume (vph)	366	717	125	137	375	780	147	626	156	1376	1094	274
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.97	0.95		0.97	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.97		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	3433	3433		3433	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	3433	3433		3433	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	398	779	136	149	408	848	160	680	170	1496	1189	298
RTOR Reduction (vph)	0	0	96	0	0	0	0	19	0	0	0	127
Lane Group Flow (vph)	398	779	40	149	408	848	160	831	0	1496	1189	171
Turn Type	Prot	NA	Perm	Prot	NA	Free	Prot	NA		Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			Free						6
Actuated Green, G (s)	14.0	22.0	22.0	8.0	16.0	120.0	9.5	30.0		44.0	64.5	64.5
Effective Green, g (s)	14.0	22.0	22.0	8.0	16.0	120.0	9.5	30.0		44.0	64.5	64.5
Actuated g/C Ratio	0.12	0.18	0.18	0.07	0.13	1.00	0.08	0.25		0.37	0.54	0.54
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	400	648	290	118	471	1583	271	858		1258	1902	850
v/s Ratio Prot	c0.12	c0.22		c0.08	0.12		0.05	c0.24		c0.44	0.34	
v/s Ratio Perm			0.03			0.54						0.11
v/c Ratio	0.99	1.20	0.14	1.26	0.87	0.54	0.59	0.97		1.19	0.63	0.20
Uniform Delay, d1	53.0	49.0	41.0	56.0	51.0	0.0	53.4	44.5		38.0	19.3	14.4
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	43.4	105.2	0.2	169.4	15.3	1.3	3.4	23.1		93.3	0.6	0.1
Delay (s)	96.4	154.2	41.3	225.4	66.3	1.3	56.8	67.6		131.3	20.0	14.5
Level of Service	F	F	D	F	E	A	E	E		F	B	B
Approach Delay (s)		125.0			43.9			65.9			75.3	
Approach LOS		F			D			E			E	
Intersection Summary												
HCM 2000 Control Delay			77.0			HCM 2000 Level of Service				E		
HCM 2000 Volume to Capacity ratio			1.14									
Actuated Cycle Length (s)			120.0			Sum of lost time (s)			16.0			
Intersection Capacity Utilization			102.3%			ICU Level of Service				G		
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis
18: Bernal Ave/Valley Ave & Stanley Blvd

BART to Livermore Extension Project
2040 DMU PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	223	834	58	93	236	348	94	360	303	824	550	131
Future Volume (vph)	223	834	58	93	236	348	94	360	303	824	550	131
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.95	1.00	0.97	0.91	0.91	1.00	0.95	1.00	0.97	0.95	0.95
Frt	1.00	1.00	0.85	1.00	0.94	0.85	1.00	1.00	0.85	1.00	0.97	0.97
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	3433	3182	1441	1770	3539	1583	3433	3437	3437
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	3433	3182	1441	1770	3539	1583	3433	3437	3437
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	242	907	63	101	257	378	102	391	329	896	598	142
RTOR Reduction (vph)	0	0	38	0	118	53	0	0	169	0	22	0
Lane Group Flow (vph)	242	907	25	101	317	147	102	391	160	896	718	0
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	NA
Protected Phases	7	4	5	3	8	1	5	2		1	6	
Permitted Phases			4			8			2			
Actuated Green, G (s)	10.2	25.6	33.3	3.0	18.4	43.7	7.7	15.5	15.5	25.3	33.1	
Effective Green, g (s)	10.2	25.6	33.3	3.0	18.4	43.7	7.7	15.5	15.5	25.3	33.1	
Actuated g/C Ratio	0.12	0.30	0.39	0.04	0.22	0.51	0.09	0.18	0.18	0.30	0.39	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	410	1060	691	120	685	804	159	642	287	1017	1332	
v/s Ratio Prot	c0.07	c0.26	0.00	0.03	0.10	0.05	0.06	0.11		c0.26	c0.21	
v/s Ratio Perm			0.01			0.05			0.10			
v/c Ratio	0.59	0.86	0.04	0.84	0.46	0.18	0.64	0.61	0.56	0.88	0.54	
Uniform Delay, d1	35.6	28.2	16.1	41.0	29.2	11.2	37.5	32.2	31.8	28.6	20.2	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	2.3	6.9	0.0	38.5	0.5	0.1	8.5	1.6	2.4	9.1	0.4	
Delay (s)	37.9	35.1	16.1	79.5	29.7	11.3	46.1	33.8	34.2	37.7	20.7	
Level of Service	D	D	B	E	C	B	D	C	C	D	C	
Approach Delay (s)		34.7			31.5			35.5			30.0	
Approach LOS		C			C			D			C	










































Intersection Summary

HCM 2000 Control Delay	32.6	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.81		
Actuated Cycle Length (s)	85.4	Sum of lost time (s)	16.0
Intersection Capacity Utilization	75.3%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 19: Fallon Rd & Dublin Blvd/Croak Rd

BART to Livermore Extension Project
 2040 DMU PM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 	  	 	  	  		  	  	 	 	  	 
Traffic Volume (vph)	163	627	385	85	26	82	251	821	301	146	686	26
Future Volume (vph)	163	627	385	85	26	82	251	821	301	146	686	26
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.91	0.88	0.94	0.91	1.00	0.94	0.91	0.88	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5085	2787	4990	5085	1583	4990	5085	2787	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5085	2787	4990	5085	1583	4990	5085	2787	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	177	682	418	92	28	89	273	892	327	159	746	28
RTOR Reduction (vph)	0	0	66	0	0	81	0	0	160	0	0	15
Lane Group Flow (vph)	177	682	352	92	28	8	273	892	167	159	746	13
Turn Type	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4	5	3	8		5	2		1	6	
Permitted Phases			4			8			2			6
Actuated Green, G (s)	17.8	21.8	38.5	5.6	9.6	9.6	16.7	56.2	56.2	10.4	49.9	49.9
Effective Green, g (s)	17.8	21.8	38.5	5.6	9.6	9.6	16.7	56.2	56.2	10.4	49.9	49.9
Actuated g/C Ratio	0.16	0.20	0.35	0.05	0.09	0.09	0.15	0.51	0.51	0.09	0.45	0.45
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	555	1007	975	254	443	138	757	2597	1423	324	2306	718
v/s Ratio Prot	0.05	c0.13	0.05	c0.02	0.01		0.05	c0.18		c0.05	0.15	
v/s Ratio Perm			0.07			0.00			0.06			0.01
v/c Ratio	0.32	0.68	0.36	0.36	0.06	0.06	0.36	0.34	0.12	0.49	0.32	0.02
Uniform Delay, d1	40.7	40.8	26.6	50.5	46.1	46.0	41.9	16.0	14.0	47.3	19.2	16.6
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	0.96	0.94	0.95	1.00	1.00	1.00
Incremental Delay, d2	0.3	1.8	0.2	0.9	0.1	0.2	0.3	0.3	0.2	1.2	0.4	0.0
Delay (s)	41.1	42.7	26.8	51.4	46.1	46.2	40.4	15.3	13.5	48.5	19.6	16.6
Level of Service	D	D	C	D	D	D	D	B	B	D	B	B
Approach Delay (s)		37.3			48.5			19.5			24.4	
Approach LOS		D			D			B			C	
Intersection Summary												
HCM 2000 Control Delay			28.0			HCM 2000 Level of Service		C				
HCM 2000 Volume to Capacity ratio			0.44									
Actuated Cycle Length (s)			110.0			Sum of lost time (s)		16.0				
Intersection Capacity Utilization			48.8%			ICU Level of Service		A				
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis
20: El Charro Rd/Fallon Rd & I-580 WB Ramps

BART to Livermore Extension Project
2040 DMU PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↙	↖	↗		↑↑↑	↗		↑↑↑	↗
Traffic Volume (vph)	0	0	0	579	0	498	0	964	245	0	856	405
Future Volume (vph)	0	0	0	579	0	498	0	964	245	0	856	405
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0	4.0	4.0		4.0	4.0		4.0	4.0
Lane Util. Factor				0.95	0.95	0.88		0.91	1.00		0.91	1.00
Frt				1.00	1.00	0.85		1.00	0.85		1.00	0.85
Flt Protected				0.95	0.95	1.00		1.00	1.00		1.00	1.00
Satd. Flow (prot)				1681	1681	2787		5085	1583		5085	1583
Flt Permitted				0.95	0.95	1.00		1.00	1.00		1.00	1.00
Satd. Flow (perm)				1681	1681	2787		5085	1583		5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	629	0	541	0	1048	266	0	930	440
RTOR Reduction (vph)	0	0	0	0	0	70	0	0	117	0	0	193
Lane Group Flow (vph)	0	0	0	321	308	471	0	1048	149	0	930	247
Turn Type				Perm	NA	Perm		NA	Perm		NA	Perm
Protected Phases					8			2			6	
Permitted Phases				8		8			2			6
Actuated Green, G (s)				16.6	16.6	16.6		30.9	30.9		30.9	30.9
Effective Green, g (s)				16.1	16.1	16.1		30.9	30.9		30.9	30.9
Actuated g/C Ratio				0.29	0.29	0.29		0.56	0.56		0.56	0.56
Clearance Time (s)				3.5	3.5	3.5		4.0	4.0		4.0	4.0
Vehicle Extension (s)				2.0	2.0	2.0		2.0	2.0		2.0	2.0
Lane Grp Cap (vph)				492	492	815		2856	889		2856	889
v/s Ratio Prot								c0.21			0.18	
v/s Ratio Perm				c0.19	0.18	0.17			0.09			0.16
v/c Ratio				0.65	0.63	0.58		0.37	0.17		0.33	0.28
Uniform Delay, d1				17.0	16.8	16.6		6.7	5.8		6.5	6.3
Progression Factor				1.00	1.00	1.00		0.70	0.39		0.79	1.87
Incremental Delay, d2				2.4	1.8	0.6		0.2	0.3		0.3	0.8
Delay (s)				19.4	18.6	17.2		4.9	2.5		5.4	12.4
Level of Service				B	B	B		A	A		A	B
Approach Delay (s)		0.0			18.2			4.4			7.7	
Approach LOS		A			B			A			A	

Intersection Summary

HCM 2000 Control Delay	9.7	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.46		
Actuated Cycle Length (s)	55.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	47.8%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
21: El Charro Rd & I-580 EB Ramps

BART to Livermore Extension Project
2040 DMU PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔		↔					↕	↗		↕	↗
Traffic Volume (vph)	334	0	421	0	0	0	0	1604	281	0	1598	0
Future Volume (vph)	334	0	421	0	0	0	0	1604	281	0	1598	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0					4.0	4.0		4.0	
Lane Util. Factor	0.97		0.88					0.91	0.91		0.91	
Frt	1.00		0.85					1.00	0.85		1.00	
Flt Protected	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (prot)	3433		2787					3380	1441		3390	
Flt Permitted	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (perm)	3433		2787					3380	1441		3390	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	363	0	458	0	0	0	0	1743	305	0	1737	0
RTOR Reduction (vph)	0	0	43	0	0	0	0	2	90	0	0	0
Lane Group Flow (vph)	363	0	415	0	0	0	0	1778	178	0	1737	0
Turn Type	Prot		Perm					NA	Perm		NA	Perm
Protected Phases	4							2			6	
Permitted Phases			4						2			6
Actuated Green, G (s)	10.5		10.5					36.5	36.5		36.5	
Effective Green, g (s)	10.5		10.5					36.5	36.5		36.5	
Actuated g/C Ratio	0.19		0.19					0.66	0.66		0.66	
Clearance Time (s)	4.0		4.0					4.0	4.0		4.0	
Vehicle Extension (s)	2.0		2.0					3.0	3.0		3.0	
Lane Grp Cap (vph)	655		532					2243	956		2249	
v/s Ratio Prot	0.11							c0.53			0.51	
v/s Ratio Perm			c0.15						0.12			
v/c Ratio	0.55		0.78					0.79	0.19		0.77	
Uniform Delay, d1	20.1		21.2					6.6	3.5		6.4	
Progression Factor	1.00		1.00					1.00	1.00		1.19	
Incremental Delay, d2	0.6		6.7					3.0	0.4		2.5	
Delay (s)	20.7		27.9					9.5	4.0		10.1	
Level of Service	C		C					A	A		B	
Approach Delay (s)		24.7			0.0			8.8			10.1	
Approach LOS		C			A			A			B	

Intersection Summary

HCM 2000 Control Delay	12.1	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.79		
Actuated Cycle Length (s)	55.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	65.6%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 22: El Charro Rd & Stoneridge Dr/Jack London Blvd

BART to Livermore Extension Project
 2040 DMU PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔↔↔	↑↑	↗	↖	↑↑	↗↗	↖	↑↑		↖↖↖	↑	↗↗
Traffic Volume (vph)	184	577	55	95	324	669	18	512	59	771	395	71
Future Volume (vph)	184	577	55	95	324	669	18	512	59	771	395	71
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	0.94	0.95	1.00	1.00	0.95	0.88	1.00	0.95		0.94	1.00	0.88
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.98		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	4491	3185	1425	1593	3185	2508	1593	3136		4491	1676	2508
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	4491	3185	1425	1593	3185	2508	1593	3136		4491	1676	2508
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	200	627	60	103	352	727	20	557	64	838	429	77
RTOR Reduction (vph)	0	0	46	0	0	74	0	13	0	0	0	41
Lane Group Flow (vph)	200	627	14	103	352	653	20	608	0	838	429	36
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Prot	NA		Prot	NA	Perm
Protected Phases	7	4		3	8	1	5	2		1	6	
Permitted Phases			4			8						6
Actuated Green, G (s)	6.0	16.7	16.7	4.6	15.3	33.7	0.8	16.0		18.4	33.6	33.6
Effective Green, g (s)	6.0	16.7	16.7	4.6	15.3	33.7	0.8	16.0		18.4	33.6	33.6
Actuated g/C Ratio	0.08	0.23	0.23	0.06	0.21	0.47	0.01	0.22		0.26	0.47	0.47
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	375	741	331	102	679	1178	17	699		1152	785	1175
v/s Ratio Prot	0.04	c0.20		c0.06	0.11	0.14	0.01	c0.19		c0.19	0.26	
v/s Ratio Perm			0.01			0.12						0.01
v/c Ratio	0.53	0.85	0.04	1.01	0.52	0.55	1.18	0.87		0.73	0.55	0.03
Uniform Delay, d1	31.5	26.3	21.3	33.6	24.9	13.6	35.5	26.8		24.4	13.6	10.3
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	1.5	8.8	0.1	91.8	0.7	0.6	279.8	11.2		2.3	0.8	0.0
Delay (s)	33.0	35.1	21.4	125.3	25.6	14.2	315.2	38.0		26.7	14.4	10.3
Level of Service	C	D	C	F	C	B	F	D		C	B	B
Approach Delay (s)		33.7			27.3			46.7			21.8	
Approach LOS		C			C			D			C	

Intersection Summary

HCM 2000 Control Delay	29.9	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.83		
Actuated Cycle Length (s)	71.7	Sum of lost time (s)	16.0
Intersection Capacity Utilization	71.0%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 23: Stanley Blvd & El Charro Rd



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	↖	↗↗	↖↖↖	↗	↖↖	↗↗
Traffic Volume (vph)	483	2581	782	12	135	356
Future Volume (vph)	483	2581	782	12	135	356
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95	0.91	1.00	0.97	0.88
Frt	1.00	1.00	1.00	0.85	1.00	0.85
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1770	3539	5085	1583	3433	2787
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1770	3539	5085	1583	3433	2787
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	525	2805	850	13	147	387
RTOR Reduction (vph)	0	0	0	7	0	350
Lane Group Flow (vph)	525	2805	850	6	147	37
Turn Type	Prot	NA	NA	Perm	Prot	Perm
Protected Phases	7	4	8		6	
Permitted Phases				8		6
Actuated Green, G (s)	35.9	86.0	46.1	46.1	10.0	10.0
Effective Green, g (s)	35.9	86.0	46.1	46.1	10.0	10.0
Actuated g/C Ratio	0.35	0.83	0.44	0.44	0.10	0.10
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	610	2926	2254	701	330	267
v/s Ratio Prot	0.30	c0.79	0.17		c0.04	
v/s Ratio Perm				0.00		0.01
v/c Ratio	0.86	0.96	0.38	0.01	0.45	0.14
Uniform Delay, d1	31.7	7.5	19.4	16.2	44.4	43.1
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	11.9	8.9	0.1	0.0	1.0	0.2
Delay (s)	43.6	16.4	19.5	16.2	45.3	43.3
Level of Service	D	B	B	B	D	D
Approach Delay (s)		20.7	19.4		43.9	
Approach LOS		C	B		D	

Intersection Summary

HCM 2000 Control Delay	23.1	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.94		
Actuated Cycle Length (s)	104.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	81.9%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 24: Airway Blvd/Driveway & N Canyons Pkwy

BART to Livermore Extension Project
 2040 DMU PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑	↑	↑↑	↑	↑		↑	↑↑		↑	
Traffic Volume (vph)	0	549	468	936	71	0	62	0	744	0	0	0
Future Volume (vph)	0	549	468	936	71	0	62	0	744	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		2.0	2.0	2.0	2.0			4.2	2.0			
Lane Util. Factor		0.95	1.00	0.97	1.00			1.00	0.88			
Frt		1.00	0.85	1.00	1.00			1.00	0.85			
Flt Protected		1.00	1.00	0.95	1.00			0.95	1.00			
Satd. Flow (prot)		3539	1583	3433	1863			1770	2787			
Flt Permitted		1.00	1.00	0.95	1.00			0.95	1.00			
Satd. Flow (perm)		3539	1583	3433	1863			1770	2787			
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	597	509	1017	77	0	67	0	809	0	0	0
RTOR Reduction (vph)	0	0	294	0	0	0	0	0	383	0	0	0
Lane Group Flow (vph)	0	597	215	1017	77	0	0	67	426	0	0	0
Turn Type		NA	Perm	Prot	NA	Perm	Split	NA	pm+ov			
Protected Phases		2		1	6		8	8	1	4	4	
Permitted Phases			2			6			8			
Actuated Green, G (s)		48.8	48.8	47.7	100.5			11.5	59.2			
Effective Green, g (s)		50.8	50.8	49.7	102.5			11.3	63.2			
Actuated g/C Ratio		0.42	0.42	0.41	0.85			0.09	0.53			
Clearance Time (s)		4.0	4.0	4.0	4.0			4.0	4.0			
Vehicle Extension (s)		3.0	3.0	3.0	3.0			3.0	3.0			
Lane Grp Cap (vph)		1498	670	1421	1591			166	1514			
v/s Ratio Prot		c0.17		c0.30	0.04			c0.04	0.12			
v/s Ratio Perm			0.14						0.04			
v/c Ratio		0.40	0.32	0.72	0.05			0.40	0.28			
Uniform Delay, d1		24.0	23.1	29.3	1.3			51.2	15.8			
Progression Factor		1.00	1.00	1.00	1.00			1.00	1.00			
Incremental Delay, d2		0.8	1.3	1.7	0.1			1.6	0.1			
Delay (s)		24.8	24.4	31.0	1.4			52.8	15.9			
Level of Service		C	C	C	A			D	B			
Approach Delay (s)		24.6			28.9			18.7			0.0	
Approach LOS		C			C			B			A	

Intersection Summary		
HCM 2000 Control Delay	24.5	HCM 2000 Level of Service C
HCM 2000 Volume to Capacity ratio	0.55	
Actuated Cycle Length (s)	120.0	Sum of lost time (s) 12.2
Intersection Capacity Utilization	62.3%	ICU Level of Service B
Analysis Period (min)	15	

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
25: Airway Blvd & I-580 WB Ramps



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↙	↖	↗		↑↑	↗		↑↑↑	
Traffic Volume (vph)	0	0	0	137	39	180	0	685	392	0	825	687
Future Volume (vph)	0	0	0	137	39	180	0	685	392	0	825	687
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0	4.0	4.0		4.0	4.0		4.0	
Lane Util. Factor				0.95	0.95	0.88		0.95	1.00		0.91	
Frt				1.00	1.00	0.85		1.00	0.85		0.93	
Flt Protected				0.95	0.97	1.00		1.00	1.00		1.00	
Satd. Flow (prot)				1681	1716	2787		3539	1583		4739	
Flt Permitted				0.95	0.97	1.00		1.00	1.00		1.00	
Satd. Flow (perm)				1681	1716	2787		3539	1583		4739	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	149	42	196	0	745	426	0	897	747
RTOR Reduction (vph)	0	0	0	0	0	166	0	0	114	0	167	0
Lane Group Flow (vph)	0	0	0	79	112	30	0	745	312	0	1477	0
Turn Type				Split	NA	Perm		NA	Perm		NA	
Protected Phases				8	8			2			6	
Permitted Phases						8			2			
Actuated Green, G (s)				10.7	10.7	10.7		50.0	50.0		50.0	
Effective Green, g (s)				10.7	10.7	10.7		51.3	51.3		51.3	
Actuated g/C Ratio				0.15	0.15	0.15		0.73	0.73		0.73	
Clearance Time (s)				4.0	4.0	4.0		5.3	5.3		5.3	
Vehicle Extension (s)				2.0	2.0	2.0		4.0	4.0		4.0	
Lane Grp Cap (vph)				256	262	426		2593	1160		3473	
v/s Ratio Prot				0.05	c0.07			0.21			c0.31	
v/s Ratio Perm						0.01			0.20			
v/c Ratio				0.31	0.43	0.07		0.29	0.27		0.43	
Uniform Delay, d1				26.4	26.9	25.4		3.2	3.1		3.6	
Progression Factor				1.00	1.00	1.00		1.00	1.00		1.00	
Incremental Delay, d2				0.3	0.4	0.0		0.3	0.6		0.4	
Delay (s)				26.6	27.3	25.4		3.4	3.7		4.0	
Level of Service				C	C	C		A	A		A	
Approach Delay (s)		0.0			26.2			3.5			4.0	
Approach LOS		A			C			A			A	

Intersection Summary

HCM 2000 Control Delay	6.5	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.43		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	46.4%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 26: Airway Blvd & I-580 EB Ramps/Kitty Hawk Rd

BART to Livermore Extension Project
 2040 DMU PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↑	↖	↖	↑	↖	↖	↕↔		↖	↕↔	
Traffic Volume (vph)	564	185	354	67	89	126	51	474	163	119	382	421
Future Volume (vph)	564	185	354	67	89	126	51	474	163	119	382	421
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.4	4.4	4.4	4.5	2.7		4.0	2.7	
Lane Util. Factor	0.97	1.00	1.00	1.00	1.00	1.00	1.00	0.95		1.00	0.95	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.96		1.00	0.92	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	3433	1863	1583	1770	1863	1583	1770	3403		1770	3261	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	3433	1863	1583	1770	1863	1583	1770	3403		1770	3261	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	613	201	385	73	97	137	55	515	177	129	415	458
RTOR Reduction (vph)	0	0	303	0	0	96	0	48	0	0	219	0
Lane Group Flow (vph)	613	201	82	73	97	41	55	644	0	129	654	0
Turn Type	Split	NA	Perm	Split	NA	pm+ov	Prot	NA		Prot	NA	
Protected Phases	7	7		8	8	1	5	2		1	6	
Permitted Phases			7			8						
Actuated Green, G (s)	18.0	18.0	18.0	11.2	11.2	26.2	4.6	24.8		15.0	35.2	
Effective Green, g (s)	18.0	18.0	18.0	10.8	10.8	25.4	4.1	26.1		15.0	36.5	
Actuated g/C Ratio	0.21	0.21	0.21	0.13	0.13	0.30	0.05	0.31		0.18	0.43	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Vehicle Extension (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	3.5		2.0	4.0	
Lane Grp Cap (vph)	726	394	335	224	236	473	85	1044		312	1400	
v/s Ratio Prot	c0.18	0.11		0.04	c0.05	0.01	0.03	c0.19		0.07	c0.20	
v/s Ratio Perm			0.05			0.01						
v/c Ratio	0.84	0.51	0.24	0.33	0.41	0.09	0.65	0.62		0.41	0.47	
Uniform Delay, d1	32.2	29.6	27.8	33.8	34.2	21.4	39.7	25.2		31.1	17.3	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	8.5	0.5	0.1	0.3	0.4	0.0	12.0	2.7		0.3	1.1	
Delay (s)	40.7	30.1	28.0	34.1	34.6	21.5	51.7	27.9		31.4	18.4	
Level of Service	D	C	C	C	C	C	D	C		C	B	
Approach Delay (s)		34.8			28.6			29.7			20.1	
Approach LOS		C			C			C			C	

Intersection Summary

HCM 2000 Control Delay	28.5	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.64		
Actuated Cycle Length (s)	85.0	Sum of lost time (s)	15.6
Intersection Capacity Utilization	69.3%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 27: Collier Canyon Rd & N Canyons Pkwy/Portola Ave

BART to Livermore Extension Project
 2040 DMU PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↖↖	↖↗	↖↗	↖↖	↖↗	↖↗	↖↖		↖↗	↖↖	↖↗
Traffic Volume (vph)	420	568	172	46	193	16	57	7	184	122	17	178
Future Volume (vph)	420	568	172	46	193	16	57	7	184	122	17	178
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	2.7	2.7	4.0	2.7	2.7	4.0	3.0		4.0	4.6	4.6
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.86		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	1770	1594		1770	1863	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	1770	1594		1770	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	457	617	187	50	210	17	62	8	200	133	18	193
RTOR Reduction (vph)	0	0	118	0	0	13	0	155	0	0	0	141
Lane Group Flow (vph)	457	617	69	50	210	4	62	53	0	133	18	52
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA		Prot	NA	Perm
Protected Phases	1	6		5	2		3	8		7	4	
Permitted Phases			6			2						4
Actuated Green, G (s)	13.7	23.0	23.0	4.0	13.3	13.3	4.8	13.9		9.4	18.5	18.5
Effective Green, g (s)	13.7	24.3	24.3	4.0	14.6	14.6	4.8	14.9		9.4	17.9	17.9
Actuated g/C Ratio	0.21	0.37	0.37	0.06	0.22	0.22	0.07	0.22		0.14	0.27	0.27
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	709	1297	580	106	779	348	128	358		250	502	427
v/s Ratio Prot	c0.13	c0.17		0.03	0.06		0.04	c0.03		c0.08	0.01	
v/s Ratio Perm			0.04			0.00						0.03
v/c Ratio	0.64	0.48	0.12	0.47	0.27	0.01	0.48	0.15		0.53	0.04	0.12
Uniform Delay, d1	24.1	16.1	13.9	30.1	21.4	20.2	29.6	20.6		26.4	17.8	18.3
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	2.0	0.3	0.1	3.3	0.2	0.0	2.9	0.2		2.2	0.0	0.1
Delay (s)	26.1	16.4	14.0	33.4	21.6	20.2	32.4	20.8		28.6	17.9	18.4
Level of Service	C	B	B	C	C	C	C	C		C	B	B
Approach Delay (s)		19.6			23.7			23.5			22.3	
Approach LOS		B			C			C			C	

Intersection Summary

HCM 2000 Control Delay	21.0	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.47		
Actuated Cycle Length (s)	66.3	Sum of lost time (s)	15.3
Intersection Capacity Utilization	51.3%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
28: Isabel Ave/Campus Hill Dr & Portola Ave

BART to Livermore Extension Project
2040 DMU PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	2	466	421	437	130	116	183	414	151	106	256	1
Future Volume (vph)	2	466	421	437	130	116	183	414	151	106	256	1
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	5.8	5.8
Lane Util. Factor	1.00	0.95	0.88	0.94	0.95		0.97	0.95	1.00	1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	0.93		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3539	2787	4990	3289		3433	3539	1583	1770	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	3539	2787	4990	3289		3433	3539	1583	1770	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	2	507	458	475	141	126	199	450	164	115	278	1
RTOR Reduction (vph)	0	0	322	0	76	0	0	0	120	0	0	1
Lane Group Flow (vph)	2	507	136	475	191	0	199	450	44	115	278	0
Turn Type	Prot	NA	Perm	Prot	NA		Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4						2			6
Actuated Green, G (s)	1.4	21.7	21.7	9.2	29.5		9.2	19.3	19.3	8.4	18.9	18.9
Effective Green, g (s)	1.4	23.0	23.0	9.2	30.8		9.2	20.6	20.6	8.4	18.0	18.0
Actuated g/C Ratio	0.02	0.30	0.30	0.12	0.40		0.12	0.27	0.27	0.11	0.23	0.23
Clearance Time (s)	4.0	5.3	5.3	4.0	5.3		4.0	5.3	5.3	4.0	4.9	4.9
Vehicle Extension (s)	2.0	3.0	3.0	2.0	3.0		2.0	3.0	3.0	2.0	3.0	3.0
Lane Grp Cap (vph)	32	1054	830	594	1312		409	944	422	192	825	369
v/s Ratio Prot	0.00	c0.14		c0.10	0.06		0.06	c0.13		c0.06	0.08	
v/s Ratio Perm			0.05						0.03			0.00
v/c Ratio	0.06	0.48	0.16	0.80	0.15		0.49	0.48	0.10	0.60	0.34	0.00
Uniform Delay, d1	37.3	22.2	20.0	33.1	14.8		31.8	23.8	21.3	32.8	24.6	22.7
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.3	0.3	0.1	7.0	0.1		0.3	0.4	0.1	3.3	0.2	0.0
Delay (s)	37.6	22.6	20.1	40.1	14.9		32.1	24.2	21.4	36.1	24.9	22.7
Level of Service	D	C	C	D	B		C	C	C	D	C	C
Approach Delay (s)		21.4			31.0			25.6			28.2	
Approach LOS		C			C			C			C	

Intersection Summary

HCM 2000 Control Delay	25.9	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.56		
Actuated Cycle Length (s)	77.2	Sum of lost time (s)	17.8
Intersection Capacity Utilization	53.5%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 29: Isabel Ave & I-580 WB Ramps





















Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↖↗		↖		↑↑↑	↖		↑↑↑	↖
Traffic Volume (vph)	0	0	0	681	0	430	0	421	0	0	687	498
Future Volume (vph)	0	0	0	681	0	430	0	421	0	0	687	498
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0		4.0		4.8			4.8	4.8
Lane Util. Factor				0.97		1.00		0.91			0.91	1.00
Frt				1.00		0.85		1.00			1.00	0.85
Flt Protected				0.95		1.00		1.00			1.00	1.00
Satd. Flow (prot)				3433		1583		5085			5085	1583
Flt Permitted				0.95		1.00		1.00			1.00	1.00
Satd. Flow (perm)				3433		1583		5085			5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	740	0	467	0	458	0	0	747	541
RTOR Reduction (vph)	0	0	0	0	0	223	0	0	0	0	0	221
Lane Group Flow (vph)	0	0	0	740	0	244	0	458	0	0	747	320
Turn Type				Prot		Prot		NA	Free		NA	Prot
Protected Phases				8		8		2			6	6
Permitted Phases									Free			
Actuated Green, G (s)				19.8		19.8		42.2			42.2	42.2
Effective Green, g (s)				19.8		19.8		41.4			41.4	41.4
Actuated g/C Ratio				0.28		0.28		0.59			0.59	0.59
Clearance Time (s)				4.0		4.0		4.0			4.0	4.0
Vehicle Extension (s)				2.0		2.0		4.0			4.0	4.0
Lane Grp Cap (vph)				971		447		3007			3007	936
v/s Ratio Prot				c0.22		0.15		0.09			0.15	c0.20
v/s Ratio Perm												
v/c Ratio				0.76		0.55		0.15			0.25	0.34
Uniform Delay, d1				22.9		21.3		6.4			6.8	7.3
Progression Factor				1.00		1.00		0.78			1.00	1.00
Incremental Delay, d2				3.2		0.7		0.1			0.2	1.0
Delay (s)				26.2		22.0		5.1			7.0	8.3
Level of Service				C		C		A			A	A
Approach Delay (s)		0.0			24.6			5.1			7.6	
Approach LOS		A			C			A			A	

Intersection Summary		
HCM 2000 Control Delay	14.1	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.48	B
Actuated Cycle Length (s)	70.0	Sum of lost time (s)
Intersection Capacity Utilization	42.3%	8.8
Analysis Period (min)	15	ICU Level of Service
		A

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
30: Isabel Ave & I-580 EB Ramps

BART to Livermore Extension Project
2040 DMU PM

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations													
Traffic Volume (vph)	181	0	384	0	0	0	0	698	1170	0	910	676	
Future Volume (vph)	181	0	384	0	0	0	0	698	1170	0	910	676	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)	4.0		4.0					4.0	4.0		4.0	4.0	
Lane Util. Factor	0.97		0.88					0.91	1.00		0.91	1.00	
Frt	1.00		0.85					1.00	0.85		1.00	0.85	
Flt Protected	0.95		1.00					1.00	1.00		1.00	1.00	
Satd. Flow (prot)	3433		2787					5085	1583		5085	1583	
Flt Permitted	0.95		1.00					1.00	1.00		1.00	1.00	
Satd. Flow (perm)	3433		2787					5085	1583		5085	1583	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	
Adj. Flow (vph)	197	0	417	0	0	0	0	759	1272	0	989	735	
RTOR Reduction (vph)	0	0	165	0	0	0	0	0	0	0	0	0	
Lane Group Flow (vph)	197	0	252	0	0	0	0	759	1272	0	989	735	
Turn Type	Prot		Perm					NA	Free		NA	Free	
Protected Phases	4							2			6		
Permitted Phases			4						Free			Free	
Actuated Green, G (s)	10.5		10.5					50.5	70.0		50.5	70.0	
Effective Green, g (s)	10.5		10.5					51.5	70.0		51.5	70.0	
Actuated g/C Ratio	0.15		0.15					0.74	1.00		0.74	1.00	
Clearance Time (s)	4.0		4.0					5.0			5.0		
Vehicle Extension (s)	2.0		2.0					4.0			4.0		
Lane Grp Cap (vph)	514		418					3741	1583		3741	1583	
v/s Ratio Prot	0.06							0.15			0.19		
v/s Ratio Perm			0.09						c0.80			0.46	
v/c Ratio	0.38		0.60					0.20	0.80		0.26	0.46	
Uniform Delay, d1	26.8		27.8					2.9	0.0		3.0	0.0	
Progression Factor	1.00		1.00					1.00	1.00		0.61	1.00	
Incremental Delay, d2	0.2		1.7					0.1	4.4		0.2	0.9	
Delay (s)	27.0		29.5					3.0	4.4		2.0	0.9	
Level of Service	C		C					A	A		A	A	
Approach Delay (s)		28.7			0.0			3.9			1.6		
Approach LOS		C			A			A			A		
Intersection Summary													
HCM 2000 Control Delay			6.5									HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio			0.91										
Actuated Cycle Length (s)			70.0									Sum of lost time (s)	8.0
Intersection Capacity Utilization			37.7%									ICU Level of Service	A
Analysis Period (min)			15										

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
31: Isabel Ave & Airway Blvd




































Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	8	110	404	260	121	639	442	1147	263	349	1352	17
Future Volume (vph)	8	110	404	260	121	639	442	1147	263	349	1352	17
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.2	5.2	5.6	5.2	5.2	5.6	4.0	4.0	4.0	4.0	4.0	5.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.91	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	1863	1583	1770	1863	1583	1770	5085	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	1863	1583	1770	1863	1583	1770	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	9	120	439	283	132	695	480	1247	286	379	1470	18
RTOR Reduction (vph)	0	0	99	0	0	63	0	0	177	0	0	12
Lane Group Flow (vph)	9	120	340	283	132	632	480	1247	109	379	1470	6
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4	5	3	8	1	5	2		1	6	
Permitted Phases			4			8			2			6
Actuated Green, G (s)	0.8	14.8	31.8	11.4	25.4	38.4	17.0	34.4	34.4	13.0	30.4	30.4
Effective Green, g (s)	0.2	14.2	30.6	10.8	24.8	37.2	18.0	35.4	35.4	14.0	31.4	30.4
Actuated g/C Ratio	0.00	0.15	0.33	0.12	0.27	0.40	0.19	0.38	0.38	0.15	0.34	0.33
Clearance Time (s)	4.6	4.6	5.0	4.6	4.6	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	5.0	5.0	3.0	5.0	5.0
Lane Grp Cap (vph)	3	285	521	205	497	634	343	1939	603	517	1720	518
v/s Ratio Prot	0.01	0.06	0.12	c0.16	0.07	c0.13	c0.27	0.25		0.11	c0.29	
v/s Ratio Perm			0.10			0.27			0.07			0.00
v/c Ratio	3.00	0.42	0.65	1.38	0.27	1.00	1.40	0.64	0.18	0.73	0.85	0.01
Uniform Delay, d1	46.3	35.6	26.6	41.0	26.8	27.7	37.4	23.5	19.1	37.6	28.6	21.1
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1456.2	1.0	2.9	198.7	0.3	34.7	196.6	1.0	0.3	5.3	4.8	0.0
Delay (s)	1502.5	36.6	29.5	239.7	27.1	62.5	234.0	24.5	19.4	42.9	33.4	21.1
Level of Service	F	D	C	F	C	E	F	C	B	D	C	C
Approach Delay (s)		54.3			103.4			73.7			35.2	
Approach LOS		D			F			E			D	

Intersection Summary		
HCM 2000 Control Delay	64.7	HCM 2000 Level of Service E
HCM 2000 Volume to Capacity ratio	1.15	
Actuated Cycle Length (s)	92.8	Sum of lost time (s) 20.0
Intersection Capacity Utilization	82.7%	ICU Level of Service E
Analysis Period (min)	15	

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
32: Isabel Ave & Jack London Blvd

BART to Livermore Extension Project
2040 DMU PM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 	 			 		 	  		 	  	
Traffic Volume (vph)	128	888	335	273	187	305	146	1432	559	503	1392	65
Future Volume (vph)	128	888	335	273	187	305	146	1432	559	503	1392	65
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.97	0.91	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	3433	5085	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	3433	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	139	965	364	297	203	332	159	1557	608	547	1513	71
RTOR Reduction (vph)	0	0	137	0	0	30	0	0	195	0	0	44
Lane Group Flow (vph)	139	965	227	297	203	302	159	1557	413	547	1513	27
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8	1	5	2		1	NA	6
Permitted Phases			4			8			2			6
Actuated Green, G (s)	9.8	35.4	35.4	22.1	47.7	68.8	8.9	40.2	40.2	21.1	52.4	52.4
Effective Green, g (s)	9.8	35.4	35.4	22.1	47.7	68.8	8.9	40.2	40.2	21.1	52.4	52.4
Actuated g/C Ratio	0.07	0.25	0.25	0.16	0.34	0.49	0.06	0.29	0.29	0.15	0.37	0.37
Clearance Time (s)	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	240	894	400	279	1205	837	218	1460	454	517	1903	592
v/s Ratio Prot	0.04	c0.27		c0.17	0.06	0.05	0.05	c0.31		c0.16	0.30	
v/s Ratio Perm			0.14			0.14			0.26			0.02
v/c Ratio	0.58	1.08	0.57	1.06	0.17	0.36	0.73	1.07	0.91	1.06	0.80	0.04
Uniform Delay, d1	63.1	52.3	45.6	58.9	32.3	22.0	64.4	49.9	48.1	59.5	39.0	27.9
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	3.4	53.9	1.9	72.0	0.1	0.3	11.5	43.5	21.7	55.8	2.4	0.0
Delay (s)	66.5	106.2	47.5	130.9	32.3	22.3	75.9	93.4	69.9	115.3	41.4	27.9
Level of Service	E	F	D	F	C	C	E	F	E	F	D	C
Approach Delay (s)		87.9			63.5			86.0			59.9	
Approach LOS		F			E			F			E	

Intersection Summary		
HCM 2000 Control Delay	75.4	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	1.07	E
Actuated Cycle Length (s)	140.0	Sum of lost time (s)
Intersection Capacity Utilization	99.4%	21.2
Analysis Period (min)	15	ICU Level of Service
		F

c Critical Lane Group



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑	↑	↔	↑↑	↔	↔
Traffic Volume (vph)	2049	742	826	550	154	1006
Future Volume (vph)	2049	742	826	550	154	1006
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	2.3	2.3	4.0	2.3	2.5	2.5
Lane Util. Factor	0.95	1.00	0.97	0.95	0.97	0.88
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	3539	1583	3433	3539	3433	2787
Flt Permitted	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (perm)	3539	1583	3433	3539	3433	2787
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	2227	807	898	598	167	1093
RTOR Reduction (vph)	0	0	0	0	0	2
Lane Group Flow (vph)	2227	807	898	598	167	1091
Turn Type	NA	pm+ov	Prot	NA	Prot	pm+ov
Protected Phases	2	8	1	6	8	1
Permitted Phases		2				8
Actuated Green, G (s)	57.0	66.9	21.0	82.0	9.9	30.9
Effective Green, g (s)	58.7	70.3	21.0	83.7	11.4	33.9
Actuated g/C Ratio	0.59	0.70	0.21	0.84	0.11	0.34
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Grp Cap (vph)	2079	1150	721	2965	391	1015
v/s Ratio Prot	c0.63	0.08	0.26	0.17	0.05	c0.24
v/s Ratio Perm		0.43				0.15
v/c Ratio	1.07	0.70	1.25	0.20	0.43	1.07
Uniform Delay, d1	20.6	8.7	39.5	1.6	41.2	33.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	42.0	1.6	121.9	0.0	0.3	50.6
Delay (s)	62.6	10.3	161.4	1.6	41.5	83.6
Level of Service	E	B	F	A	D	F
Approach Delay (s)	48.7			97.5	78.1	
Approach LOS	D			F	E	





















Intersection Summary

HCM 2000 Control Delay	67.7	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.12		
Actuated Cycle Length (s)	99.9	Sum of lost time (s)	8.8
Intersection Capacity Utilization	98.5%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 34: Murrieta Blvd/Driveway & Portola Ave

BART to Livermore Extension Project
 2040 DMU PM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	900	194	326	790	0	263	6	435	3	8	0
Future Volume (vph)	0	900	194	326	790	0	263	6	435	3	8	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.8		4.0	5.8		5.2	5.2	5.2		4.0	
Lane Util. Factor		0.95		1.00	0.95		0.95	0.95	1.00		1.00	
Frt		0.97		1.00	1.00		1.00	1.00	0.85		1.00	
Flt Protected		1.00		0.95	1.00		0.95	0.95	1.00		0.99	
Satd. Flow (prot)		3445		1770	3539		1681	1689	1583		1840	
Flt Permitted		1.00		0.95	1.00		0.95	0.95	1.00		0.99	
Satd. Flow (perm)		3445		1770	3539		1681	1689	1583		1840	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	978	211	354	859	0	286	7	473	3	9	0
RTOR Reduction (vph)	0	18	0	0	0	0	0	0	294	0	0	0
Lane Group Flow (vph)	0	1171	0	354	859	0	149	144	179	0	12	0
Turn Type	Prot	NA		Prot	NA		Split	NA	Perm		Split	NA
Protected Phases	5	2		1	6		8	8			4	4
Permitted Phases									8			
Actuated Green, G (s)		30.0		14.2	48.2		13.4	13.4	13.4		0.6	
Effective Green, g (s)		29.1		14.2	47.3		12.8	12.8	12.8		0.6	
Actuated g/C Ratio		0.38		0.19	0.62		0.17	0.17	0.17		0.01	
Clearance Time (s)		4.9		4.0	4.9		4.6	4.6	4.6		4.0	
Vehicle Extension (s)		2.0		2.0	2.0		2.0	2.0	2.0		2.0	
Lane Grp Cap (vph)		1324		332	2211		284	285	267		14	
v/s Ratio Prot		c0.34		c0.20	0.24		0.09	0.09			c0.01	
v/s Ratio Perm									c0.11			
v/c Ratio		0.88		1.07	0.39		0.52	0.51	0.67		0.86	
Uniform Delay, d1		21.7		30.8	7.0		28.7	28.6	29.5		37.5	
Progression Factor		1.00		1.00	1.00		1.00	1.00	1.00		1.00	
Incremental Delay, d2		7.1		68.0	0.0		0.8	0.5	4.9		160.8	
Delay (s)		28.9		98.8	7.1		29.5	29.1	34.3		198.3	
Level of Service		C		F	A		C	C	C		F	
Approach Delay (s)		28.9			33.8			32.4			198.3	
Approach LOS		C			C			C			F	
Intersection Summary												
HCM 2000 Control Delay			32.3			HCM 2000 Level of Service			C			
HCM 2000 Volume to Capacity ratio			0.88									
Actuated Cycle Length (s)			75.7			Sum of lost time (s)			19.0			
Intersection Capacity Utilization			75.7%			ICU Level of Service			D			
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis
35: Murrieta Blvd & Jack London Blvd

BART to Livermore Extension Project
2040 DMU PM



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	316	1212	518	268	445	170
Future Volume (vph)	316	1212	518	268	445	170
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00	1.00	0.95	0.91	
Frt	1.00	0.85	1.00	1.00	0.96	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1770	1583	1770	3539	4874	
Flt Permitted	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	1770	1583	1770	3539	4874	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	343	1317	563	291	484	185
RTOR Reduction (vph)	0	394	0	0	58	0
Lane Group Flow (vph)	343	923	563	291	611	0
Turn Type	Prot	Perm	Prot	NA	NA	
Protected Phases	4		5	2	6	
Permitted Phases		4				
Actuated Green, G (s)	57.0	57.0	35.0	55.0	16.0	
Effective Green, g (s)	57.0	57.0	35.0	55.0	16.0	
Actuated g/C Ratio	0.48	0.48	0.29	0.46	0.13	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	840	751	516	1622	649	
v/s Ratio Prot	0.19		c0.32	0.08	c0.13	
v/s Ratio Perm		c0.58				
v/c Ratio	0.41	1.23	1.09	0.18	0.94	
Uniform Delay, d1	20.5	31.5	42.5	19.2	51.5	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.3	114.5	66.7	0.1	22.0	
Delay (s)	20.8	146.0	109.2	19.2	73.5	
Level of Service	C	F	F	B	E	
Approach Delay (s)	120.1			78.5	73.5	
Approach LOS	F			E	E	

Intersection Summary

HCM 2000 Control Delay	99.2	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.14		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	94.1%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 36: Murrieta Blvd & Stanley Blvd

BART to Livermore Extension Project
 2040 DMU PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	330	1479	834	84	1038	227	280	343	19	262	423	223
Future Volume (vph)	330	1479	834	84	1038	227	280	343	19	262	423	223
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	5.8	5.8	4.0	5.8	4.9	4.9	5.8		4.9	5.8	4.9
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.97	0.95		1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	3433	3511		1770	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	3433	3511		1770	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	359	1608	907	91	1128	247	304	373	21	285	460	242
RTOR Reduction (vph)	0	0	226	0	0	54	0	3	0	0	0	119
Lane Group Flow (vph)	359	1608	681	91	1128	193	304	391	0	285	460	123
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Prot	NA		Prot	NA	Perm
Protected Phases	1	6		5	2	3	7	4		3	8	
Permitted Phases			6			2						8
Actuated Green, G (s)	12.0	51.3	51.3	4.0	43.3	60.3	14.4	19.8		17.0	22.4	22.4
Effective Green, g (s)	12.0	50.4	50.4	4.0	42.4	58.5	13.5	18.9		16.1	21.5	22.4
Actuated g/C Ratio	0.11	0.46	0.46	0.04	0.39	0.53	0.12	0.17		0.15	0.20	0.20
Clearance Time (s)	4.0	4.9	4.9	4.0	4.9	4.0	4.0	4.9		4.0	4.9	4.9
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	374	1622	725	64	1365	842	421	603		259	692	322
v/s Ratio Prot	c0.10	c0.45		c0.05	0.32	0.03	0.09	0.11		c0.16	c0.13	
v/s Ratio Perm			0.43			0.09						0.08
v/c Ratio	0.96	0.99	0.94	1.42	0.83	0.23	0.72	0.65		1.10	0.66	0.38
Uniform Delay, d1	48.7	29.5	28.3	53.0	30.4	13.7	46.4	42.4		46.9	40.9	37.8
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	35.6	20.2	19.8	259.3	4.2	0.1	6.0	2.4		85.4	2.4	0.8
Delay (s)	84.3	49.7	48.1	312.2	34.7	13.8	52.4	44.8		132.3	43.3	38.5
Level of Service	F	D	D	F	C	B	D	D		F	D	D
Approach Delay (s)		53.6			48.4			48.1			67.8	
Approach LOS		D			D			D			E	

Intersection Summary

HCM 2000 Control Delay	54.0	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.99		
Actuated Cycle Length (s)	109.9	Sum of lost time (s)	20.5
Intersection Capacity Utilization	87.2%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
37: Livermore Ave & I-580 WB Ramps



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↖	↔		↗	↑			↕	
Traffic Volume (vph)	0	0	0	800	24	34	579	449	0	0	111	0
Future Volume (vph)	0	0	0	800	24	34	579	449	0	0	111	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)					4.0		4.0	4.0			4.0	
Lane Util. Factor					0.95		0.97	1.00			0.95	
Frt					0.99		1.00	1.00			1.00	
Flt Protected					0.96		0.95	1.00			1.00	
Satd. Flow (prot)					1681		3433	1863			3539	
Flt Permitted					0.96		0.95	1.00			1.00	
Satd. Flow (perm)					1681		3433	1863			3539	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	870	26	37	629	488	0	0	121	0
RTOR Reduction (vph)	0	0	0	0	1	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	0	932	0	629	488	0	0	121	0
Turn Type				Split	NA		Prot	NA			NA	
Protected Phases				8	8		5	2			6	
Permitted Phases												
Actuated Green, G (s)					83.7		28.8	46.6			14.3	
Effective Green, g (s)					83.7		28.3	48.3			16.0	
Actuated g/C Ratio					0.60		0.20	0.34			0.11	
Clearance Time (s)					4.0		3.5	5.7			5.7	
Vehicle Extension (s)					2.0		2.0	2.5			2.5	
Lane Grp Cap (vph)					1004		693	642			404	
v/s Ratio Prot					c0.55		c0.18	c0.26			0.03	
v/s Ratio Perm												
v/c Ratio					0.93		0.91	0.76			0.30	
Uniform Delay, d1					25.4		54.6	40.7			56.9	
Progression Factor					1.00		0.40	0.26			1.00	
Incremental Delay, d2					13.9		1.8	0.8			1.9	
Delay (s)					39.3		23.5	11.3			58.8	
Level of Service					D		C	B			E	
Approach Delay (s)		0.0			39.3			18.1			58.8	
Approach LOS		A			D			B			E	

Intersection Summary

HCM 2000 Control Delay	29.5	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.91		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	111.9%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 38: Livermore Ave & I-580 EB Ramps



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕	↗					↕		↘	↕	
Traffic Volume (vph)	222	10	1303	0	0	0	0	826	218	122	784	0
Future Volume (vph)	222	10	1303	0	0	0	0	826	218	122	784	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0					3.0		5.0	3.0	
Lane Util. Factor		0.95	0.95					0.95		1.00	0.95	
Frt		0.89	0.85					0.97		1.00	1.00	
Flt Protected		0.99	1.00					1.00		0.95	1.00	
Satd. Flow (prot)		1555	1504					3428		1770	3539	
Flt Permitted		0.99	1.00					1.00		0.95	1.00	
Satd. Flow (perm)		1555	1504					3428		1770	3539	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	241	11	1416	0	0	0	0	898	237	133	852	0
RTOR Reduction (vph)	0	53	53	0	0	0	0	17	0	0	0	0
Lane Group Flow (vph)	0	893	669	0	0	0	0	1118	0	133	852	0
Turn Type	Prot	NA	Perm					NA		Prot	NA	
Protected Phases	7	4						2		1	6	
Permitted Phases			4									
Actuated Green, G (s)		67.3	67.3					48.1		12.6	64.7	
Effective Green, g (s)		67.3	67.3					49.1		11.6	65.7	
Actuated g/C Ratio		0.48	0.48					0.35		0.08	0.47	
Clearance Time (s)		4.0	4.0					4.0		4.0	4.0	
Vehicle Extension (s)		2.0	2.0					2.5		2.0	2.5	
Lane Grp Cap (vph)		747	722					1202		146	1660	
v/s Ratio Prot								c0.33		c0.08	0.24	
v/s Ratio Perm		0.57	0.44									
v/c Ratio		1.19	0.93					0.93		0.91	0.51	
Uniform Delay, d1		36.4	34.0					43.8		63.7	26.0	
Progression Factor		1.00	1.00					1.00		0.85	0.96	
Incremental Delay, d2		100.5	17.5					13.9		30.9	0.6	
Delay (s)		136.9	51.5					57.7		85.2	25.5	
Level of Service		F	D					E		F	C	
Approach Delay (s)		99.9			0.0			57.7			33.6	
Approach LOS		F			A			E			C	

Intersection Summary		
HCM 2000 Control Delay	70.0	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	1.07	E
Actuated Cycle Length (s)	140.0	Sum of lost time (s)
Intersection Capacity Utilization	111.9%	12.0
Analysis Period (min)	15	ICU Level of Service
		H

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
39: Livermore Ave & Portola Ave

BART to Livermore Extension Project
2040 DMU PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	657	600	169	19	394	71	239	663	97	248	1025	545
Future Volume (vph)	657	600	169	19	394	71	239	663	97	248	1025	545
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	2.7	4.0	4.0	2.7	4.0	4.0	4.9		4.0	4.9	4.9
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	1.00	0.95		1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.98		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	1770	3472		1770	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	1770	3472		1770	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	714	652	184	21	428	77	260	721	105	270	1114	592
RTOR Reduction (vph)	0	0	117	0	0	63	0	8	0	0	0	49
Lane Group Flow (vph)	714	652	67	21	428	14	260	818	0	270	1114	543
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA		Prot	NA	pm+ov
Protected Phases	3	8		7	4		1	6		5	2	3
Permitted Phases			8			4						2
Actuated Green, G (s)	27.0	46.9	46.9	2.9	22.8	22.8	19.0	35.7		27.4	44.1	71.1
Effective Green, g (s)	27.0	48.2	46.9	2.9	24.1	22.8	19.0	34.8		27.4	43.2	69.3
Actuated g/C Ratio	0.21	0.37	0.36	0.02	0.19	0.18	0.15	0.27		0.21	0.34	0.54
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	719	1323	575	39	661	280	260	937		376	1186	851
v/s Ratio Prot	c0.21	0.18		0.01	c0.12		c0.15	0.24		0.15	c0.31	0.13
v/s Ratio Perm			0.04			0.01						0.21
v/c Ratio	0.99	0.49	0.12	0.54	0.65	0.05	1.00	0.87		0.72	0.94	0.64
Uniform Delay, d1	50.9	31.0	27.2	62.3	48.5	44.0	55.0	44.9		47.2	41.6	21.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	31.7	0.3	0.1	13.5	2.2	0.1	55.8	9.0		6.4	13.8	1.6
Delay (s)	82.5	31.3	27.3	75.9	50.7	44.1	110.8	54.0		53.6	55.4	22.6
Level of Service	F	C	C	E	D	D	F	D		D	E	C
Approach Delay (s)		54.4			50.7			67.6			45.3	
Approach LOS		D			D			E			D	

Intersection Summary

HCM 2000 Control Delay	53.3	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.91		
Actuated Cycle Length (s)	128.9	Sum of lost time (s)	16.5
Intersection Capacity Utilization	85.3%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
40: First St/Springtown Blvd & I-580 WB Ramps

BART to Livermore Extension Project
2040 DMU PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations			↗↘			↗	↗↘	↑			↗↘	↗
Traffic Volume (vph)	0	0	262	0	0	0	385	1439	0	0	421	178
Future Volume (vph)	0	0	262	0	0	0	385	1439	0	0	421	178
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)			4.5				4.5	4.0			4.5	4.5
Lane Util. Factor			0.88				0.97	1.00			0.95	1.00
Frt			0.85				1.00	1.00			1.00	0.85
Flt Protected			1.00				0.95	1.00			1.00	1.00
Satd. Flow (prot)			2787				3433	1863			3539	1583
Flt Permitted			1.00				0.95	1.00			1.00	1.00
Satd. Flow (perm)			2787				3433	1863			3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	285	0	0	0	418	1564	0	0	458	193
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	9
Lane Group Flow (vph)	0	0	285	0	0	0	418	1564	0	0	458	184
Turn Type			Over			Free	Prot	NA			NA	Perm
Protected Phases			5				5	2			6	
Permitted Phases						Free						6
Actuated Green, G (s)			21.0				21.0	140.0			111.0	111.0
Effective Green, g (s)			20.5				20.5	140.0			110.5	110.5
Actuated g/C Ratio			0.15				0.15	1.00			0.79	0.79
Clearance Time (s)			4.0				4.0	4.0			4.0	4.0
Vehicle Extension (s)			2.0				2.0	0.2			4.0	4.0
Lane Grp Cap (vph)			408				502	1863			2793	1249
v/s Ratio Prot			0.10				0.12	c0.84			0.13	
v/s Ratio Perm												0.12
v/c Ratio			0.70				0.83	0.84			0.16	0.15
Uniform Delay, d1			56.8				58.1	0.0			3.6	3.5
Progression Factor			1.00				1.07	1.00			1.00	1.00
Incremental Delay, d2			4.2				1.1	0.5			0.1	0.2
Delay (s)			61.0				63.5	0.5			3.7	3.8
Level of Service			E				E	A			A	A
Approach Delay (s)		61.0			0.0			13.7			3.7	
Approach LOS		E			A			B			A	

Intersection Summary

HCM 2000 Control Delay	16.1	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.90		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	79.1%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 41: First St & I-580 EB Ramps

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations													
Traffic Volume (vph)	535	3	706	0	0	0	0	1679	445	98	1224	0	
Future Volume (vph)	535	3	706	0	0	0	0	1679	445	98	1224	0	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)		4.0	4.0					5.0	5.0	5.0	5.0		
Lane Util. Factor		1.00	0.88					0.95	1.00	1.00	0.95		
Frt		1.00	0.85					1.00	0.85	1.00	1.00		
Flt Protected		0.95	1.00					1.00	1.00	0.95	1.00		
Satd. Flow (prot)		1774	2787					3539	1583	1770	3539		
Flt Permitted		0.95	1.00					1.00	1.00	0.95	1.00		
Satd. Flow (perm)		1774	2787					3539	1583	1770	3539		
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	
Adj. Flow (vph)	582	3	767	0	0	0	0	1825	484	107	1330	0	
RTOR Reduction (vph)	0	0	72	0	0	0	0	0	142	0	0	0	
Lane Group Flow (vph)	0	585	695	0	0	0	0	1825	342	107	1330	0	
Turn Type	Perm	NA	Perm					NA	Perm	Prot	NA		
Protected Phases		4						2		1	6		
Permitted Phases	4		4						2				
Actuated Green, G (s)		45.5	45.5					72.5	72.5	10.0	86.5		
Effective Green, g (s)		45.0	45.0					72.0	72.0	9.0	86.0		
Actuated g/C Ratio		0.32	0.32					0.51	0.51	0.06	0.61		
Clearance Time (s)		3.5	3.5					4.5	4.5	4.0	4.5		
Vehicle Extension (s)		2.5	2.5					4.0	4.0	2.0	4.0		
Lane Grp Cap (vph)		570	895					1820	814	113	2173		
v/s Ratio Prot								c0.52		c0.06	0.38		
v/s Ratio Perm		0.33	0.25						0.22				
v/c Ratio		1.03	0.78					1.00	0.42	0.95	0.61		
Uniform Delay, d1		47.5	43.0					34.0	21.1	65.3	16.7		
Progression Factor		1.00	1.00					1.00	1.00	0.89	0.72		
Incremental Delay, d2		44.6	4.1					21.8	1.6	66.5	1.3		
Delay (s)		92.1	47.1					55.8	22.7	124.6	13.2		
Level of Service		F	D					E	C	F	B		
Approach Delay (s)		66.5			0.0			48.8			21.5		
Approach LOS		E			A			D			C		
Intersection Summary													
HCM 2000 Control Delay			45.8									HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio			1.01										
Actuated Cycle Length (s)			140.0									Sum of lost time (s)	14.0
Intersection Capacity Utilization			93.3%									ICU Level of Service	F
Analysis Period (min)			15										
c Critical Lane Group													

HCM Signalized Intersection Capacity Analysis
42: 1st St & Mines Rd























BART to Livermore Extension Project
2040 DMU PM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	70	254	82	440	243	290	87	1565	979	381	1205	55
Future Volume (vph)	70	254	82	440	243	290	87	1565	979	381	1205	55
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	0.97	1.00	1.00	1.00	0.91	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	1863	1583	3433	1863	1583	1770	5085	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	1863	1583	3433	1863	1583	1770	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	76	276	89	478	264	315	95	1701	1064	414	1310	60
RTOR Reduction (vph)	0	0	77	0	0	31	0	0	155	0	0	29
Lane Group Flow (vph)	76	276	12	478	264	284	95	1701	909	414	1310	31
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8	1	5	2		1	NA	6
Permitted Phases			4			8			2			6
Actuated Green, G (s)	6.4	16.8	16.8	15.0	25.4	38.4	11.0	60.0	60.0	13.0	62.0	62.0
Effective Green, g (s)	6.4	16.8	16.8	15.0	25.4	38.4	11.0	60.0	60.0	13.0	62.0	62.0
Actuated g/C Ratio	0.05	0.14	0.14	0.12	0.21	0.32	0.09	0.50	0.50	0.11	0.51	0.51
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	93	259	220	426	391	555	161	2525	786	369	2609	812
v/s Ratio Prot	0.04	c0.15		c0.14	0.14	0.06	0.05	0.33		c0.12	0.26	
v/s Ratio Perm			0.01			0.12			c0.57			0.02
v/c Ratio	0.82	1.07	0.06	1.12	0.68	0.51	0.59	0.67	1.16	1.12	0.50	0.04
Uniform Delay, d1	56.6	52.0	45.1	52.9	43.9	33.6	52.7	23.0	30.4	53.9	19.3	14.6
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	40.4	74.4	0.1	81.2	4.6	0.8	5.7	0.7	84.8	84.1	0.2	0.0
Delay (s)	97.0	126.4	45.2	134.1	48.5	34.4	58.4	23.7	115.2	138.0	19.4	14.6
Level of Service	F	F	D	F	D	C	E	C	F	F	B	B
Approach Delay (s)		104.9			83.0			58.9			46.8	
Approach LOS		F			F			E			D	
Intersection Summary												
HCM 2000 Control Delay			62.8									E
HCM 2000 Volume to Capacity ratio			1.13									
Actuated Cycle Length (s)			120.8								16.0	
Intersection Capacity Utilization			94.9%									F
ICU Level of Service												
Analysis Period (min)			15									

c Critical Lane Group

HCM Unsignalized Intersection Capacity Analysis
 43: Vasco Rd & I-580 WB Ramps

BART to Livermore Extension Project
 2040 DMU PM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations								  			  	
Traffic Volume (veh/h)	0	0	0	0	0	155	0	2460	0	0	599	0
Future Volume (Veh/h)	0	0	0	0	0	155	0	2460	0	0	599	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	0	0	0	168	0	2674	0	0	651	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage (veh)												
Upstream signal (ft)											524	
pX, platoon unblocked												
vC, conflicting volume	1710	3325	217	2891	3325	891	651			2674		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1710	3325	217	2891	3325	891	651			2674		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	100	100	41	100			100		
cM capacity (veh/h)	24	8	787	7	8	285	931			153		
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	NB 4	SB 1	SB 2	SB 3	SB 4		
Volume Total	0	168	891	891	891	0	217	217	217	0		
Volume Left	0	0	0	0	0	0	0	0	0	0		
Volume Right	0	168	0	0	0	0	0	0	0	0		
cSH	1700	285	1700	1700	1700	1700	1700	1700	1700	1700		
Volume to Capacity	0.00	0.59	0.52	0.52	0.52	0.00	0.13	0.13	0.13	0.00		
Queue Length 95th (ft)	0	87	0	0	0	0	0	0	0	0		
Control Delay (s)	0.0	34.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
Lane LOS	A	D										
Approach Delay (s)	0.0	34.2	0.0				0.0					
Approach LOS	A	D										
Intersection Summary												
Average Delay			1.6									
Intersection Capacity Utilization			63.8%		ICU Level of Service					B		
Analysis Period (min)			15									

HCM Unsignalized Intersection Capacity Analysis
44: Vasco Rd & I-580 EB Ramps






















BART to Livermore Extension Project
2040 DMU PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations			↗			↗		↑↑↑	↗	↘	↑↑↑	
Traffic Volume (veh/h)	0	0	0	0	0	0	0	2837	0	64	746	0
Future Volume (Veh/h)	0	0	0	0	0	0	0	2837	0	64	746	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	0	0	0	0	0	3084	0	70	811	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1979	4035	270	3494	4035	1028	811			3084		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1979	4035	270	3494	4035	1028	811			3084		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	100	100	100	100			33		
cM capacity (veh/h)	17	1	728	1	1	231	811			104		
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	NB 4	SB 1	SB 2	SB 3	SB 4		
Volume Total	0	0	1028	1028	1028	0	70	270	270	270		
Volume Left	0	0	0	0	0	0	70	0	0	0		
Volume Right	0	0	0	0	0	0	0	0	0	0		
cSH	1700	1700	1700	1700	1700	1700	104	1700	1700	1700		
Volume to Capacity	0.00	0.00	0.60	0.60	0.60	0.00	0.67	0.16	0.16	0.16		
Queue Length 95th (ft)	0	0	0	0	0	0	85	0	0	0		
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	91.3	0.0	0.0	0.0		
Lane LOS	A	A					F					
Approach Delay (s)	0.0	0.0	0.0				7.3					
Approach LOS	A	A										
Intersection Summary												
Average Delay			1.6									
Intersection Capacity Utilization			58.1%		ICU Level of Service				B			
Analysis Period (min)			15									

HCM Signalized Intersection Capacity Analysis
45: Vasco Rd & East Ave

BART to Livermore Extension Project
2040 DMU PM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	730	39	118	133	404	279	109	386	13	16	385	473
Future Volume (vph)	730	39	118	133	404	279	109	386	13	16	385	473
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	0.95		0.97	1.00	1.00
Frt	1.00	0.89		1.00	0.94		1.00	1.00		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	3139		1770	3322		1770	3522		3433	1863	1583
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1770	3139		1770	3322		1770	3522		3433	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	793	42	128	145	439	303	118	420	14	17	418	514
RTOR Reduction (vph)	0	72	0	0	113	0	0	2	0	0	0	393
Lane Group Flow (vph)	793	98	0	145	629	0	118	432	0	17	418	121
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												6
Actuated Green, G (s)	45.0	49.6		13.4	18.0		7.0	31.8		1.6	26.4	26.4
Effective Green, g (s)	45.0	49.6		13.4	18.0		7.0	31.8		1.6	26.4	26.4
Actuated g/C Ratio	0.40	0.44		0.12	0.16		0.06	0.28		0.01	0.23	0.23
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	708	1385		211	531		110	996		48	437	371
v/s Ratio Prot	c0.45	0.03		0.08	c0.19		c0.07	0.12		0.00	c0.22	
v/s Ratio Perm												0.08
v/c Ratio	1.12	0.07		0.69	1.18		1.07	0.43		0.35	0.96	0.33
Uniform Delay, d1	33.7	18.1		47.5	47.2		52.7	32.9		54.9	42.4	35.6
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	71.9	0.0		9.0	100.7		106.7	0.3		4.5	31.8	0.5
Delay (s)	105.6	18.1		56.4	147.9		159.4	33.2		59.3	74.2	36.1
Level of Service	F	B		E	F		F	C		E	E	D
Approach Delay (s)		90.1			132.9			60.2			53.3	
Approach LOS		F			F			E			D	
Intersection Summary												
HCM 2000 Control Delay			86.1									F
HCM 2000 Volume to Capacity ratio			1.08									
Actuated Cycle Length (s)			112.4								16.0	
Intersection Capacity Utilization			100.2%									G
Analysis Period (min)			15									

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
46: Greenville Rd & I-580 WB Ramps

BART to Livermore Extension Project
2040 DMU PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↔		↗		↕	↗		↕	↗
Traffic Volume (vph)	0	0	0	105	0	34	0	1316	568	0	167	26
Future Volume (vph)	0	0	0	105	0	34	0	1316	568	0	167	26
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0		4.0		4.0	4.0		4.0	
Lane Util. Factor				0.97		1.00		0.95	1.00		0.95	
Frt				1.00		0.85		1.00	0.85		0.98	
Flt Protected				0.95		1.00		1.00	1.00		1.00	
Satd. Flow (prot)				3433		1583		3539	1583		3468	
Flt Permitted				0.95		1.00		1.00	1.00		1.00	
Satd. Flow (perm)				3433		1583		3539	1583		3468	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	114	0	37	0	1430	617	0	182	28
RTOR Reduction (vph)	0	0	0	0	0	34	0	0	79	0	4	0
Lane Group Flow (vph)	0	0	0	114	0	3	0	1430	538	0	206	0
Turn Type				Prot		Prot		NA	Perm		NA	
Protected Phases				3		3		2			6	
Permitted Phases									2			
Actuated Green, G (s)				10.0		10.0		122.0	122.0		122.0	
Effective Green, g (s)				10.0		10.0		122.0	122.0		122.0	
Actuated g/C Ratio				0.07		0.07		0.87	0.87		0.87	
Clearance Time (s)				4.0		4.0		4.0	4.0		4.0	
Vehicle Extension (s)				3.0		3.0		3.0	3.0		3.0	
Lane Grp Cap (vph)				245		113		3083	1379		3022	
v/s Ratio Prot				c0.03		0.00		c0.40			0.06	
v/s Ratio Perm									0.34			
v/c Ratio				0.47		0.02		0.46	0.39		0.07	
Uniform Delay, d1				62.4		60.5		1.9	1.8		1.2	
Progression Factor				1.00		1.00		0.66	0.39		1.00	
Incremental Delay, d2				1.4		0.1		0.5	0.8		0.0	
Delay (s)				63.8		60.5		1.7	1.5		1.3	
Level of Service				E		E		A	A		A	
Approach Delay (s)		0.0			63.0			1.7			1.3	
Approach LOS		A			E			A			A	



















Intersection Summary

HCM 2000 Control Delay	5.5	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.46		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	46.4%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
47: Greenville Rd & I-580 EB Ramps

BART to Livermore Extension Project
2040 DMU PM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	194	0	107	0	0	0	0	1375	398	0	202	65
Future Volume (vph)	194	0	107	0	0	0	0	1375	398	0	202	65
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0					4.0	4.0		4.0	4.0
Lane Util. Factor	0.97		1.00					0.95	1.00		0.95	1.00
Frt	1.00		0.85					1.00	0.85		1.00	0.85
Flt Protected	0.95		1.00					1.00	1.00		1.00	1.00
Satd. Flow (prot)	3433		1583					3539	1583		3539	1583
Flt Permitted	0.95		1.00					1.00	1.00		1.00	1.00
Satd. Flow (perm)	3433		1583					3539	1583		3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	211	0	116	0	0	0	0	1495	433	0	220	71
RTOR Reduction (vph)	0	0	104	0	0	0	0	0	68	0	0	11
Lane Group Flow (vph)	211	0	12	0	0	0	0	1495	365	0	220	60
Turn Type	Prot		Prot					NA	Perm		NA	Perm
Protected Phases	7		7					2			6	
Permitted Phases									2			6
Actuated Green, G (s)	13.9		13.9					118.1	118.1		118.1	118.1
Effective Green, g (s)	13.9		13.9					118.1	118.1		118.1	118.1
Actuated g/C Ratio	0.10		0.10					0.84	0.84		0.84	0.84
Clearance Time (s)	4.0		4.0					4.0	4.0		4.0	4.0
Vehicle Extension (s)	3.0		3.0					3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	340		157					2985	1335		2985	1335
v/s Ratio Prot	c0.06		0.01					c0.42			0.06	
v/s Ratio Perm									0.23			0.04
v/c Ratio	0.62		0.07					0.50	0.27		0.07	0.04
Uniform Delay, d1	60.5		57.2					3.0	2.2		1.8	1.8
Progression Factor	1.00		1.00					0.76	0.50		0.60	0.10
Incremental Delay, d2	3.5		0.2					0.5	0.4		0.0	0.1
Delay (s)	64.0		57.4					2.8	1.6		1.1	0.2
Level of Service	E		E					A	A		A	A
Approach Delay (s)		61.7			0.0			2.5			0.9	
Approach LOS		E			A			A			A	
Intersection Summary												
HCM 2000 Control Delay			9.9		HCM 2000 Level of Service				A			
HCM 2000 Volume to Capacity ratio			0.51									
Actuated Cycle Length (s)			140.0		Sum of lost time (s)				8.0			
Intersection Capacity Utilization			50.2%		ICU Level of Service				A			
Analysis Period (min)			15									

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
48: Greenville Rd & Northfront Road/Altamont Pass Road



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↑	↑	↑	↑	↑
Traffic Volume (vph)	555	180	2	73	267	1209
Future Volume (vph)	555	180	2	73	267	1209
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	1863	1583	1770	1863	1770	1583
Flt Permitted	1.00	1.00	0.12	1.00	0.95	1.00
Satd. Flow (perm)	1863	1583	226	1863	1770	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	603	196	2	79	290	1314
RTOR Reduction (vph)	0	88	0	0	0	20
Lane Group Flow (vph)	603	108	2	79	290	1294
Turn Type	NA	Perm	Perm	NA	Prot	Perm
Protected Phases	4			8	2	
Permitted Phases		4	8			2
Actuated Green, G (s)	33.0	33.0	33.0	33.0	79.0	79.0
Effective Green, g (s)	33.0	33.0	33.0	33.0	79.0	79.0
Actuated g/C Ratio	0.28	0.28	0.28	0.28	0.66	0.66
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	512	435	62	512	1165	1042
v/s Ratio Prot	c0.32			0.04	0.16	
v/s Ratio Perm		0.07	0.01			c0.82
v/c Ratio	1.18	0.25	0.03	0.15	0.25	1.24
Uniform Delay, d1	43.5	33.9	31.8	32.9	8.4	20.5
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	98.8	0.3	0.2	0.1	0.1	117.1
Delay (s)	142.3	34.2	32.0	33.1	8.5	137.6
Level of Service	F	C	C	C	A	F
Approach Delay (s)	115.8			33.1	114.3	
Approach LOS	F			C	F	

Intersection Summary

HCM 2000 Control Delay	112.1	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.22		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	110.7%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	402	111	229	1268	163	143
Future Volume (vph)	402	111	229	1268	163	143
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.2	5.2	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.88	0.97	0.95	0.95	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	3433	2787	3433	3539	3539	1583
Flt Permitted	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (perm)	3433	2787	3433	3539	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	437	121	249	1378	177	155
RTOR Reduction (vph)	0	95	0	0	0	85
Lane Group Flow (vph)	437	26	249	1378	177	70
Turn Type	Prot	Perm	Prot	NA	NA	Perm
Protected Phases	8		1	6	2	
Permitted Phases		8				2
Actuated Green, G (s)	15.4	15.4	10.6	44.3	29.7	29.7
Effective Green, g (s)	14.8	14.8	10.6	46.0	31.4	31.4
Actuated g/C Ratio	0.21	0.21	0.15	0.66	0.45	0.45
Clearance Time (s)	4.6	4.6	4.0	5.7	5.7	5.7
Vehicle Extension (s)	5.0	5.0	6.0	2.5	2.5	2.5
Lane Grp Cap (vph)	725	589	519	2325	1587	710
v/s Ratio Prot	c0.13		0.07	c0.39	0.05	
v/s Ratio Perm		0.01				0.04
v/c Ratio	0.60	0.04	0.48	0.59	0.11	0.10
Uniform Delay, d1	24.9	22.0	27.2	6.7	11.2	11.1
Progression Factor	1.00	1.00	1.00	1.00	0.70	0.55
Incremental Delay, d2	2.1	0.1	2.0	1.1	0.1	0.3
Delay (s)	27.0	22.0	29.1	7.9	8.0	6.4
Level of Service	C	C	C	A	A	A
Approach Delay (s)	25.9			11.1	7.3	
Approach LOS	C			B	A	

Intersection Summary

HCM 2000 Control Delay	13.9	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.64		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	13.2
Intersection Capacity Utilization	54.2%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
50: Greenville Rd & Patterson Pass Rd

BART to Livermore Extension Project
2040 DMU PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	39	528	64	6	13	8	66	473	340	412	217	39
Future Volume (vph)	39	528	64	6	13	8	66	473	340	412	217	39
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.98		1.00	0.94		1.00	0.94		1.00	0.98	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1832		1770	1753		1770	1746		1770	1821	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	1832		1770	1753		1770	1746		1770	1821	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	42	574	70	7	14	9	72	514	370	448	236	42
RTOR Reduction (vph)	0	4	0	0	7	0	0	21	0	0	5	0
Lane Group Flow (vph)	42	640	0	7	16	0	72	863	0	448	273	0
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												
Actuated Green, G (s)	4.2	31.0		0.8	27.6		7.6	47.8		22.0	62.2	
Effective Green, g (s)	4.2	31.0		0.8	27.6		7.6	47.8		22.0	62.2	
Actuated g/C Ratio	0.04	0.26		0.01	0.23		0.06	0.41		0.19	0.53	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	63	482		12	411		114	709		331	963	
v/s Ratio Prot	c0.02	c0.35		0.00	0.01		0.04	c0.49		c0.25	0.15	
v/s Ratio Perm												
v/c Ratio	0.67	1.33		0.58	0.04		0.63	1.22		1.35	0.28	
Uniform Delay, d1	56.0	43.3		58.2	34.8		53.6	34.9		47.8	15.3	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	23.5	161.6		56.2	0.0		10.9	110.5		177.7	0.7	
Delay (s)	79.5	204.9		114.5	34.8		64.5	145.4		225.5	16.1	
Level of Service	E	F		F	C		E	F		F	B	
Approach Delay (s)		197.2			53.4			139.3			145.3	
Approach LOS		F			D			F			F	

Intersection Summary

HCM 2000 Control Delay	156.6	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.28		
Actuated Cycle Length (s)	117.6	Sum of lost time (s)	16.0
Intersection Capacity Utilization	110.2%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 1: Dougherty Rd & Amador Valley Rd

BART to Livermore Extension Project
 2040 Express Bus AM



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	99	769	464	824	2163	133
Future Volume (vph)	99	769	464	824	2163	133
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00	0.97	0.91	0.91	
Frt	1.00	0.85	1.00	1.00	0.99	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1770	1583	3433	5085	5041	
Flt Permitted	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	1770	1583	3433	5085	5041	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	108	836	504	896	2351	145
RTOR Reduction (vph)	0	158	0	0	6	0
Lane Group Flow (vph)	108	678	504	896	2490	0
Turn Type	Perm	Perm	Prot	NA	NA	
Protected Phases			5	2	6	
Permitted Phases	4	4				
Actuated Green, G (s)	39.0	39.0	14.0	68.0	50.0	
Effective Green, g (s)	39.0	39.0	14.0	68.0	50.0	
Actuated g/C Ratio	0.34	0.34	0.12	0.59	0.43	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	600	536	417	3006	2191	
v/s Ratio Prot			c0.15	0.18	c0.49	
v/s Ratio Perm	0.06	c0.43				
v/c Ratio	0.18	1.27	1.21	0.30	1.14	
Uniform Delay, d1	26.7	38.0	50.5	11.7	32.5	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.1	133.6	114.4	0.1	67.7	
Delay (s)	26.9	171.6	164.9	11.7	100.2	
Level of Service	C	F	F	B	F	
Approach Delay (s)	155.0			66.9	100.2	
Approach LOS	F			E	F	

Intersection Summary

HCM 2000 Control Delay	101.2	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.19		
Actuated Cycle Length (s)	115.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	99.0%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
2: Hopyard Road/Dougherty Rd & Dublin Blvd

BART to Livermore Extension Project
2040 Express Bus AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↑↑↑	↖↗	↖↗↘	↑↑↑	↖	↖↗↘	↑↑↑	↖↗	↖↗	↑↑↑	↖↗
Traffic Volume (vph)	53	507	528	344	906	480	749	1066	135	937	2178	108
Future Volume (vph)	53	507	528	344	906	480	749	1066	135	937	2178	108
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	6.0	5.0	5.0	5.5	5.0	5.0	5.5	5.0	5.0	5.5	
Lane Util. Factor	0.97	0.91	0.88	0.94	0.91	1.00	0.94	0.91	0.88	0.97	0.86	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	3433	5085	2787	4990	5085	1583	4990	5085	2787	3433	6363	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	3433	5085	2787	4990	5085	1583	4990	5085	2787	3433	6363	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	58	551	574	374	985	522	814	1159	147	1018	2367	117
RTOR Reduction (vph)	0	0	63	0	0	82	0	0	60	0	4	0
Lane Group Flow (vph)	58	551	511	374	985	440	814	1159	87	1018	2480	0
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	
Protected Phases	5	2	3	1	6	7	3	8	1	7	4	
Permitted Phases			2			6			8			
Actuated Green, G (s)	12.0	32.3	49.3	15.4	36.2	62.0	17.0	45.0	60.4	25.8	53.8	
Effective Green, g (s)	12.0	32.3	49.3	15.4	36.2	62.0	17.0	45.0	60.4	25.8	53.8	
Actuated g/C Ratio	0.09	0.23	0.35	0.11	0.26	0.44	0.12	0.32	0.43	0.18	0.38	
Clearance Time (s)	5.0	6.0	5.0	5.0	5.5	5.0	5.0	5.5	5.0	5.0	5.5	
Vehicle Extension (s)	2.0	4.5	2.0	2.0	4.5	2.0	2.0	4.5	2.0	2.0	4.5	
Lane Grp Cap (vph)	294	1173	981	548	1314	701	605	1634	1202	632	2445	
v/s Ratio Prot	0.02	0.11	c0.06	0.07	c0.19	0.12	c0.16	0.23	0.01	c0.30	c0.39	
v/s Ratio Perm			0.12			0.16			0.02			
v/c Ratio	0.20	0.47	0.52	0.68	0.75	0.63	1.35	0.71	0.07	1.61	1.01	
Uniform Delay, d1	59.5	46.5	36.0	59.9	47.7	30.1	61.5	41.8	23.4	57.1	43.1	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	0.83	0.74	0.74	1.00	1.00	
Incremental Delay, d2	0.1	1.4	0.2	2.8	4.0	1.3	164.1	1.3	0.0	282.2	21.8	
Delay (s)	59.6	47.8	36.2	62.7	51.7	31.3	214.9	32.3	17.3	339.3	64.9	
Level of Service	E	D	D	E	D	C	F	C	B	F	E	
Approach Delay (s)		42.8			48.2			101.4			144.7	
Approach LOS		D			D			F			F	

Intersection Summary

HCM 2000 Control Delay	99.3	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.05		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	21.5
Intersection Capacity Utilization	95.1%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 3: Dougherty Rd/Hopyard Road & I-580 WB Ramps

BART to Livermore Extension Project
 2040 Express Bus AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↔↔		↔↔		↑↑↑			↑↑↑	↔
Traffic Volume (vph)	0	0	0	393	0	637	0	1728	0	0	2178	0
Future Volume (vph)	0	0	0	393	0	637	0	1728	0	0	2178	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0		4.0		4.0			4.0	
Lane Util. Factor				0.97		0.88		0.91			0.86	
Frt				1.00		0.85		1.00			1.00	
Flt Protected				0.95		1.00		1.00			1.00	
Satd. Flow (prot)				3433		2787		5085			4806	
Flt Permitted				0.95		1.00		1.00			1.00	
Satd. Flow (perm)				3433		2787		5085			4806	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	427	0	692	0	1878	0	0	2367	0
RTOR Reduction (vph)	0	0	0	0	0	21	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	427	0	671	0	1878	0	0	2367	0
Turn Type				Prot		Prot		NA			NA	Perm
Protected Phases				4		4		2			6	
Permitted Phases												6
Actuated Green, G (s)				39.5		39.5		89.7			89.7	
Effective Green, g (s)				40.9		40.9		91.1			91.1	
Actuated g/C Ratio				0.29		0.29		0.65			0.65	
Clearance Time (s)				5.4		5.4		5.4			5.4	
Vehicle Extension (s)				3.0		3.0		3.0			3.0	
Lane Grp Cap (vph)				1002		814		3308			3127	
v/s Ratio Prot				0.12		c0.24		0.37			c0.49	
v/s Ratio Perm												
v/c Ratio				0.43		0.82		0.57			0.76	
Uniform Delay, d1				40.1		46.2		13.5			16.8	
Progression Factor				1.00		1.00		0.93			0.44	
Incremental Delay, d2				0.3		6.8		0.6			0.8	
Delay (s)				40.4		53.0		13.2			8.2	
Level of Service				D		D		B			A	
Approach Delay (s)		0.0			48.2			13.2			8.2	
Approach LOS		A			D			B			A	

Intersection Summary			
HCM 2000 Control Delay	18.3	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.78		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	62.3%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
4: Hopyard Rd/Dougherty Rd & I-580 EB Ramps

BART to Livermore Extension Project
2040 Express Bus AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗		↖↗					↑↑↑	↖		↑↑↑	↖
Traffic Volume (vph)	894	0	1423	0	0	0	0	931	0	0	1783	0
Future Volume (vph)	894	0	1423	0	0	0	0	931	0	0	1783	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0					4.0			4.0	
Lane Util. Factor	0.97		0.88					0.91			0.86	
Frt	1.00		0.85					1.00			1.00	
Flt Protected	0.95		1.00					1.00			1.00	
Satd. Flow (prot)	3433		2787					5085			4806	
Flt Permitted	0.95		1.00					1.00			1.00	
Satd. Flow (perm)	3433		2787					5085			4806	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	972	0	1547	0	0	0	0	1012	0	0	1938	0
RTOR Reduction (vph)	0	0	9	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	972	0	1538	0	0	0	0	1012	0	0	1938	0
Turn Type	Prot		Prot					NA	Free		NA	Perm
Protected Phases	4		4					2			6	
Permitted Phases									Free			6
Actuated Green, G (s)	72.6		72.6					56.6			56.6	
Effective Green, g (s)	74.0		74.0					58.0			58.0	
Actuated g/C Ratio	0.53		0.53					0.41			0.41	
Clearance Time (s)	5.4		5.4					5.4			5.4	
Vehicle Extension (s)	3.0		3.0					3.0			3.0	
Lane Grp Cap (vph)	1814		1473					2106			1991	
v/s Ratio Prot	0.28		c0.55					0.20			c0.40	
v/s Ratio Perm												
v/c Ratio	0.54		1.04					0.48			0.97	
Uniform Delay, d1	21.7		33.0					30.0			40.2	
Progression Factor	1.00		1.00					1.00			1.02	
Incremental Delay, d2	0.3		35.9					0.8			11.7	
Delay (s)	22.0		68.9					30.8			52.9	
Level of Service	C		E					C			D	
Approach Delay (s)		50.8			0.0			30.8			52.9	
Approach LOS		D			A			C			D	

Intersection Summary

HCM 2000 Control Delay	47.8	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	1.01		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	90.9%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
5: Hopyard Rd & Owens Rd

BART to Livermore Extension Project
2040 Express Bus AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↔↗		↖	↗	↗	↖	↑↑↑	↗	↖↗	↑↑↗	
Traffic Volume (vph)	211	89	49	118	123	226	142	850	155	902	1791	562
Future Volume (vph)	211	89	49	118	123	226	142	850	155	902	1791	562
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	2.7	2.7		2.7	2.7	2.7	4.0	2.3	2.3	4.0	2.3	
Lane Util. Factor	0.91	0.91		1.00	0.95	0.95	1.00	0.91	1.00	0.97	0.91	
Frt	1.00	0.97		1.00	0.95	0.85	1.00	1.00	0.85	1.00	0.96	
Flt Protected	0.95	0.98		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1610	3218		1770	1674	1504	1770	5085	1583	3433	4903	
Flt Permitted	0.95	0.98		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1610	3218		1770	1674	1504	1770	5085	1583	3433	4903	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	229	97	53	128	134	246	154	924	168	980	1947	611
RTOR Reduction (vph)	0	25	0	0	23	31	0	0	117	0	63	0
Lane Group Flow (vph)	126	228	0	128	187	139	154	924	51	980	2495	0
Turn Type	Split	NA		Split	NA	pm+ov	Prot	NA	Perm	Prot	NA	
Protected Phases	8	8		4	4	1	5	2		1	6	
Permitted Phases						4			2			
Actuated Green, G (s)	7.0	7.0		9.0	9.0	41.5	9.0	25.5	25.5	32.5	49.0	
Effective Green, g (s)	8.3	8.3		10.3	10.3	44.1	9.0	27.2	27.2	32.5	50.7	
Actuated g/C Ratio	0.09	0.09		0.11	0.11	0.49	0.10	0.30	0.30	0.36	0.56	
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	148	296		202	191	782	177	1536	478	1239	2762	
v/s Ratio Prot	c0.08	0.07		0.07	c0.11	0.07	0.09	0.18		c0.29	c0.51	
v/s Ratio Perm						0.03			0.03			
v/c Ratio	0.85	0.77		0.63	0.98	0.18	0.87	0.60	0.11	0.79	0.90	
Uniform Delay, d1	40.2	39.9		38.0	39.7	12.8	39.9	26.8	22.6	25.7	17.5	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	34.8	11.8		6.4	58.3	0.1	34.1	1.8	0.4	3.5	5.4	
Delay (s)	75.1	51.7		44.4	98.0	12.9	74.0	28.5	23.1	29.2	22.9	
Level of Service	E	D		D	F	B	E	C	C	C	C	
Approach Delay (s)		59.5			56.0			33.4			24.6	
Approach LOS		E			E			C			C	

Intersection Summary

HCM 2000 Control Delay	31.7	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.92		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	11.7
Intersection Capacity Utilization	86.2%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
6: Hopyard Rd & Stoneridge Dr

BART to Livermore Extension Project
2040 Express Bus AM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	208	786	468	72	1019	135	635	813	74	296	1024	285
Future Volume (vph)	208	786	468	72	1019	135	635	813	74	296	1024	285
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.91	1.00	0.97	0.91	1.00	0.94	0.95	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5085	1583	3433	5085	1583	4990	3539	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5085	1583	3433	5085	1583	4990	3539	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	226	854	509	78	1108	147	690	884	80	322	1113	310
RTOR Reduction (vph)	0	0	200	0	0	105	0	0	57	0	0	126
Lane Group Flow (vph)	226	854	309	78	1108	42	690	884	23	322	1113	184
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8			2			6
Actuated Green, G (s)	4.0	19.2	19.2	2.4	17.6	17.6	8.0	18.0	18.0	6.0	16.0	16.0
Effective Green, g (s)	4.0	19.2	19.2	2.4	17.6	17.6	8.0	18.0	18.0	6.0	16.0	16.0
Actuated g/C Ratio	0.06	0.31	0.31	0.04	0.29	0.29	0.13	0.29	0.29	0.10	0.26	0.26
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	222	1584	493	133	1452	452	648	1034	462	334	1320	411
v/s Ratio Prot	c0.07	0.17		0.02	c0.22		c0.14	c0.25		0.09	0.22	
v/s Ratio Perm			0.20			0.03			0.01			0.12
v/c Ratio	1.02	0.54	0.63	0.59	0.76	0.09	1.06	0.85	0.05	0.96	0.84	0.45
Uniform Delay, d1	28.8	17.5	18.1	29.1	20.1	16.1	26.8	20.6	15.7	27.7	21.6	19.1
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	65.1	0.4	2.5	6.5	2.4	0.1	53.9	7.0	0.0	39.4	5.1	0.8
Delay (s)	93.9	17.9	20.6	35.6	22.5	16.2	80.7	27.6	15.7	67.1	26.7	19.9
Level of Service	F	B	C	D	C	B	F	C	B	E	C	B
Approach Delay (s)		29.6			22.6			49.2			32.9	
Approach LOS		C			C			D			C	

Intersection Summary			
HCM 2000 Control Delay	34.2	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.89		
Actuated Cycle Length (s)	61.6	Sum of lost time (s)	16.0
Intersection Capacity Utilization	70.8%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
7: Hopyard Rd & Las Positas Blvd

BART to Livermore Extension Project
2040 Express Bus AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↖↖	↗	↖↗	↖↖	↗	↖↗	↖↖↖	↗	↖↗	↖↖↖	↗
Traffic Volume (vph)	151	489	406	352	452	52	457	1167	392	115	1075	96
Future Volume (vph)	151	489	406	352	452	52	457	1167	392	115	1075	96
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.95	1.00	0.97	0.95	1.00	0.97	0.91	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	3433	3539	1583	3433	5085	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	3433	3539	1583	3433	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	164	532	441	383	491	57	497	1268	426	125	1168	104
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	74
Lane Group Flow (vph)	164	532	441	383	491	57	497	1268	426	125	1168	30
Turn Type	Prot	NA	Free	Prot	NA	Free	Prot	NA	Free	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1		6
Permitted Phases			Free			Free			Free			6
Actuated Green, G (s)	6.9	14.5	69.4	8.0	15.6	69.4	11.0	27.7	69.4	3.2	19.9	19.9
Effective Green, g (s)	6.9	14.5	69.4	8.0	15.6	69.4	11.0	27.7	69.4	3.2	19.9	19.9
Actuated g/C Ratio	0.10	0.21	1.00	0.12	0.22	1.00	0.16	0.40	1.00	0.05	0.29	0.29
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	341	739	1583	395	795	1583	544	2029	1583	158	1458	453
v/s Ratio Prot	0.05	c0.15		c0.11	0.14		c0.14	0.25		0.04	c0.23	
v/s Ratio Perm			c0.28			0.04			0.27			0.02
v/c Ratio	0.48	0.72	0.28	0.97	0.62	0.04	0.91	0.62	0.27	0.79	0.80	0.07
Uniform Delay, d1	29.6	25.6	0.0	30.6	24.2	0.0	28.7	16.7	0.0	32.8	22.9	18.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.1	3.4	0.4	36.8	1.4	0.0	19.8	0.6	0.4	23.1	3.3	0.1
Delay (s)	30.6	28.9	0.4	67.4	25.7	0.0	48.6	17.3	0.4	55.8	26.2	18.1
Level of Service	C	C	A	E	C	A	D	B	A	E	C	B
Approach Delay (s)		18.1			41.3			21.1			28.2	
Approach LOS		B			D			C			C	

Intersection Summary

HCM 2000 Control Delay	25.6	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.83		
Actuated Cycle Length (s)	69.4	Sum of lost time (s)	16.0
Intersection Capacity Utilization	70.7%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
8: Willow Rd & Owens Rd

BART to Livermore Extension Project
2040 Express Bus AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	103	480	220	120	334	79	116	100	0	142	98	89
Future Volume (vph)	103	480	220	120	334	79	116	100	0	142	98	89
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	5.3	4.0		5.3	4.0	4.0
Lane Util. Factor	0.97	0.91		0.97	0.91	1.00	1.00	0.95		1.00	1.00	1.00
Frt	1.00	0.95		1.00	1.00	0.85	1.00	1.00		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	4846		3433	5085	1583	1770	3539		1770	1863	1583
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.69	1.00		0.68	1.00	1.00
Satd. Flow (perm)	3433	4846		3433	5085	1583	1281	3539		1273	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	112	522	239	130	363	86	126	109	0	154	107	97
RTOR Reduction (vph)	0	113	0	0	0	49	0	0	0	0	0	75
Lane Group Flow (vph)	112	648	0	130	363	37	126	109	0	154	107	22
Turn Type	Prot	NA		Prot	NA	Perm	Perm	NA	Perm	Perm	NA	Perm
Protected Phases	1	6		5	2			4				8
Permitted Phases						2	4		4	8		8
Actuated Green, G (s)	3.7	17.1		4.5	17.9	17.9	9.3	9.3		9.3	9.3	9.3
Effective Green, g (s)	3.7	18.8		4.5	19.6	19.6	9.3	10.6		9.3	10.6	10.6
Actuated g/C Ratio	0.08	0.41		0.10	0.43	0.43	0.20	0.23		0.20	0.23	0.23
Clearance Time (s)	4.0	5.7		4.0	5.7	5.7	5.3	5.3		5.3	5.3	5.3
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	276	1984		336	2171	675	259	817		257	430	365
v/s Ratio Prot	0.03	c0.13		c0.04	0.07			0.03			0.06	
v/s Ratio Perm						0.02	0.10			c0.12		0.01
v/c Ratio	0.41	0.33		0.39	0.17	0.05	0.49	0.13		0.60	0.25	0.06
Uniform Delay, d1	20.1	9.2		19.4	8.1	7.7	16.2	14.0		16.6	14.4	13.8
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	1.0	0.1		0.7	0.0	0.0	1.4	0.1		3.7	0.3	0.1
Delay (s)	21.0	9.3		20.1	8.2	7.7	17.6	14.1		20.3	14.7	13.8
Level of Service	C	A		C	A	A	B	B		C	B	B
Approach Delay (s)		10.8			10.8			16.0			16.9	
Approach LOS		B			B			B			B	

Intersection Summary

HCM 2000 Control Delay	12.5	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.40		
Actuated Cycle Length (s)	45.9	Sum of lost time (s)	12.0
Intersection Capacity Utilization	42.2%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
9: Hacienda Dr & Dublin Blvd

BART to Livermore Extension Project
2040 Express Bus AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↑↑↑	↖↗	↖↗	↑↑↑		↖↗	↑↑	↖↗	↖↗	↑↑↑	↖↗
Traffic Volume (vph)	86	385	119	286	774	78	187	708	125	11	395	132
Future Volume (vph)	86	385	119	286	774	78	187	708	125	11	395	132
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	6.0	5.0	4.5	6.0		5.0	6.0	6.0	4.5	5.5	5.5
Lane Util. Factor	0.97	0.91	0.88	0.97	0.91		0.94	0.95	0.88	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5085	2787	3433	5015		4990	3539	2787	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5085	2787	3433	5015		4990	3539	2787	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	93	418	129	311	841	85	203	770	136	12	429	143
RTOR Reduction (vph)	0	0	53	0	8	0	0	0	98	0	0	124
Lane Group Flow (vph)	93	418	76	311	918	0	203	770	38	12	429	19
Turn Type	Prot	NA	pm+ov	Prot	NA		Prot	NA	Perm	Prot	NA	Perm
Protected Phases	5	2	3	1	6		3	8		7	NA	4
Permitted Phases			2						8			4
Actuated Green, G (s)	9.2	59.6	82.6	17.9	68.3		23.0	38.9	38.9	2.6	18.5	18.5
Effective Green, g (s)	9.2	59.6	82.6	17.9	68.3		23.0	38.9	38.9	2.6	18.5	18.5
Actuated g/C Ratio	0.07	0.43	0.59	0.13	0.49		0.16	0.28	0.28	0.02	0.13	0.13
Clearance Time (s)	4.5	6.0	5.0	4.5	6.0		5.0	6.0	6.0	4.5	5.5	5.5
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	225	2164	1644	438	2446		819	983	774	63	671	209
v/s Ratio Prot	0.03	0.08	0.01	c0.09	c0.18		0.04	c0.22		0.00	c0.08	
v/s Ratio Perm			0.02						0.01			0.01
v/c Ratio	0.41	0.19	0.05	0.71	0.38		0.25	0.78	0.05	0.19	0.64	0.09
Uniform Delay, d1	62.8	25.2	12.1	58.6	22.5		51.0	46.7	37.0	67.7	57.6	53.4
Progression Factor	1.00	1.00	1.00	1.00	1.00		0.77	0.74	0.38	1.00	1.00	1.00
Incremental Delay, d2	1.2	0.2	0.0	5.4	0.4		0.2	4.0	0.0	1.5	2.0	0.2
Delay (s)	64.0	25.4	12.1	63.9	22.9		39.2	38.8	14.1	69.1	59.6	53.5
Level of Service	E	C	B	E	C		D	D	B	E	E	D
Approach Delay (s)		28.3			33.2			35.8			58.3	
Approach LOS		C			C			D			E	

Intersection Summary

HCM 2000 Control Delay	37.3	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.58		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	21.0
Intersection Capacity Utilization	60.4%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 10: Hacienda Dr & Martinelli Blvd/Hacienda Crossings



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗	↖↗	↖↗	↗		↖↗	↑↑↑	↗	↖↗	↑↑↑	
Traffic Volume (vph)	16	11	225	107	13	9	255	976	109	18	737	56
Future Volume (vph)	16	11	225	107	13	9	255	976	109	18	737	56
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	2.0	2.0	4.5	2.0		3.0	2.0	2.0	4.5	2.5	
Lane Util. Factor	1.00	0.91	0.91	0.97	1.00		0.94	0.91	1.00	0.97	0.86	
Frt	1.00	0.90	0.85	1.00	0.94		1.00	1.00	0.85	1.00	0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1770	1523	2882	3433	1746		4990	5085	1583	3433	6340	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1770	1523	2882	3433	1746		4990	5085	1583	3433	6340	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	17	12	245	116	14	10	277	1061	118	20	801	61
RTOR Reduction (vph)	0	23	198	0	9	0	0	0	26	0	5	0
Lane Group Flow (vph)	17	15	22	116	15	0	277	1061	92	20	857	0
Turn Type	Prot	NA	Perm	Prot	NA		Prot	NA	pm+ov	Prot	NA	
Protected Phases	5	2		1	6		3	8	1	7	4	
Permitted Phases			2						8			
Actuated Green, G (s)	4.8	12.0	12.0	11.5	18.7		13.1	93.1	104.6	7.4	87.4	
Effective Green, g (s)	4.3	14.0	14.0	11.0	20.7		14.1	95.1	108.6	6.9	88.9	
Actuated g/C Ratio	0.03	0.10	0.10	0.08	0.15		0.10	0.68	0.78	0.05	0.64	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	4.0	4.0	2.0	4.0		3.0	4.0	2.0	3.0	4.0	
Lane Grp Cap (vph)	54	152	288	269	258		502	3454	1250	169	4025	
v/s Ratio Prot	0.01	c0.01		c0.03	0.01		c0.06	c0.21	0.01	0.01	c0.14	
v/s Ratio Perm			0.01						0.05			
v/c Ratio	0.31	0.10	0.08	0.43	0.06		0.55	0.31	0.07	0.12	0.21	
Uniform Delay, d1	66.4	57.2	57.1	61.5	51.3		59.9	9.1	3.7	63.6	10.8	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.02	1.08	2.18	0.78	0.15	
Incremental Delay, d2	3.3	0.4	0.2	0.4	0.1		1.2	0.2	0.0	0.3	0.1	
Delay (s)	69.7	57.6	57.3	61.9	51.4		62.2	10.1	8.1	49.7	1.8	
Level of Service	E	E	E	E	D		E	B	A	D	A	
Approach Delay (s)		58.1			60.1			19.8			2.9	
Approach LOS		E			E			B			A	

Intersection Summary		
HCM 2000 Control Delay	20.2	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.32	C
Actuated Cycle Length (s)	140.0	Sum of lost time (s)
Intersection Capacity Utilization	44.3%	13.0
Analysis Period (min)	15	ICU Level of Service
		A

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 11: Hacienda Dr & I-580 WB Ramps

BART to Livermore Extension Project
 2040 Express Bus AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↔↔		↔↔		↑↑↑			↑↑↑	↔
Traffic Volume (vph)	0	0	0	309	0	453	0	1247	298	0	731	416
Future Volume (vph)	0	0	0	309	0	453	0	1247	298	0	731	416
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				2.6		2.6		2.1			2.1	2.1
Lane Util. Factor				0.97		0.88		0.91			0.86	0.86
Frt				1.00		0.85		0.97			0.97	0.85
Flt Protected				0.95		1.00		1.00			1.00	1.00
Satd. Flow (prot)				3433		2787		4938			4646	1362
Flt Permitted				0.95		1.00		1.00			1.00	1.00
Satd. Flow (perm)				3433		2787		4938			4646	1362
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	336	0	492	0	1355	324	0	795	452
RTOR Reduction (vph)	0	0	0	0	0	69	0	46	0	0	54	72
Lane Group Flow (vph)	0	0	0	336	0	423	0	1633	0	0	967	154
Turn Type				Prot		Prot		NA			NA	Perm
Protected Phases				4		4		2			6	
Permitted Phases												6
Actuated Green, G (s)				16.2		16.2		45.8			45.8	45.8
Effective Green, g (s)				17.6		17.6		47.7			47.7	47.7
Actuated g/C Ratio				0.25		0.25		0.68			0.68	0.68
Clearance Time (s)				4.0		4.0		4.0			4.0	4.0
Vehicle Extension (s)				3.0		3.0		3.0			3.0	3.0
Lane Grp Cap (vph)				863		700		3364			3165	928
v/s Ratio Prot				0.10		c0.15		c0.33			0.21	
v/s Ratio Perm												0.11
v/c Ratio				0.39		0.60		0.49			0.31	0.17
Uniform Delay, d1				21.7		23.1		5.3			4.5	4.0
Progression Factor				1.00		1.00		0.67			0.48	0.80
Incremental Delay, d2				0.3		1.5		0.4			0.2	0.4
Delay (s)				22.0		24.6		4.0			2.4	3.6
Level of Service				C		C		A			A	A
Approach Delay (s)		0.0			23.6			4.0			2.6	
Approach LOS		A			C			A			A	

Intersection Summary			
HCM 2000 Control Delay	7.9	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.51		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	4.7
Intersection Capacity Utilization	53.3%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 12: Hacienda Dr & I-580 EB Ramps

BART to Livermore Extension Project
 2040 Express Bus AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	818	0	1170	0	0	0	0	693	270	0	1096	197
Future Volume (vph)	818	0	1170	0	0	0	0	693	270	0	1096	197
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0					4.0	4.0		4.0	
Lane Util. Factor	0.97		0.88					0.86	0.86		0.91	
Frt	1.00		0.85					0.98	0.85		0.98	
Flt Protected	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (prot)	3433		2787					4728	1362		4969	
Flt Permitted	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (perm)	3433		2787					4728	1362		4969	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	889	0	1272	0	0	0	0	753	293	0	1191	214
RTOR Reduction (vph)	0	0	24	0	0	0	0	20	119	0	37	0
Lane Group Flow (vph)	889	0	1248	0	0	0	0	824	83	0	1368	0
Turn Type	Prot		Prot					NA	Perm		NA	
Protected Phases	4		4					2			6	
Permitted Phases									2			
Actuated Green, G (s)	32.0		32.0					26.7	26.7		26.7	
Effective Green, g (s)	33.4		33.4					28.6	28.6		28.6	
Actuated g/C Ratio	0.48		0.48					0.41	0.41		0.41	
Clearance Time (s)	5.4		5.4					5.9	5.9		5.9	
Vehicle Extension (s)	2.0		2.0					2.0	2.0		2.0	
Lane Grp Cap (vph)	1638		1329					1931	556		2030	
v/s Ratio Prot	0.26		c0.45					0.17			c0.28	
v/s Ratio Perm									0.06			
v/c Ratio	0.54		0.94					0.43	0.15		0.67	
Uniform Delay, d1	12.9		17.3					14.8	13.0		16.9	
Progression Factor	1.00		1.00					1.00	1.00		0.87	
Incremental Delay, d2	0.2		12.6					0.7	0.6		1.8	
Delay (s)	13.1		29.9					15.5	13.6		16.6	
Level of Service	B		C					B	B		B	
Approach Delay (s)		23.0			0.0			15.1			16.6	
Approach LOS		C			A			B			B	

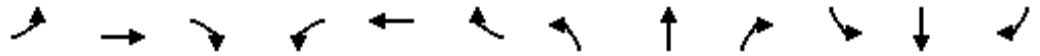
Intersection Summary

HCM 2000 Control Delay	19.3	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.82		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	73.2%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
13: Hacienda Dr & Owens Rd

BART to Livermore Extension Project
2040 Express Bus AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	178	270	26	139	418	458	26	321	126	667	948	625
Future Volume (vph)	178	270	26	139	418	458	26	321	126	667	948	625
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	2.3	4.0	4.0	2.3	4.0	4.0	2.7	4.0	4.0	2.7
Lane Util. Factor	0.97	0.91	1.00	0.97	0.91	1.00	0.97	0.91	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5085	1583	3433	5085	1583	3433	5085	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5085	1583	3433	5085	1583	3433	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	193	293	28	151	454	498	28	349	137	725	1030	679
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	193	293	28	151	454	498	28	349	137	725	1030	679
Turn Type	Prot	NA	Free	Prot	NA	Free	Prot	NA	Free	Prot	NA	Free
Protected Phases	1	6		5	2		7	4		3	8	
Permitted Phases			Free			Free			Free			Free
Actuated Green, G (s)	13.9	19.0	115.0	10.9	16.0	115.0	4.2	31.4	115.0	34.7	61.9	115.0
Effective Green, g (s)	13.9	20.7	115.0	10.9	17.7	115.0	4.2	32.7	115.0	34.7	63.2	115.0
Actuated g/C Ratio	0.12	0.18	1.00	0.09	0.15	1.00	0.04	0.28	1.00	0.30	0.55	1.00
Clearance Time (s)	4.0	5.7		4.0	5.7		4.0	5.3		4.0	5.3	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	414	915	1583	325	782	1583	125	1445	1583	1035	2794	1583
v/s Ratio Prot	0.06	0.06		0.04	c0.09		0.01	0.07		c0.21	0.20	
v/s Ratio Perm			0.02			0.31			0.09			c0.43
v/c Ratio	0.47	0.32	0.02	0.46	0.58	0.31	0.22	0.24	0.09	0.70	0.37	0.43
Uniform Delay, d1	47.1	41.0	0.0	49.3	45.2	0.0	53.8	31.6	0.0	35.5	14.6	0.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.8	0.2	0.0	1.1	1.1	0.5	0.9	0.4	0.1	2.2	0.4	0.9
Delay (s)	47.9	41.2	0.0	50.3	46.3	0.5	54.7	32.0	0.1	37.7	15.0	0.9
Level of Service	D	D	A	D	D	A	D	C	A	D	B	A
Approach Delay (s)		41.5			26.2			24.7			17.8	
Approach LOS		D			C			C			B	

Intersection Summary

HCM 2000 Control Delay	23.3	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.59		
Actuated Cycle Length (s)	115.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	51.7%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 14: Tassajara Rd & Dublin Blvd

BART to Livermore Extension Project
 2040 Express Bus AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	102	203	141	647	1275	67	269	486	171	35	1144	331
Future Volume (vph)	102	203	141	647	1275	67	269	486	171	35	1144	331
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	6.0	6.0	5.0	6.0		5.0	6.0	6.0	5.0	5.7	5.7
Lane Util. Factor	0.97	0.86	0.88	0.94	0.91		0.94	0.86	1.00	0.97	0.86	0.88
Frt	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	6408	2787	4990	5047		4990	6408	1583	3433	6408	2787
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	6408	2787	4990	5047		4990	6408	1583	3433	6408	2787
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	111	221	153	703	1386	73	292	528	186	38	1243	360
RTOR Reduction (vph)	0	0	112	0	4	0	0	0	139	0	0	257
Lane Group Flow (vph)	111	221	41	703	1455	0	292	528	47	38	1243	103
Turn Type	Prot	NA	Perm	Prot	NA		Prot	NA	Perm	Prot	NA	Perm
Protected Phases	5	2		1	6		3	8		7	NA	4
Permitted Phases			2						8			4
Actuated Green, G (s)	16.1	39.5	39.5	24.8	48.2		18.2	37.0	37.0	22.7	41.8	41.8
Effective Green, g (s)	16.1	39.5	39.5	24.8	48.2		18.2	37.0	37.0	22.7	41.8	41.8
Actuated g/C Ratio	0.11	0.27	0.27	0.17	0.33		0.12	0.25	0.25	0.16	0.29	0.29
Clearance Time (s)	5.0	6.0	6.0	5.0	6.0		5.0	6.0	6.0	5.0	5.7	5.7
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	378	1733	754	847	1666		622	1623	401	533	1834	797
v/s Ratio Prot	0.03	0.03		c0.14	c0.29		c0.06	0.08		c0.01	c0.19	
v/s Ratio Perm			0.01						0.03			0.04
v/c Ratio	0.29	0.13	0.05	0.83	0.87		0.47	0.33	0.12	0.07	0.68	0.13
Uniform Delay, d1	59.7	40.2	39.4	58.6	46.0		59.4	44.3	41.9	52.6	46.1	38.6
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.4	0.0	0.0	6.8	5.4		0.6	0.1	0.1	0.1	1.0	0.1
Delay (s)	60.2	40.3	39.5	65.3	51.4		60.0	44.5	42.1	52.7	47.1	38.7
Level of Service	E	D	D	E	D		E	D	D	D	D	D
Approach Delay (s)		44.6			55.9			48.5			45.4	
Approach LOS		D			E			D			D	

Intersection Summary		
HCM 2000 Control Delay	50.2	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.76	D
Actuated Cycle Length (s)	146.0	Sum of lost time (s)
Intersection Capacity Utilization	87.5%	22.0
Analysis Period (min)	15	ICU Level of Service
		E

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 15: Tassajara Rd & I-580 WB Ramps

BART to Livermore Extension Project
 2040 Express Bus AM
























Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↔↔		↔↔		↑↑	↔		↑↑↔	↔
Traffic Volume (vph)	0	0	0	590	0	296	0	1190	472	0	1032	935
Future Volume (vph)	0	0	0	590	0	296	0	1190	472	0	1032	935
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0		4.0		4.0	4.0		4.0	4.0
Lane Util. Factor				0.97		0.88		0.95	1.00		0.86	0.86
Frt				1.00		0.85		1.00	0.85		0.95	0.85
Flt Protected				0.95		1.00		1.00	1.00		1.00	1.00
Satd. Flow (prot)				3433		2787		3539	1583		4581	1362
Flt Permitted				0.95		1.00		1.00	1.00		1.00	1.00
Satd. Flow (perm)				3433		2787		3539	1583		4581	1362
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	641	0	322	0	1293	513	0	1122	1016
RTOR Reduction (vph)	0	0	0	0	0	68	0	0	195	0	103	193
Lane Group Flow (vph)	0	0	0	641	0	254	0	1293	318	0	1527	315
Turn Type				Perm		Perm		NA	Perm		NA	Perm
Protected Phases								2			6	
Permitted Phases				8		8			2			6
Actuated Green, G (s)				18.6		18.6		43.4	43.4		43.4	43.4
Effective Green, g (s)				18.6		18.6		43.4	43.4		43.4	43.4
Actuated g/C Ratio				0.27		0.27		0.62	0.62		0.62	0.62
Clearance Time (s)				4.0		4.0		4.0	4.0		4.0	4.0
Vehicle Extension (s)				3.0		3.0		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)				912		740		2194	981		2840	844
v/s Ratio Prot								c0.37			0.33	
v/s Ratio Perm				c0.19		0.09			0.20			0.23
v/c Ratio				0.70		0.34		0.59	0.32		0.54	0.37
Uniform Delay, d1				23.2		20.8		8.0	6.3		7.6	6.6
Progression Factor				1.00		1.00		1.00	1.00		1.00	1.00
Incremental Delay, d2				2.5		0.3		1.2	0.9		0.7	1.3
Delay (s)				25.7		21.0		9.1	7.2		8.3	7.8
Level of Service				C		C		A	A		A	A
Approach Delay (s)		0.0			24.1			8.6			8.2	
Approach LOS		A			C			A			A	

Intersection Summary		
HCM 2000 Control Delay	11.5	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.62	B
Actuated Cycle Length (s)	70.0	Sum of lost time (s)
Intersection Capacity Utilization	56.4%	8.0
Analysis Period (min)	15	ICU Level of Service
		B

c Critical Lane Group































HCM Signalized Intersection Capacity Analysis
16: Santa Rita Rd & I-580 EB Ramps/Pimilco Dr

BART to Livermore Extension Project
2040 Express Bus AM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	567	116	742	186	0	188	0	880	117	182	1343	0
Future Volume (vph)	567	116	742	186	0	188	0	880	117	182	1343	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0		4.0		4.0		4.0	4.0	
Lane Util. Factor	0.97	1.00	1.00	0.97		0.88		0.86		1.00	0.95	
Frt	1.00	1.00	0.85	1.00		0.85		0.98		1.00	1.00	
Flt Protected	0.95	1.00	1.00	0.95		1.00		1.00		0.95	1.00	
Satd. Flow (prot)	3433	1863	1583	3433		2787		6295		1770	3539	
Flt Permitted	0.95	1.00	1.00	0.95		1.00		1.00		0.95	1.00	
Satd. Flow (perm)	3433	1863	1583	3433		2787		6295		1770	3539	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	616	126	807	202	0	204	0	957	127	198	1460	0
RTOR Reduction (vph)	0	0	0	0	0	71	0	40	0	0	0	0
Lane Group Flow (vph)	616	126	807	202	0	133	0	1044	0	198	1460	0
Turn Type	Perm	NA	Free	Prot		pm+ov		NA		Prot	NA	Perm
Protected Phases		4		3		1		2		1	6	
Permitted Phases	4		Free			3						6
Actuated Green, G (s)	14.9	14.9	60.0	4.6		13.0		16.1		8.4	28.5	
Effective Green, g (s)	14.9	14.9	60.0	4.6		13.0		16.1		8.4	28.5	
Actuated g/C Ratio	0.25	0.25	1.00	0.08		0.22		0.27		0.14	0.48	
Clearance Time (s)	4.0	4.0		4.0		4.0		4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0		3.0		3.0		3.0	3.0	
Lane Grp Cap (vph)	852	462	1583	263		603		1689		247	1681	
v/s Ratio Prot		0.07		0.06		0.03		0.17		0.11	c0.41	
v/s Ratio Perm	c0.18		c0.51			0.02						
v/c Ratio	0.72	0.27	0.51	0.77		0.22		0.62		0.80	0.87	
Uniform Delay, d1	20.7	18.2	0.0	27.2		19.3		19.3		25.0	14.1	
Progression Factor	1.00	1.00	1.00	1.00		1.00		1.00		1.00	1.00	
Incremental Delay, d2	3.1	0.3	1.2	12.6		0.2		1.7		16.8	6.4	
Delay (s)	23.7	18.5	1.2	39.8		19.5		21.0		41.8	20.5	
Level of Service	C	B	A	D		B		C		D	C	
Approach Delay (s)		11.5			29.6			21.0			23.0	
Approach LOS		B			C			C			C	
Intersection Summary												
HCM 2000 Control Delay			19.3			HCM 2000 Level of Service				B		
HCM 2000 Volume to Capacity ratio			0.91									
Actuated Cycle Length (s)			60.0			Sum of lost time (s)				16.0		
Intersection Capacity Utilization			60.0%			ICU Level of Service				B		
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis
 17: Santa Rita Rd & Valley Ave

BART to Livermore Extension Project
 2040 Express Bus AM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 	 			 		 	 		 	 	
Traffic Volume (vph)	214	250	82	194	425	983	114	541	80	598	893	179
Future Volume (vph)	214	250	82	194	425	983	114	541	80	598	893	179
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.97	0.95		0.97	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.98		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	3433	3471		3433	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	3433	3471		3433	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	233	272	89	211	462	1068	124	588	87	650	971	195
RTOR Reduction (vph)	0	0	73	0	0	0	0	16	0	0	0	114
Lane Group Flow (vph)	233	272	16	211	462	1068	124	659	0	650	971	81
Turn Type	Prot	NA	Perm	Prot	NA	Free	Prot	NA		Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1		6
Permitted Phases			4			Free						6
Actuated Green, G (s)	8.6	12.8	12.8	10.1	14.3	71.7	3.1	17.7		15.1	29.7	29.7
Effective Green, g (s)	8.6	12.8	12.8	10.1	14.3	71.7	3.1	17.7		15.1	29.7	29.7
Actuated g/C Ratio	0.12	0.18	0.18	0.14	0.20	1.00	0.04	0.25		0.21	0.41	0.41
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	411	631	282	249	705	1583	148	856		722	1465	655
v/s Ratio Prot	0.07	0.08		c0.12	0.13		0.04	0.19		c0.19	0.27	
v/s Ratio Perm			0.01			c0.67						0.05
v/c Ratio	0.57	0.43	0.06	0.85	0.66	0.67	0.84	0.77		0.90	0.66	0.12
Uniform Delay, d1	29.8	26.2	24.4	30.0	26.4	0.0	34.1	25.1		27.6	17.0	13.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	1.8	0.5	0.1	22.5	2.2	2.3	31.8	4.3		14.3	1.1	0.1
Delay (s)	31.6	26.7	24.5	52.5	28.6	2.3	65.9	29.4		41.9	18.1	13.0
Level of Service	C	C	C	D	C	A	E	C		D	B	B
Approach Delay (s)		28.3			15.4			35.1			26.1	
Approach LOS		C			B			D			C	
Intersection Summary												
HCM 2000 Control Delay			24.0			HCM 2000 Level of Service				C		
HCM 2000 Volume to Capacity ratio			0.89									
Actuated Cycle Length (s)			71.7			Sum of lost time (s)			16.0			
Intersection Capacity Utilization			65.8%			ICU Level of Service				C		
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis
 18: Bernal Ave/Valley Ave & Stanley Blvd

BART to Livermore Extension Project
 2040 Express Bus AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↕	↗	↖↗	↕	↗	↖	↕	↗	↖↗	↕	↖↗
Traffic Volume (vph)	217	204	55	248	896	955	174	480	102	141	362	123
Future Volume (vph)	217	204	55	248	896	955	174	480	102	141	362	123
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.95	1.00	0.97	0.91	0.91	1.00	0.95	1.00	0.97	0.95	0.95
Frt	1.00	1.00	0.85	1.00	0.96	0.85	1.00	1.00	0.85	1.00	0.96	0.96
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	3433	3238	1441	1770	3539	1583	3433	3404	3404
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	3433	3238	1441	1770	3539	1583	3433	3404	3404
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	236	222	60	270	974	1038	189	522	111	153	393	134
RTOR Reduction (vph)	0	0	30	0	47	28	0	0	88	0	38	0
Lane Group Flow (vph)	236	222	30	270	1342	595	189	522	23	153	489	0
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	NA
Protected Phases	7	4	5	3	8	1	5	2		1	6	
Permitted Phases			4			8			2			
Actuated Green, G (s)	7.0	33.0	44.6	11.0	37.0	46.9	11.6	18.0	18.0	9.9	16.3	
Effective Green, g (s)	7.0	33.0	44.6	11.0	37.0	46.9	11.6	18.0	18.0	9.9	16.3	
Actuated g/C Ratio	0.08	0.38	0.51	0.13	0.42	0.53	0.13	0.20	0.20	0.11	0.19	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	273	1328	875	429	1362	834	233	724	324	386	631	
v/s Ratio Prot	c0.07	0.06	0.00	0.08	c0.41	0.08	c0.11	c0.15		0.04	0.14	
v/s Ratio Perm			0.01			0.33			0.01			
v/c Ratio	0.86	0.17	0.03	0.63	0.99	0.71	0.81	0.72	0.07	0.40	0.77	
Uniform Delay, d1	40.0	18.3	10.9	36.5	25.2	15.4	37.1	32.6	28.2	36.2	34.1	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	23.5	0.1	0.0	2.9	20.8	2.9	18.9	3.5	0.1	0.7	5.9	
Delay (s)	63.5	18.4	10.9	39.4	45.9	18.3	56.0	36.2	28.3	36.9	40.0	
Level of Service	E	B	B	D	D	B	E	D	C	D	D	
Approach Delay (s)		38.1			37.6			39.7			39.3	
Approach LOS		D			D			D			D	

Intersection Summary		
HCM 2000 Control Delay	38.3	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.90	D
Actuated Cycle Length (s)	87.9	Sum of lost time (s)
Intersection Capacity Utilization	78.0%	16.0
Analysis Period (min)	15	ICU Level of Service
		D

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
19: Fallon Rd & Dublin Blvd/Croak Rd

BART to Livermore Extension Project
2040 Express Bus AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↑↑↑	↖↗	↖↗↘	↑↑↑	↖	↖↗↘	↑↑↑	↖↗	↖↗	↑↑↑	↖
Traffic Volume (vph)	49	78	93	352	1267	416	829	280	43	79	716	321
Future Volume (vph)	49	78	93	352	1267	416	829	280	43	79	716	321
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.91	0.88	0.94	0.91	1.00	0.94	0.91	0.88	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5085	2787	4990	5085	1583	4990	5085	2787	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5085	2787	4990	5085	1583	4990	5085	2787	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	53	85	101	383	1377	452	901	304	47	86	778	349
RTOR Reduction (vph)	0	0	42	0	0	229	0	0	32	0	0	133
Lane Group Flow (vph)	53	85	59	383	1377	223	901	304	15	86	778	216
Turn Type	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4	5	3	8		5	2		1	6	
Permitted Phases			4			8			2			6
Actuated Green, G (s)	2.4	9.6	28.7	30.8	38.0	38.0	19.1	29.2	29.2	4.4	14.5	14.5
Effective Green, g (s)	2.4	9.6	28.7	30.8	38.0	38.0	19.1	29.2	29.2	4.4	14.5	14.5
Actuated g/C Ratio	0.03	0.11	0.32	0.34	0.42	0.42	0.21	0.32	0.32	0.05	0.16	0.16
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	91	542	888	1707	2147	668	1058	1649	904	167	819	255
v/s Ratio Prot	c0.02	0.02	0.01	0.08	c0.27		c0.18	0.06		0.03	c0.15	
v/s Ratio Perm			0.01			0.14			0.01			0.14
v/c Ratio	0.58	0.16	0.07	0.22	0.64	0.33	0.85	0.18	0.02	0.51	0.95	0.85
Uniform Delay, d1	43.3	36.5	21.3	21.1	20.6	17.5	34.1	21.8	20.6	41.8	37.4	36.7
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	9.2	0.1	0.0	0.1	0.7	0.3	6.7	0.2	0.0	2.7	21.4	28.1
Delay (s)	52.5	36.7	21.4	21.2	21.3	17.8	40.8	22.1	20.7	44.4	58.8	64.7
Level of Service	D	D	C	C	C	B	D	C	C	D	E	E
Approach Delay (s)		33.7			20.5			35.5			59.5	
Approach LOS		C			C			D			E	

Intersection Summary

HCM 2000 Control Delay	34.6	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.75		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	70.1%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 20: El Charro Rd/Fallon Rd & I-580 WB Ramps

BART to Livermore Extension Project
 2040 Express Bus AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↙	↖	↗		↑↑↑	↗		↑↑↑	↗
Traffic Volume (vph)	0	0	0	176	0	613	0	882	478	0	649	399
Future Volume (vph)	0	0	0	176	0	613	0	882	478	0	649	399
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0	4.0	4.0		4.0	4.0		4.0	4.0
Lane Util. Factor				0.95	0.95	0.88		0.91	1.00		0.91	1.00
Frt				1.00	1.00	0.85		1.00	0.85		1.00	0.85
Flt Protected				0.95	0.95	1.00		1.00	1.00		1.00	1.00
Satd. Flow (prot)				1681	1681	2787		5085	1583		5085	1583
Flt Permitted				0.95	0.95	1.00		1.00	1.00		1.00	1.00
Satd. Flow (perm)				1681	1681	2787		5085	1583		5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	191	0	666	0	959	520	0	705	434
RTOR Reduction (vph)	0	0	0	0	0	111	0	0	195	0	0	163
Lane Group Flow (vph)	0	0	0	97	94	555	0	959	325	0	705	271
Turn Type				Perm	NA	Perm		NA	Perm		NA	Perm
Protected Phases					8			2			6	
Permitted Phases				8		8			2			6
Actuated Green, G (s)				18.8	18.8	18.8		43.7	43.7		43.7	43.7
Effective Green, g (s)				18.3	18.3	18.3		43.7	43.7		43.7	43.7
Actuated g/C Ratio				0.26	0.26	0.26		0.62	0.62		0.62	0.62
Clearance Time (s)				3.5	3.5	3.5		4.0	4.0		4.0	4.0
Vehicle Extension (s)				2.0	2.0	2.0		2.0	2.0		2.0	2.0
Lane Grp Cap (vph)				439	439	728		3174	988		3174	988
v/s Ratio Prot								0.19			0.14	
v/s Ratio Perm				0.06	0.06	c0.20			c0.21			0.17
v/c Ratio				0.22	0.21	0.76		0.30	0.33		0.22	0.27
Uniform Delay, d1				20.3	20.2	23.8		6.1	6.2		5.7	6.0
Progression Factor				1.00	1.00	1.00		0.83	0.96		1.00	1.00
Incremental Delay, d2				0.1	0.1	4.3		0.2	0.7		0.2	0.7
Delay (s)				20.4	20.3	28.1		5.3	6.7		5.9	6.6
Level of Service				C	C	C		A	A		A	A
Approach Delay (s)		0.0			26.4			5.8			6.2	
Approach LOS		A			C			A			A	

Intersection Summary			
HCM 2000 Control Delay	11.0	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.46		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	45.2%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
21: El Charro Rd & I-580 EB Ramps

BART to Livermore Extension Project
2040 Express Bus AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔↔		↔↔					↕↕	↔		↕↕	↔
Traffic Volume (vph)	278	0	617	0	0	0	0	1363	426	0	474	0
Future Volume (vph)	278	0	617	0	0	0	0	1363	426	0	474	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0					4.0	4.0		4.0	
Lane Util. Factor	0.97		0.88					0.91	0.91		0.91	
Frt	1.00		0.85					0.99	0.85		1.00	
Flt Protected	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (prot)	3433		2787					3372	1441		3390	
Flt Permitted	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (perm)	3433		2787					3372	1441		3390	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	302	0	671	0	0	0	0	1482	463	0	515	0
RTOR Reduction (vph)	0	0	570	0	0	0	0	3	108	0	0	0
Lane Group Flow (vph)	302	0	101	0	0	0	0	1535	299	0	515	0
Turn Type	Prot		Perm					NA	Perm		NA	Perm
Protected Phases	4							2			6	
Permitted Phases			4						2			6
Actuated Green, G (s)	10.5		10.5					51.5	51.5		51.5	
Effective Green, g (s)	10.5		10.5					51.5	51.5		51.5	
Actuated g/C Ratio	0.15		0.15					0.74	0.74		0.74	
Clearance Time (s)	4.0		4.0					4.0	4.0		4.0	
Vehicle Extension (s)	2.0		2.0					3.0	3.0		3.0	
Lane Grp Cap (vph)	514		418					2480	1060		2494	
v/s Ratio Prot	c0.09							c0.46			0.15	
v/s Ratio Perm			0.04						0.21			
v/c Ratio	0.59		0.24					0.62	0.28		0.21	
Uniform Delay, d1	27.7		26.2					4.5	3.1		2.9	
Progression Factor	1.00		1.00					1.00	1.00		1.10	
Incremental Delay, d2	1.1		0.1					1.2	0.7		0.2	
Delay (s)	28.8		26.3					5.7	3.8		3.3	
Level of Service	C		C					A	A		A	
Approach Delay (s)		27.1			0.0			5.3			3.3	
Approach LOS		C			A			A			A	

Intersection Summary

HCM 2000 Control Delay	11.2	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.61		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	56.8%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 22: El Charro Rd & Stoneridge Dr/Jack London Blvd

BART to Livermore Extension Project
 2040 Express Bus AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔↔↔	↑↑	↗	↖	↑↑	↗↗	↖	↑↑		↖↖↖	↑	↗↗
Traffic Volume (vph)	95	129	15	64	639	818	31	539	27	322	208	110
Future Volume (vph)	95	129	15	64	639	818	31	539	27	322	208	110
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	0.94	0.95	1.00	1.00	0.95	0.88	1.00	0.95		0.94	1.00	0.88
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	4491	3185	1425	1593	3185	2508	1593	3163		4491	1676	2508
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	4491	3185	1425	1593	3185	2508	1593	3163		4491	1676	2508
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	103	140	16	70	695	889	34	586	29	350	226	120
RTOR Reduction (vph)	0	0	12	0	0	100	0	6	0	0	0	74
Lane Group Flow (vph)	103	140	4	70	695	789	34	609	0	350	226	46
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Prot	NA		Prot	NA	Perm
Protected Phases	7	4		3	8	1	5	2		1	6	
Permitted Phases			4			8						6
Actuated Green, G (s)	3.0	15.1	15.1	3.0	15.1	23.3	2.5	17.2		8.2	22.9	22.9
Effective Green, g (s)	3.0	15.1	15.1	3.0	15.1	23.3	2.5	17.2		8.2	22.9	22.9
Actuated g/C Ratio	0.05	0.25	0.25	0.05	0.25	0.39	0.04	0.29		0.14	0.38	0.38
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	226	808	361	80	808	982	66	914		618	645	965
v/s Ratio Prot	c0.02	0.04		0.04	c0.22	c0.11	0.02	c0.19		0.08	0.13	
v/s Ratio Perm			0.00			0.20						0.02
v/c Ratio	0.46	0.17	0.01	0.88	0.86	0.80	0.52	0.67		0.57	0.35	0.05
Uniform Delay, d1	27.5	17.3	16.6	28.1	21.2	16.1	27.9	18.6		24.0	13.0	11.5
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	1.5	0.1	0.0	60.2	9.3	4.8	6.6	1.9		1.2	0.3	0.0
Delay (s)	28.9	17.4	16.6	88.3	30.5	20.9	34.5	20.5		25.2	13.3	11.5
Level of Service	C	B	B	F	C	C	C	C		C	B	B
Approach Delay (s)		21.9			27.8			21.2			19.0	
Approach LOS		C			C			C			B	

Intersection Summary		
HCM 2000 Control Delay	24.1	HCM 2000 Level of Service C
HCM 2000 Volume to Capacity ratio	0.74	
Actuated Cycle Length (s)	59.5	Sum of lost time (s) 16.0
Intersection Capacity Utilization	62.6%	ICU Level of Service B
Analysis Period (min)	15	

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 23: Stanley Blvd & El Charro Rd

BART to Livermore Extension Project
 2040 Express Bus AM



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	↖	↑↑	↑↑↑	↑	↙↘	↙↘
Traffic Volume (vph)	394	457	2745	110	25	113
Future Volume (vph)	394	457	2745	110	25	113
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95	0.91	1.00	0.97	0.88
Frt	1.00	1.00	1.00	0.85	1.00	0.85
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1770	3539	5085	1583	3433	2787
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1770	3539	5085	1583	3433	2787
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	428	497	2984	120	27	123
RTOR Reduction (vph)	0	0	0	27	0	116
Lane Group Flow (vph)	428	497	2984	93	27	7
Turn Type	Prot	NA	NA	Perm	Prot	Perm
Protected Phases	7	4	8		6	
Permitted Phases				8		6
Actuated Green, G (s)	27.0	96.0	65.0	65.0	6.6	6.6
Effective Green, g (s)	27.0	96.0	65.0	65.0	6.6	6.6
Actuated g/C Ratio	0.24	0.87	0.59	0.59	0.06	0.06
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	432	3071	2988	930	204	166
v/s Ratio Prot	c0.24	0.14	c0.59		c0.01	
v/s Ratio Perm				0.06		0.00
v/c Ratio	0.99	0.16	1.00	0.10	0.13	0.04
Uniform Delay, d1	41.7	1.1	22.8	10.0	49.3	49.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	40.7	0.0	16.0	0.0	0.3	0.1
Delay (s)	82.4	1.1	38.8	10.0	49.6	49.1
Level of Service	F	A	D	B	D	D
Approach Delay (s)		38.7	37.7		49.2	
Approach LOS		D	D		D	

Intersection Summary			
HCM 2000 Control Delay	38.3	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.94		
Actuated Cycle Length (s)	110.6	Sum of lost time (s)	12.0
Intersection Capacity Utilization	88.2%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
24: Airway Blvd/Driveway & N Canyons Pkwy

BART to Livermore Extension Project
2040 Express Bus AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑	↑	↑↑	↑	↑		↑	↑↑		↑	
Traffic Volume (vph)	0	91	49	719	1013	0	944	0	958	0	0	0
Future Volume (vph)	0	91	49	719	1013	0	944	0	958	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		2.0	2.0	2.0	2.0			4.2	2.0			
Lane Util. Factor		0.95	1.00	0.97	1.00			1.00	0.88			
Frt		1.00	0.85	1.00	1.00			1.00	0.85			
Flt Protected		1.00	1.00	0.95	1.00			0.95	1.00			
Satd. Flow (prot)		3539	1583	3433	1863			1770	2787			
Flt Permitted		1.00	1.00	0.95	1.00			0.95	1.00			
Satd. Flow (perm)		3539	1583	3433	1863			1770	2787			
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	99	53	782	1101	0	1026	0	1041	0	0	0
RTOR Reduction (vph)	0	0	47	0	0	0	0	0	88	0	0	0
Lane Group Flow (vph)	0	99	6	782	1101	0	0	1026	953	0	0	0
Turn Type		NA	Perm	Prot	NA	Perm	Split	NA	pm+ov			
Protected Phases		2		1	6		8	8	1	4	4	
Permitted Phases			2			6			8			
Actuated Green, G (s)		10.0	10.0	41.0	55.0			39.0	80.0			
Effective Green, g (s)		12.0	12.0	43.0	57.0			38.8	84.0			
Actuated g/C Ratio		0.12	0.12	0.42	0.56			0.38	0.82			
Clearance Time (s)		4.0	4.0	4.0	4.0			4.0	4.0			
Vehicle Extension (s)		3.0	3.0	3.0	3.0			3.0	3.0			
Lane Grp Cap (vph)		416	186	1447	1041			673	2349			
v/s Ratio Prot		0.03		0.23	c0.59			c0.58	0.17			
v/s Ratio Perm			0.00						0.17			
v/c Ratio		0.24	0.03	0.54	1.06			1.52	0.41			
Uniform Delay, d1		40.8	39.9	22.1	22.5			31.6	2.4			
Progression Factor		1.00	1.00	1.00	1.00			1.00	1.00			
Incremental Delay, d2		0.3	0.1	0.4	44.5			243.6	0.1			
Delay (s)		41.1	39.9	22.5	67.0			275.2	2.5			
Level of Service		D	D	C	E			F	A			
Approach Delay (s)		40.7			48.5			137.8			0.0	
Approach LOS		D			D			F			A	

Intersection Summary

HCM 2000 Control Delay	93.2	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.32		
Actuated Cycle Length (s)	102.0	Sum of lost time (s)	12.2
Intersection Capacity Utilization	112.4%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
25: Airway Blvd & I-580 WB Ramps

BART to Livermore Extension Project
2040 Express Bus AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↙	↖	↗		↕	↘		↕	↘
Traffic Volume (vph)	0	0	0	67	43	802	0	1210	343	0	294	553
Future Volume (vph)	0	0	0	67	43	802	0	1210	343	0	294	553
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0	4.0	4.0		4.0	4.0		4.0	
Lane Util. Factor				0.95	0.95	0.88		0.95	1.00		0.91	
Frt				1.00	1.00	0.85		1.00	0.85		0.90	
Flt Protected				0.95	0.98	1.00		1.00	1.00		1.00	
Satd. Flow (prot)				1681	1733	2787		3539	1583		4588	
Flt Permitted				0.95	0.98	1.00		1.00	1.00		1.00	
Satd. Flow (perm)				1681	1733	2787		3539	1583		4588	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	73	47	872	0	1315	373	0	320	601
RTOR Reduction (vph)	0	0	0	0	0	36	0	0	184	0	297	0
Lane Group Flow (vph)	0	0	0	39	81	836	0	1315	189	0	624	0
Turn Type				Split	NA	Perm		NA	Perm		NA	
Protected Phases				8	8			2			6	
Permitted Phases						8			2			
Actuated Green, G (s)				19.8	19.8	19.8		27.2	27.2		27.2	
Effective Green, g (s)				19.8	19.8	19.8		28.5	28.5		28.5	
Actuated g/C Ratio				0.35	0.35	0.35		0.51	0.51		0.51	
Clearance Time (s)				4.0	4.0	4.0		5.3	5.3		5.3	
Vehicle Extension (s)				2.0	2.0	2.0		4.0	4.0		4.0	
Lane Grp Cap (vph)				591	609	980		1791	801		2322	
v/s Ratio Prot				0.02	0.05			c0.37			0.14	
v/s Ratio Perm						c0.30			0.12			
v/c Ratio				0.07	0.13	0.85		0.73	0.24		0.27	
Uniform Delay, d1				12.1	12.4	16.9		10.9	7.8		7.9	
Progression Factor				1.00	1.00	1.00		1.00	1.00		1.00	
Incremental Delay, d2				0.0	0.0	7.1		1.7	0.2		0.1	
Delay (s)				12.1	12.4	24.0		12.6	8.0		8.0	
Level of Service				B	B	C		B	A		A	
Approach Delay (s)		0.0			22.6			11.6			8.0	
Approach LOS		A			C			B			A	

Intersection Summary

HCM 2000 Control Delay	13.7	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.78		
Actuated Cycle Length (s)	56.3	Sum of lost time (s)	8.0
Intersection Capacity Utilization	68.2%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 26: Airway Blvd & I-580 EB Ramps/Kitty Hawk Rd

BART to Livermore Extension Project
 2040 Express Bus AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔↔	↑	↔	↔	↑	↔	↔	↕↔		↔	↕↔	
Traffic Volume (vph)	648	197	246	29	38	90	33	514	164	71	147	162
Future Volume (vph)	648	197	246	29	38	90	33	514	164	71	147	162
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.4	4.4	4.4	4.5	2.7		4.0	2.7	
Lane Util. Factor	0.97	1.00	1.00	1.00	1.00	1.00	1.00	0.95		1.00	0.95	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.96		1.00	0.92	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	3433	1863	1583	1770	1863	1583	1770	3411		1770	3261	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	3433	1863	1583	1770	1863	1583	1770	3411		1770	3261	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	704	214	267	32	41	98	36	559	178	77	160	176
RTOR Reduction (vph)	0	0	199	0	0	82	0	40	0	0	118	0
Lane Group Flow (vph)	704	214	68	32	41	16	36	697	0	77	218	0
Turn Type	Split	NA	Perm	Split	NA	pm+ov	Prot	NA		Prot	NA	
Protected Phases	7	7		8	8	1	5	2		1	6	
Permitted Phases			7			8						
Actuated Green, G (s)	17.0	17.0	17.0	7.1	7.1	11.3	5.5	22.0		4.2	20.7	
Effective Green, g (s)	17.0	17.0	17.0	6.7	6.7	10.5	5.0	23.3		4.2	22.0	
Actuated g/C Ratio	0.26	0.26	0.26	0.10	0.10	0.16	0.08	0.35		0.06	0.33	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Vehicle Extension (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	3.5		2.0	4.0	
Lane Grp Cap (vph)	880	477	405	178	188	355	133	1198		112	1082	
v/s Ratio Prot	c0.21	0.11		0.02	c0.02	0.00	0.02	c0.20		c0.04	0.07	
v/s Ratio Perm			0.04			0.01						
v/c Ratio	0.80	0.45	0.17	0.18	0.22	0.04	0.27	0.58		0.69	0.20	
Uniform Delay, d1	23.1	20.7	19.2	27.3	27.4	23.6	28.9	17.5		30.4	15.9	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	5.0	0.2	0.1	0.2	0.2	0.0	0.4	0.8		13.1	0.1	
Delay (s)	28.0	21.0	19.2	27.5	27.6	23.7	29.3	18.3		43.5	16.0	
Level of Service	C	C	B	C	C	C	C	B		D	B	
Approach Delay (s)		24.8			25.3			18.8			21.1	
Approach LOS		C			C			B			C	

Intersection Summary		
HCM 2000 Control Delay	22.4	HCM 2000 Level of Service C
HCM 2000 Volume to Capacity ratio	0.62	
Actuated Cycle Length (s)	66.3	Sum of lost time (s) 15.6
Intersection Capacity Utilization	58.5%	ICU Level of Service B
Analysis Period (min)	15	

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 27: Collier Canyon Rd & N Canyons Pkwy/Portola Ave

BART to Livermore Extension Project
 2040 Express Bus AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	262	188	98	151	883	57	77	8	102	57	14	204
Future Volume (vph)	262	188	98	151	883	57	77	8	102	57	14	204
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	2.7	2.7	4.0	2.7	2.7	4.0	3.0		4.0	4.6	4.6
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.86		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	1770	1604		1770	1863	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	1770	1604		1770	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	285	204	107	164	960	62	84	9	111	62	15	222
RTOR Reduction (vph)	0	0	69	0	0	37	0	86	0	0	0	180
Lane Group Flow (vph)	285	204	38	164	960	25	84	34	0	62	15	42
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA		Prot	NA	Perm
Protected Phases	1	6		5	2		3	8		7		4
Permitted Phases			6			2						4
Actuated Green, G (s)	7.0	21.9	21.9	10.2	25.1	25.1	4.0	13.9		3.1	13.0	13.0
Effective Green, g (s)	7.0	23.2	23.2	10.2	26.4	26.4	4.0	14.9		3.1	12.4	12.4
Actuated g/C Ratio	0.11	0.36	0.36	0.16	0.41	0.41	0.06	0.23		0.05	0.19	0.19
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	369	1261	564	277	1435	641	108	367		84	354	301
v/s Ratio Prot	c0.08	0.06		0.09	c0.27		c0.05	0.02		0.04	0.01	
v/s Ratio Perm			0.02			0.02						c0.03
v/c Ratio	0.77	0.16	0.07	0.59	0.67	0.04	0.78	0.09		0.74	0.04	0.14
Uniform Delay, d1	28.3	14.3	13.8	25.5	15.8	11.7	30.1	19.8		30.6	21.5	21.9
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	9.7	0.1	0.1	3.4	1.2	0.0	28.9	0.1		28.3	0.0	0.2
Delay (s)	37.9	14.4	13.9	28.9	17.0	11.7	59.0	19.9		58.9	21.6	22.1
Level of Service	D	B	B	C	B	B	E	B		E	C	C
Approach Delay (s)		25.5			18.4			36.0			29.7	
Approach LOS		C			B			D			C	

Intersection Summary

HCM 2000 Control Delay	23.3	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.56		
Actuated Cycle Length (s)	65.1	Sum of lost time (s)	15.3
Intersection Capacity Utilization	52.8%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
28: Isabel Ave/Campus Hill Dr & Portola Ave

BART to Livermore Extension Project
2040 Express Bus AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↘	↑↑	↗↗	↘↘↘	↑↑		↘↘	↑↑	↗	↘	↑↑	↗
Traffic Volume (vph)	1	195	227	532	594	142	496	299	84	65	200	2
Future Volume (vph)	1	195	227	532	594	142	496	299	84	65	200	2
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	5.8	5.8
Lane Util. Factor	1.00	0.95	0.88	0.94	0.95		0.97	0.95	1.00	1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	0.97		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3539	2787	4990	3437		3433	3539	1583	1770	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	3539	2787	4990	3437		3433	3539	1583	1770	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	1	212	247	578	646	154	539	325	91	71	217	2
RTOR Reduction (vph)	0	0	191	0	14	0	0	0	63	0	0	2
Lane Group Flow (vph)	1	212	56	578	786	0	539	325	28	71	217	0
Turn Type	Prot	NA	Perm	Prot	NA		Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4						2			6
Actuated Green, G (s)	1.5	18.1	18.1	16.1	32.7		20.3	25.6	25.6	7.7	13.4	13.4
Effective Green, g (s)	1.5	19.4	19.4	16.1	34.0		20.3	26.9	26.9	7.7	12.5	12.5
Actuated g/C Ratio	0.02	0.23	0.23	0.19	0.39		0.24	0.31	0.31	0.09	0.15	0.15
Clearance Time (s)	4.0	5.3	5.3	4.0	5.3		4.0	5.3	5.3	4.0	4.9	4.9
Vehicle Extension (s)	2.0	3.0	3.0	2.0	3.0		2.0	3.0	3.0	2.0	3.0	3.0
Lane Grp Cap (vph)	30	797	627	933	1357		809	1105	494	158	513	229
v/s Ratio Prot	0.00	0.06		c0.12	c0.23		c0.16	0.09		0.04	c0.06	
v/s Ratio Perm			0.02						0.02			0.00
v/c Ratio	0.03	0.27	0.09	0.62	0.58		0.67	0.29	0.06	0.45	0.42	0.00
Uniform Delay, d1	41.6	27.5	26.4	32.2	20.4		29.8	22.4	20.7	37.2	33.5	31.5
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.2	0.2	0.1	0.9	0.6		1.6	0.1	0.0	0.7	0.6	0.0
Delay (s)	41.8	27.7	26.4	33.1	21.0		31.4	22.6	20.8	37.9	34.1	31.5
Level of Service	D	C	C	C	C		C	C	C	D	C	C
Approach Delay (s)		27.0			26.1			27.4			35.0	
Approach LOS		C			C			C			D	

Intersection Summary

HCM 2000 Control Delay	27.5	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.61		
Actuated Cycle Length (s)	86.1	Sum of lost time (s)	17.8
Intersection Capacity Utilization	67.4%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
29: Isabel Ave & I-580 WB Ramps

BART to Livermore Extension Project
2040 Express Bus AM





















Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↔↔		↗		↑↑↑	↗		↑↑↑	↗
Traffic Volume (vph)	0	0	0	653	0	450	0	503	0	0	671	452
Future Volume (vph)	0	0	0	653	0	450	0	503	0	0	671	452
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0		4.0		4.8			4.8	4.8
Lane Util. Factor				0.97		1.00		0.91			0.91	1.00
Frt				1.00		0.85		1.00			1.00	0.85
Flt Protected				0.95		1.00		1.00			1.00	1.00
Satd. Flow (prot)				3433		1583		5085			5085	1583
Flt Permitted				0.95		1.00		1.00			1.00	1.00
Satd. Flow (perm)				3433		1583		5085			5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	710	0	489	0	547	0	0	729	491
RTOR Reduction (vph)	0	0	0	0	0	126	0	0	0	0	0	226
Lane Group Flow (vph)	0	0	0	710	0	363	0	547	0	0	729	265
Turn Type				Prot		Prot		NA	Free		NA	Prot
Protected Phases				8		8		2			6	6
Permitted Phases									Free			
Actuated Green, G (s)				18.8		18.8		33.2			33.2	33.2
Effective Green, g (s)				18.8		18.8		32.4			32.4	32.4
Actuated g/C Ratio				0.31		0.31		0.54			0.54	0.54
Clearance Time (s)				4.0		4.0		4.0			4.0	4.0
Vehicle Extension (s)				2.0		2.0		4.0			4.0	4.0
Lane Grp Cap (vph)				1075		496		2745			2745	854
v/s Ratio Prot				0.21		c0.23		0.11			0.14	c0.17
v/s Ratio Perm												
v/c Ratio				0.66		0.73		0.20			0.27	0.31
Uniform Delay, d1				17.8		18.3		7.1			7.4	7.6
Progression Factor				1.00		1.00		1.02			1.00	1.00
Incremental Delay, d2				1.2		4.7		0.2			0.2	0.9
Delay (s)				19.0		23.1		7.4			7.6	8.6
Level of Service				B		C		A			A	A
Approach Delay (s)		0.0			20.7			7.4			8.0	
Approach LOS		A			C			A			A	

Intersection Summary			
HCM 2000 Control Delay	13.0	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.46		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.8
Intersection Capacity Utilization	44.9%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
30: Isabel Ave & I-580 EB Ramps

BART to Livermore Extension Project
2040 Express Bus AM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	224	0	469	0	0	0	0	729	522	0	1026	364
Future Volume (vph)	224	0	469	0	0	0	0	729	522	0	1026	364
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0					4.0	4.0		4.0	4.0
Lane Util. Factor	0.97		0.88					0.91	1.00		0.91	1.00
Frt	1.00		0.85					1.00	0.85		1.00	0.85
Flt Protected	0.95		1.00					1.00	1.00		1.00	1.00
Satd. Flow (prot)	3433		2787					5085	1583		5085	1583
Flt Permitted	0.95		1.00					1.00	1.00		1.00	1.00
Satd. Flow (perm)	3433		2787					5085	1583		5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	243	0	510	0	0	0	0	792	567	0	1115	396
RTOR Reduction (vph)	0	0	120	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	243	0	390	0	0	0	0	792	567	0	1115	396
Turn Type	Prot		Perm					NA	Free		NA	Free
Protected Phases	4							2			6	
Permitted Phases			4						Free			Free
Actuated Green, G (s)	12.4		12.4					38.6	60.0		38.6	60.0
Effective Green, g (s)	12.4		12.4					39.6	60.0		39.6	60.0
Actuated g/C Ratio	0.21		0.21					0.66	1.00		0.66	1.00
Clearance Time (s)	4.0		4.0					5.0			5.0	
Vehicle Extension (s)	2.0		2.0					4.0			4.0	
Lane Grp Cap (vph)	709		575					3356	1583		3356	1583
v/s Ratio Prot	0.07							0.16			0.22	
v/s Ratio Perm			c0.14						c0.36			0.25
v/c Ratio	0.34		0.68					0.24	0.36		0.33	0.25
Uniform Delay, d1	20.3		22.0					4.1	0.0		4.4	0.0
Progression Factor	1.00		1.00					1.00	1.00		0.49	1.00
Incremental Delay, d2	0.1		2.5					0.2	0.6		0.3	0.4
Delay (s)	20.4		24.5					4.3	0.6		2.4	0.4
Level of Service	C		C					A	A		A	A
Approach Delay (s)		23.2			0.0			2.8			1.9	
Approach LOS		C			A			A			A	
Intersection Summary												
HCM 2000 Control Delay			6.6								HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio			0.46									
Actuated Cycle Length (s)			60.0								Sum of lost time (s)	8.0
Intersection Capacity Utilization			42.9%								ICU Level of Service	A
Analysis Period (min)			15									

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 31: Isabel Ave & Airway Blvd

BART to Livermore Extension Project
 2040 Express Bus AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	80	291	203	297	134	338	1080	22	246	1425	17
Future Volume (vph)	0	80	291	203	297	134	338	1080	22	246	1425	17
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.2	5.6	5.2	5.2	5.6	4.0	4.0	4.0	4.0	4.0	5.0
Lane Util. Factor		1.00	1.00	1.00	1.00	1.00	1.00	0.91	1.00	0.97	0.91	1.00
Frt		1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1863	1583	1770	1863	1583	1770	5085	1583	3433	5085	1583
Flt Permitted		1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)		1863	1583	1770	1863	1583	1770	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	87	316	221	323	146	367	1174	24	267	1549	18
RTOR Reduction (vph)	0	0	108	0	0	79	0	0	13	0	0	11
Lane Group Flow (vph)	0	87	208	221	323	67	367	1174	11	267	1549	7
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4	5	3	8	1	5	2		1	NA	6
Permitted Phases			4			8			2			6
Actuated Green, G (s)		7.9	24.0	11.8	24.3	34.9	16.1	37.0	37.0	10.6	31.5	31.5
Effective Green, g (s)		7.3	22.8	11.2	23.7	33.7	17.1	38.0	38.0	11.6	32.5	31.5
Actuated g/C Ratio		0.08	0.26	0.13	0.27	0.39	0.20	0.44	0.44	0.13	0.38	0.36
Clearance Time (s)		4.6	5.0	4.6	4.6	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Extension (s)		3.0	3.0	3.0	3.0	3.0	3.0	5.0	5.0	3.0	5.0	5.0
Lane Grp Cap (vph)		157	417	229	510	616	349	2233	695	460	1910	576
v/s Ratio Prot		0.05	0.09	c0.12	c0.17	0.01	c0.21	0.23		0.08	c0.30	
v/s Ratio Perm			0.04			0.03			0.01			0.00
v/c Ratio		0.55	0.50	0.97	0.63	0.11	1.05	0.53	0.02	0.58	0.81	0.01
Uniform Delay, d1		38.0	27.0	37.5	27.6	16.8	34.7	17.7	13.7	35.2	24.2	17.6
Progression Factor		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2		4.2	0.9	49.2	2.6	0.1	62.4	0.4	0.0	1.9	3.1	0.0
Delay (s)		42.2	27.9	86.7	30.2	16.9	97.1	18.1	13.7	37.0	27.3	17.6
Level of Service		D	C	F	C	B	F	B	B	D	C	B
Approach Delay (s)		31.0			45.5			36.6			28.6	
Approach LOS		C			D			D			C	

Intersection Summary			
HCM 2000 Control Delay	34.2	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.92		
Actuated Cycle Length (s)	86.5	Sum of lost time (s)	20.0
Intersection Capacity Utilization	75.2%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 32: Isabel Ave & Jack London Blvd

BART to Livermore Extension Project
 2040 Express Bus AM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	24	55	61	326	1042	371	409	880	115	171	1396	304
Future Volume (vph)	24	55	61	326	1042	371	409	880	115	171	1396	304
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.97	0.91	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	3433	5085	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	3433	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	26	60	66	354	1133	403	445	957	125	186	1517	330
RTOR Reduction (vph)	0	0	54	0	0	52	0	0	80	0	0	97
Lane Group Flow (vph)	26	60	12	354	1133	351	445	957	45	186	1517	233
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8	1	5	2		1	NA	6
Permitted Phases			4			8			2			6
Actuated Green, G (s)	3.9	23.4	23.4	27.0	46.5	58.9	17.9	47.3	47.3	12.4	41.8	41.8
Effective Green, g (s)	3.9	23.4	23.4	27.0	46.5	58.9	17.9	47.3	47.3	12.4	41.8	41.8
Actuated g/C Ratio	0.03	0.18	0.18	0.21	0.35	0.45	0.14	0.36	0.36	0.09	0.32	0.32
Clearance Time (s)	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	101	630	282	363	1253	774	468	1831	570	324	1618	503
v/s Ratio Prot	0.01	0.02		c0.20	c0.32	0.04	c0.13	0.19		0.05	c0.30	
v/s Ratio Perm			0.01			0.18			0.03			0.15
v/c Ratio	0.26	0.10	0.04	0.98	0.90	0.45	0.95	0.52	0.08	0.57	0.94	0.46
Uniform Delay, d1	62.3	45.1	44.7	51.8	40.3	25.1	56.3	33.1	27.7	56.9	43.5	35.8
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.4	0.1	0.1	40.3	9.4	0.4	29.4	0.3	0.1	2.5	10.7	0.7
Delay (s)	63.6	45.2	44.7	92.1	49.6	25.5	85.7	33.4	27.7	59.4	54.2	36.5
Level of Service	E	D	D	F	D	C	F	C	C	E	D	D
Approach Delay (s)		48.1			52.4			48.1			51.8	
Approach LOS		D			D			D			D	

Intersection Summary		
HCM 2000 Control Delay	50.9	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.96	D
Actuated Cycle Length (s)	131.3	Sum of lost time (s)
Intersection Capacity Utilization	80.7%	21.2
Analysis Period (min)	15	ICU Level of Service
		D

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 33: Isabel Ave Connector & Stanley Blvd



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑	↑	↔	↑↑	↔	↔
Traffic Volume (vph)	334	144	761	2491	559	629
Future Volume (vph)	334	144	761	2491	559	629
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	2.3	2.3	4.0	2.3	2.5	2.5
Lane Util. Factor	0.95	1.00	0.97	0.95	0.97	0.88
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	3539	1583	3433	3539	3433	2787
Flt Permitted	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (perm)	3539	1583	3433	3539	3433	2787
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	363	157	827	2708	608	684
RTOR Reduction (vph)	0	11	0	0	0	237
Lane Group Flow (vph)	363	146	827	2708	608	447
Turn Type	NA	pm+ov	Prot	NA	Prot	pm+ov
Protected Phases	2	8	1	6	8	1
Permitted Phases		2				8
Actuated Green, G (s)	46.0	70.1	32.1	82.1	24.1	56.2
Effective Green, g (s)	47.7	73.5	32.1	83.8	25.6	59.2
Actuated g/C Ratio	0.42	0.64	0.28	0.73	0.22	0.52
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Grp Cap (vph)	1478	1050	964	2596	769	1505
v/s Ratio Prot	0.10	0.03	0.24	c0.77	c0.18	0.09
v/s Ratio Perm		0.06				0.07
v/c Ratio	0.25	0.14	0.86	1.04	0.79	0.30
Uniform Delay, d1	21.6	8.0	38.9	15.2	41.8	15.7
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.0	0.0	7.4	30.2	5.2	0.0
Delay (s)	21.6	8.0	46.3	45.4	47.0	15.7
Level of Service	C	A	D	D	D	B
Approach Delay (s)	17.5			45.6	30.4	
Approach LOS	B			D	C	

Intersection Summary

HCM 2000 Control Delay	39.2	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	1.02		
Actuated Cycle Length (s)	114.2	Sum of lost time (s)	8.8
Intersection Capacity Utilization	91.5%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 34: Murrieta Blvd/Driveway & Portola Ave

BART to Livermore Extension Project
 2040 Express Bus AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗		↖	↗		↖	↗	↗		↗	
Traffic Volume (vph)	0	437	103	268	1237	1	188	6	148	1	3	0
Future Volume (vph)	0	437	103	268	1237	1	188	6	148	1	3	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.8		4.0	5.8		5.2	5.2	5.2		4.0	
Lane Util. Factor		0.95		1.00	0.95		0.95	0.95	1.00		1.00	
Frt		0.97		1.00	1.00		1.00	1.00	0.85		1.00	
Flt Protected		1.00		0.95	1.00		0.95	0.96	1.00		0.99	
Satd. Flow (prot)		3438		1770	3539		1681	1691	1583		1840	
Flt Permitted		1.00		0.95	1.00		0.95	0.96	1.00		0.99	
Satd. Flow (perm)		3438		1770	3539		1681	1691	1583		1840	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	475	112	291	1345	1	204	7	161	1	3	0
RTOR Reduction (vph)	0	25	0	0	0	0	0	0	138	0	0	0
Lane Group Flow (vph)	0	562	0	291	1346	0	106	105	23	0	4	0
Turn Type	Prot	NA		Prot	NA		Split	NA	Perm		Split	NA
Protected Phases	5	2		1	6		8	8		4	4	
Permitted Phases									8			
Actuated Green, G (s)		13.5		14.5	32.0		8.2	8.2	8.2		0.6	
Effective Green, g (s)		12.6		14.5	31.1		7.6	7.6	7.6		0.6	
Actuated g/C Ratio		0.23		0.27	0.57		0.14	0.14	0.14		0.01	
Clearance Time (s)		4.9		4.0	4.9		4.6	4.6	4.6		4.0	
Vehicle Extension (s)		2.0		2.0	2.0		2.0	2.0	2.0		2.0	
Lane Grp Cap (vph)		797		472	2026		235	236	221		20	
v/s Ratio Prot		0.16		0.16	c0.38		c0.06	0.06			c0.00	
v/s Ratio Perm									0.01			
v/c Ratio		0.70		0.62	0.66		0.45	0.44	0.10		0.20	
Uniform Delay, d1		19.1		17.5	8.0		21.4	21.4	20.4		26.6	
Progression Factor		1.00		1.00	1.00		1.00	1.00	1.00		1.00	
Incremental Delay, d2		2.3		1.7	0.6		0.5	0.5	0.1		1.8	
Delay (s)		21.5		19.1	8.6		21.9	21.9	20.4		28.4	
Level of Service		C		B	A		C	C	C		C	
Approach Delay (s)		21.5			10.5			21.3			28.4	
Approach LOS		C			B			C			C	

Intersection Summary		
HCM 2000 Control Delay	14.6	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.69	B
Actuated Cycle Length (s)	54.3	Sum of lost time (s)
Intersection Capacity Utilization	62.1%	19.0
Analysis Period (min)	15	ICU Level of Service
		B

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 35: Murrieta Blvd & Jack London Blvd

BART to Livermore Extension Project
 2040 Express Bus AM



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	69	296	869	214	243	175
Future Volume (vph)	69	296	869	214	243	175
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00	1.00	0.95	0.91	
Frt	1.00	0.85	1.00	1.00	0.94	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1770	1583	1770	3539	4766	
Flt Permitted	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	1770	1583	1770	3539	4766	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	75	322	945	233	264	190
RTOR Reduction (vph)	0	284	0	0	154	0
Lane Group Flow (vph)	75	38	945	233	300	0
Turn Type	Prot	Perm	Prot	NA	NA	
Protected Phases	4		5	2	6	
Permitted Phases		4				
Actuated Green, G (s)	9.2	9.2	46.3	60.6	10.3	
Effective Green, g (s)	9.2	9.2	46.3	60.6	10.3	
Actuated g/C Ratio	0.12	0.12	0.60	0.78	0.13	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	209	187	1053	2756	630	
v/s Ratio Prot	c0.04		c0.53	0.07	c0.06	
v/s Ratio Perm		0.02				
v/c Ratio	0.36	0.20	0.90	0.08	0.48	
Uniform Delay, d1	31.6	31.0	13.7	2.0	31.2	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	1.1	0.5	10.1	0.0	0.6	
Delay (s)	32.6	31.5	23.8	2.0	31.8	
Level of Service	C	C	C	A	C	
Approach Delay (s)	31.7			19.5	31.8	
Approach LOS	C			B	C	

Intersection Summary

HCM 2000 Control Delay	24.6	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.76		
Actuated Cycle Length (s)	77.8	Sum of lost time (s)	12.0
Intersection Capacity Utilization	70.6%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 36: Murrieta Blvd & Stanley Blvd

BART to Livermore Extension Project
 2040 Express Bus AM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	220	758	264	25	1400	142	659	375	16	197	196	471
Future Volume (vph)	220	758	264	25	1400	142	659	375	16	197	196	471
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	5.8	5.8	4.0	5.8	4.9	4.9	5.8		4.9	5.8	4.9
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.97	0.95		1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	3433	3518		1770	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	3433	3518		1770	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	239	824	287	27	1522	154	716	408	17	214	213	512
RTOR Reduction (vph)	0	0	134	0	0	33	0	2	0	0	0	61
Lane Group Flow (vph)	239	824	153	27	1522	121	716	423	0	214	213	451
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Prot	NA		Prot	NA	Perm
Protected Phases	1	6		5	2	3	7	4		3	8	
Permitted Phases			6			2						8
Actuated Green, G (s)	7.0	62.1	62.1	3.6	58.7	80.3	24.0	36.5		21.6	34.1	34.1
Effective Green, g (s)	7.0	61.2	61.2	3.6	57.8	78.5	23.1	35.6		20.7	33.2	34.1
Actuated g/C Ratio	0.05	0.43	0.43	0.03	0.41	0.55	0.16	0.25		0.15	0.23	0.24
Clearance Time (s)	4.0	4.9	4.9	4.0	4.9	4.0	4.0	4.9		4.0	4.9	4.9
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	169	1529	684	45	1444	877	560	884		258	829	381
v/s Ratio Prot	c0.07	c0.23		0.02	c0.43	0.02	c0.21	0.12		0.12	0.06	
v/s Ratio Perm			0.10			0.06						c0.29
v/c Ratio	1.41	0.54	0.22	0.60	1.05	0.14	1.28	0.48		0.83	0.26	1.18
Uniform Delay, d1	67.3	29.8	25.3	68.3	41.9	15.2	59.2	45.1		58.7	44.2	53.8
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	217.5	0.4	0.2	19.7	39.3	0.1	138.7	0.4		19.3	0.2	106.6
Delay (s)	284.8	30.1	25.4	88.0	81.2	15.3	197.9	45.5		78.0	44.3	160.4
Level of Service	F	C	C	F	F	B	F	D		E	D	F
Approach Delay (s)		74.2			75.4			141.2			115.3	
Approach LOS		E			E			F			F	

Intersection Summary		
HCM 2000 Control Delay	97.0	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	1.14	F
Actuated Cycle Length (s)	141.6	Sum of lost time (s)
Intersection Capacity Utilization	99.7%	20.5
Analysis Period (min)	15	ICU Level of Service
		F

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
37: Livermore Ave & I-580 WB Ramps

BART to Livermore Extension Project
2040 Express Bus AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↖	↔		↗	↑			↕	↘
Traffic Volume (vph)	0	0	0	344	90	28	467	81	0	0	151	0
Future Volume (vph)	0	0	0	344	90	28	467	81	0	0	151	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)					4.0		4.0	4.0			4.0	
Lane Util. Factor					0.95		0.97	1.00			0.95	
Frt					0.99		1.00	1.00			1.00	
Flt Protected					0.96		0.95	1.00			1.00	
Satd. Flow (prot)					1691		3433	1863			3539	
Flt Permitted					0.96		0.95	1.00			1.00	
Satd. Flow (perm)					1691		3433	1863			3539	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	374	98	30	508	88	0	0	164	0
RTOR Reduction (vph)	0	0	0	0	5	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	0	497	0	508	88	0	0	164	0
Turn Type				Split	NA		Prot	NA			NA	
Protected Phases				8	8		5	2			6	
Permitted Phases												
Actuated Green, G (s)					18.9		11.4	26.4			11.5	
Effective Green, g (s)					18.9		10.9	28.1			13.2	
Actuated g/C Ratio					0.34		0.20	0.51			0.24	
Clearance Time (s)					4.0		3.5	5.7			5.7	
Vehicle Extension (s)					2.0		2.0	2.5			2.5	
Lane Grp Cap (vph)					581		680	951			849	
v/s Ratio Prot					c0.29		c0.15	0.05			c0.05	
v/s Ratio Perm												
v/c Ratio					0.86		0.75	0.09			0.19	
Uniform Delay, d1					16.8		20.8	6.9			16.7	
Progression Factor					1.00		1.00	1.00			1.00	
Incremental Delay, d2					11.4		3.9	0.2			0.5	
Delay (s)					28.2		24.7	7.1			17.2	
Level of Service					C		C	A			B	
Approach Delay (s)		0.0			28.2			22.1			17.2	
Approach LOS		A			C			C			B	

Intersection Summary

HCM 2000 Control Delay	23.9	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.62		
Actuated Cycle Length (s)	55.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	56.3%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
38: Livermore Ave & I-580 EB Ramps



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔	↗					↕		↘	↕	
Traffic Volume (vph)	13	2	695	0	0	0	0	530	383	23	477	0
Future Volume (vph)	13	2	695	0	0	0	0	530	383	23	477	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0					3.0		5.0	3.0	
Lane Util. Factor		0.95	0.95					0.95		1.00	0.95	
Frt		0.86	0.85					0.94		1.00	1.00	
Flt Protected		1.00	1.00					1.00		0.95	1.00	
Satd. Flow (prot)		1512	1504					3317		1770	3539	
Flt Permitted		1.00	1.00					1.00		0.95	1.00	
Satd. Flow (perm)		1512	1504					3317		1770	3539	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	14	2	755	0	0	0	0	576	416	25	518	0
RTOR Reduction (vph)	0	222	222	0	0	0	0	201	0	0	0	0
Lane Group Flow (vph)	0	164	163	0	0	0	0	791	0	25	518	0
Turn Type	Prot	NA	Perm					NA		Prot	NA	
Protected Phases	7	4						2		1	6	
Permitted Phases			4									
Actuated Green, G (s)		12.9	12.9					24.3		0.8	29.1	
Effective Green, g (s)		12.9	12.9					25.3		0.0	30.1	
Actuated g/C Ratio		0.26	0.26					0.51		0.00	0.60	
Clearance Time (s)		4.0	4.0					4.0		4.0	4.0	
Vehicle Extension (s)		2.0	2.0					2.5		2.0	2.5	
Lane Grp Cap (vph)		390	388					1678		0	2130	
v/s Ratio Prot								c0.24			c0.15	
v/s Ratio Perm		0.11	0.11									
v/c Ratio		0.42	0.42					0.47		no cap	0.24	
Uniform Delay, d1		15.4	15.4					8.0		Error	4.6	
Progression Factor		1.00	1.00					1.00			1.00	
Incremental Delay, d2		0.3	0.3					1.0		Error	0.3	
Delay (s)		15.7	15.7					9.0		Error	4.9	
Level of Service		B	B					A		F	A	
Approach Delay (s)		15.7			0.0			9.0			Error	
Approach LOS		B			A			A			F	





























Intersection Summary

HCM 2000 Control Delay	Error	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	0.47		
Actuated Cycle Length (s)	50.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	56.3%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 39: Livermore Ave & Portola Ave



















BART to Livermore Extension Project
 2040 Express Bus AM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 	 			 			 			 	
Traffic Volume (vph)	283	246	92	32	730	95	247	494	69	138	757	440
Future Volume (vph)	283	246	92	32	730	95	247	494	69	138	757	440
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	2.7	4.0	4.0	2.7	4.0	4.0	4.9		4.0	4.9	4.9
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	1.00	0.95		1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.98		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	1770	3474		1770	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	1770	3474		1770	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	308	267	100	35	793	103	268	537	75	150	823	478
RTOR Reduction (vph)	0	0	62	0	0	74	0	9	0	0	0	43
Lane Group Flow (vph)	308	267	38	35	793	29	268	603	0	150	823	435
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA		Prot	NA	pm+ov
Protected Phases	3	8		7	4		1	6		5	2	3
Permitted Phases			8			4						2
Actuated Green, G (s)	13.8	42.7	42.7	3.3	32.2	32.2	19.8	36.3		14.3	30.8	44.6
Effective Green, g (s)	13.8	44.0	42.7	3.3	33.5	32.2	19.8	35.4		14.3	29.9	42.8
Actuated g/C Ratio	0.12	0.39	0.38	0.03	0.30	0.29	0.18	0.31		0.13	0.27	0.38
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	420	1382	600	51	1052	452	311	1092		224	939	670
v/s Ratio Prot	c0.09	0.08		0.02	c0.22		c0.15	0.17		0.08	c0.23	c0.07
v/s Ratio Perm			0.02			0.02						0.20
v/c Ratio	0.73	0.19	0.06	0.69	0.75	0.07	0.86	0.55		0.67	0.88	0.65
Uniform Delay, d1	47.6	22.6	22.2	54.1	35.8	29.2	45.1	32.0		46.9	39.6	28.7
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	6.5	0.1	0.0	32.0	3.1	0.1	20.9	0.6		7.4	9.2	2.2
Delay (s)	54.1	22.7	22.3	86.1	38.9	29.3	66.0	32.6		54.3	48.8	30.9
Level of Service	D	C	C	F	D	C	E	C		D	D	C
Approach Delay (s)		37.0			39.6			42.8			43.5	
Approach LOS		D			D			D			D	
Intersection Summary												
HCM 2000 Control Delay			41.3								HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio			0.83									
Actuated Cycle Length (s)			112.6								Sum of lost time (s)	16.5
Intersection Capacity Utilization			76.9%								ICU Level of Service	D
Analysis Period (min)			15									

c Critical Lane Group



















HCM Signalized Intersection Capacity Analysis
40: First St/Springtown Blvd & I-580 WB Ramps

BART to Livermore Extension Project
2040 Express Bus AM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	443	0	0	0	341	375	0	0	875	536
Future Volume (vph)	0	0	443	0	0	0	341	375	0	0	875	536
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)			4.5				4.5	4.0			4.5	4.5
Lane Util. Factor			0.88				0.97	1.00			0.95	1.00
Frt			0.85				1.00	1.00			1.00	0.85
Flt Protected			1.00				0.95	1.00			1.00	1.00
Satd. Flow (prot)			2787				3433	1863			3539	1583
Flt Permitted			1.00				0.95	1.00			1.00	1.00
Satd. Flow (perm)			2787				3433	1863			3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	482	0	0	0	371	408	0	0	951	583
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	70
Lane Group Flow (vph)	0	0	482	0	0	0	371	408	0	0	951	513
Turn Type			Over			Free	Prot	NA			NA	Perm
Protected Phases			5				5	2			6	
Permitted Phases						Free						6
Actuated Green, G (s)			14.2				14.2	60.0			37.8	37.8
Effective Green, g (s)			13.7				13.7	60.0			37.3	37.3
Actuated g/C Ratio			0.23				0.23	1.00			0.62	0.62
Clearance Time (s)			4.0				4.0	4.0			4.0	4.0
Vehicle Extension (s)			2.0				2.0	0.2			4.0	4.0
Lane Grp Cap (vph)			636				783	1863			2200	984
v/s Ratio Prot			c0.17				0.11	0.22			0.27	
v/s Ratio Perm												c0.32
v/c Ratio			0.76				0.47	0.22			0.43	0.52
Uniform Delay, d1			21.6				20.0	0.0			5.9	6.4
Progression Factor			1.00				0.66	1.00			1.00	1.00
Incremental Delay, d2			4.6				0.1	0.2			0.6	2.0
Delay (s)			26.2				13.3	0.2			6.5	8.3
Level of Service			C				B	A			A	A
Approach Delay (s)		26.2			0.0			6.5			7.2	
Approach LOS		C			A			A			A	
Intersection Summary												
HCM 2000 Control Delay			10.3				HCM 2000 Level of Service				B	
HCM 2000 Volume to Capacity ratio			0.58									
Actuated Cycle Length (s)			60.0				Sum of lost time (s)				9.0	
Intersection Capacity Utilization			50.4%				ICU Level of Service				A	
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis
41: First St & I-580 EB Ramps

BART to Livermore Extension Project
2040 Express Bus AM

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations													
Traffic Volume (vph)	75	2	379	0	0	0	0	926	868	89	1202	0	
Future Volume (vph)	75	2	379	0	0	0	0	926	868	89	1202	0	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)		4.0	4.0					5.0	5.0	5.0	5.0		
Lane Util. Factor		1.00	0.88					0.95	1.00	1.00	0.95		
Frt		1.00	0.85					1.00	0.85	1.00	1.00		
Flt Protected		0.95	1.00					1.00	1.00	0.95	1.00		
Satd. Flow (prot)		1776	2787					3539	1583	1770	3539		
Flt Permitted		0.95	1.00					1.00	1.00	0.95	1.00		
Satd. Flow (perm)		1776	2787					3539	1583	1770	3539		
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	
Adj. Flow (vph)	82	2	412	0	0	0	0	1007	943	97	1307	0	
RTOR Reduction (vph)	0	0	149	0	0	0	0	0	316	0	0	0	
Lane Group Flow (vph)	0	84	263	0	0	0	0	1007	627	97	1307	0	
Turn Type	Perm	NA	Perm					NA	Perm	Prot	NA		
Protected Phases		4						2		1	6		
Permitted Phases	4		4						2				
Actuated Green, G (s)		8.1	8.1					34.4	34.4	5.5	43.9		
Effective Green, g (s)		7.6	7.6					33.9	33.9	4.5	43.4		
Actuated g/C Ratio		0.13	0.13					0.56	0.56	0.08	0.72		
Clearance Time (s)		3.5	3.5					4.5	4.5	4.0	4.5		
Vehicle Extension (s)		2.5	2.5					4.0	4.0	2.0	4.0		
Lane Grp Cap (vph)		224	353					1999	894	132	2559		
v/s Ratio Prot								0.28		0.05	c0.37		
v/s Ratio Perm		0.05	c0.09						c0.40				
v/c Ratio		0.38	0.74					0.50	0.70	0.73	0.51		
Uniform Delay, d1		24.0	25.3					7.9	9.4	27.2	3.6		
Progression Factor		1.00	1.00					1.00	1.00	1.11	0.54		
Incremental Delay, d2		0.8	7.8					0.9	4.6	14.8	0.6		
Delay (s)		24.8	33.1					8.8	14.0	44.8	2.6		
Level of Service		C	C					A	B	D	A		
Approach Delay (s)		31.7			0.0			11.3			5.5		
Approach LOS		C			A			B			A		
Intersection Summary													
HCM 2000 Control Delay			11.8									HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio			0.72										
Actuated Cycle Length (s)			60.0									Sum of lost time (s)	14.0
Intersection Capacity Utilization			74.6%									ICU Level of Service	D
Analysis Period (min)			15										

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
42: 1st St & Mines Rd

BART to Livermore Extension Project
2040 Express Bus AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗		↖↗	↑	↖	↖	↑↑↑		↖↗	↑↑↑	
Traffic Volume (vph)	41	60	47	548	102	369	25	1367	345	165	1270	19
Future Volume (vph)	41	60	47	548	102	369	25	1367	345	165	1270	19
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		0.97	1.00	1.00	1.00	0.91		0.97	0.91	
Frt	1.00	0.93		1.00	1.00	0.85	1.00	0.97		1.00	1.00	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1740		3433	1863	1583	1770	4932		3433	5074	
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	1740		3433	1863	1583	1770	4932		3433	5074	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	45	65	51	596	111	401	27	1486	375	179	1380	21
RTOR Reduction (vph)	0	34	0	0	0	48	0	44	0	0	2	0
Lane Group Flow (vph)	45	82	0	596	111	353	27	1817	0	179	1399	0
Turn Type	Prot	NA		Prot	NA	pm+ov	Prot	NA		Prot	NA	
Protected Phases	7	4		3	8	1	5	2		1	6	
Permitted Phases						8						
Actuated Green, G (s)	3.4	8.6		16.6	21.8	27.9	1.9	37.8		6.1	42.0	
Effective Green, g (s)	3.4	8.6		16.6	21.8	27.9	1.9	37.8		6.1	42.0	
Actuated g/C Ratio	0.04	0.10		0.20	0.26	0.33	0.02	0.44		0.07	0.49	
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	70	175		669	477	593	39	2190		246	2504	
v/s Ratio Prot	0.03	0.05		c0.17	0.06	c0.04	0.02	c0.37		c0.05	0.28	
v/s Ratio Perm						0.18						
v/c Ratio	0.64	0.47		0.89	0.23	0.59	0.69	0.83		0.73	0.56	
Uniform Delay, d1	40.3	36.1		33.4	25.0	23.9	41.3	20.8		38.7	15.1	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	18.4	2.0		14.1	0.3	1.6	41.8	2.7		10.2	0.3	
Delay (s)	58.7	38.1		47.4	25.3	25.5	83.1	23.6		48.9	15.3	
Level of Service	E	D		D	C	C	F	C		D	B	
Approach Delay (s)		43.8			37.3			24.4			19.1	
Approach LOS		D			D			C			B	























Intersection Summary

HCM 2000 Control Delay	26.3	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.85		
Actuated Cycle Length (s)	85.1	Sum of lost time (s)	16.0
Intersection Capacity Utilization	71.1%	ICU Level of Service	C
Analysis Period (min)	15		























c Critical Lane Group

HCM Unsignalized Intersection Capacity Analysis
 43: Vasco Rd & I-580 WB Ramps

BART to Livermore Extension Project
 2040 Express Bus AM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations								  			  	
Traffic Volume (veh/h)	0	0	0	0	0	162	0	1038	0	0	1953	0
Future Volume (Veh/h)	0	0	0	0	0	162	0	1038	0	0	1953	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	0	0	0	176	0	1128	0	0	2123	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage (veh)												
Upstream signal (ft)											524	
pX, platoon unblocked												
vC, conflicting volume	2675	3251	708	1836	3251	376	2123			1128		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	2675	3251	708	1836	3251	376	2123			1128		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	100	100	72	100			100		
cM capacity (veh/h)	8	9	377	47	9	622	253			615		
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	NB 4	SB 1	SB 2	SB 3	SB 4		
Volume Total	0	176	376	376	376	0	708	708	708	0		
Volume Left	0	0	0	0	0	0	0	0	0	0		
Volume Right	0	176	0	0	0	0	0	0	0	0		
cSH	1700	622	1700	1700	1700	1700	1700	1700	1700	1700		
Volume to Capacity	0.00	0.28	0.22	0.22	0.22	0.00	0.42	0.42	0.42	0.00		
Queue Length 95th (ft)	0	29	0	0	0	0	0	0	0	0		
Control Delay (s)	0.0	13.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
Lane LOS	A	B										
Approach Delay (s)	0.0	13.1	0.0				0.0					
Approach LOS	A	B										
Intersection Summary												
Average Delay			0.7									
Intersection Capacity Utilization			41.1%		ICU Level of Service				A			
Analysis Period (min)			15									

HCM Unsignalized Intersection Capacity Analysis
44: Vasco Rd & I-580 EB Ramps

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations								  			  	
Traffic Volume (veh/h)	0	0	0	0	0	0	0	1041	0	73	2075	0
Future Volume (Veh/h)	0	0	0	0	0	0	0	1041	0	73	2075	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	0	0	0	0	0	1132	0	79	2255	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	2790	3545	752	2042	3545	377	2255			1132		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	2790	3545	752	2042	3545	377	2255			1132		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	100	100	100	100			87		
cM capacity (veh/h)	8	5	353	30	5	620	225			613		
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	NB 4	SB 1	SB 2	SB 3	SB 4		
Volume Total	0	0	377	377	377	0	79	752	752	752		
Volume Left	0	0	0	0	0	0	79	0	0	0		
Volume Right	0	0	0	0	0	0	0	0	0	0		
cSH	1700	1700	1700	1700	1700	1700	613	1700	1700	1700		
Volume to Capacity	0.00	0.00	0.22	0.22	0.22	0.00	0.13	0.44	0.44	0.44		
Queue Length 95th (ft)	0	0	0	0	0	0	11	0	0	0		
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	11.7	0.0	0.0	0.0		
Lane LOS	A	A					B					
Approach Delay (s)	0.0	0.0	0.0				0.4					
Approach LOS	A	A										
Intersection Summary												
Average Delay			0.3									
Intersection Capacity Utilization			43.4%		ICU Level of Service				A			
Analysis Period (min)			15									

HCM Signalized Intersection Capacity Analysis

45: Vasco Rd & East Ave

BART to Livermore Extension Project

2040 Express Bus AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	295	367	53	10	24	19	65	256	198	258	294	295
Future Volume (vph)	295	367	53	10	24	19	65	256	198	258	294	295
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	0.95		0.97	1.00	1.00
Frt	1.00	0.98		1.00	0.93		1.00	0.93		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	3472		1770	3302		1770	3308		3433	1863	1583
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1770	3472		1770	3302		1770	3308		3433	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	321	399	58	11	26	21	71	278	215	280	320	321
RTOR Reduction (vph)	0	19	0	0	20	0	0	156	0	0	0	212
Lane Group Flow (vph)	321	438	0	11	27	0	71	337	0	280	320	109
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												6
Actuated Green, G (s)	11.6	14.2		0.6	3.2		2.1	13.7		5.3	16.9	16.9
Effective Green, g (s)	11.6	14.2		0.6	3.2		2.1	13.7		5.3	16.9	16.9
Actuated g/C Ratio	0.23	0.29		0.01	0.06		0.04	0.28		0.11	0.34	0.34
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	412	990		21	212		74	910		365	632	537
v/s Ratio Prot	c0.18	c0.13		0.01	0.01		0.04	0.10		c0.08	c0.17	
v/s Ratio Perm												0.07
v/c Ratio	0.78	0.44		0.52	0.13		0.96	0.37		0.77	0.51	0.20
Uniform Delay, d1	17.9	14.6		24.5	22.0		23.8	14.6		21.6	13.1	11.7
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	9.0	0.3		21.6	0.3		89.6	0.3		9.3	0.6	0.2
Delay (s)	26.9	14.9		46.0	22.3		113.4	14.8		31.0	13.8	11.9
Level of Service	C	B		D	C		F	B		C	B	B
Approach Delay (s)		19.8			26.8			27.2			18.3	
Approach LOS		B			C			C			B	

Intersection Summary

HCM 2000 Control Delay	21.2	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.68		
Actuated Cycle Length (s)	49.8	Sum of lost time (s)	16.0
Intersection Capacity Utilization	53.8%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
46: Greenville Rd & I-580 WB Ramps

BART to Livermore Extension Project
2040 Express Bus AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↔↔		↗		↕↕	↗		↕↕	
Traffic Volume (vph)	0	0	0	248	0	40	0	121	341	0	943	519
Future Volume (vph)	0	0	0	248	0	40	0	121	341	0	943	519
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0		4.0		4.0	4.0		4.0	
Lane Util. Factor				0.97		1.00		0.95	1.00		0.95	
Frt				1.00		0.85		1.00	0.85		0.95	
Flt Protected				0.95		1.00		1.00	1.00		1.00	
Satd. Flow (prot)				3433		1583		3539	1583		3351	
Flt Permitted				0.95		1.00		1.00	1.00		1.00	
Satd. Flow (perm)				3433		1583		3539	1583		3351	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	270	0	43	0	132	371	0	1025	564
RTOR Reduction (vph)	0	0	0	0	0	36	0	0	106	0	125	0
Lane Group Flow (vph)	0	0	0	270	0	7	0	132	265	0	1464	0
Turn Type				Prot		Prot		NA	Perm		NA	
Protected Phases				3		3		2			6	
Permitted Phases									2			
Actuated Green, G (s)				9.1		9.1		42.9	42.9		42.9	
Effective Green, g (s)				9.1		9.1		42.9	42.9		42.9	
Actuated g/C Ratio				0.15		0.15		0.71	0.71		0.71	
Clearance Time (s)				4.0		4.0		4.0	4.0		4.0	
Vehicle Extension (s)				3.0		3.0		3.0	3.0		3.0	
Lane Grp Cap (vph)				520		240		2530	1131		2395	
v/s Ratio Prot				c0.08		0.00		0.04			c0.44	
v/s Ratio Perm									0.17			
v/c Ratio				0.52		0.03		0.05	0.23		0.61	
Uniform Delay, d1				23.4		21.7		2.5	2.9		4.3	
Progression Factor				1.00		1.00		0.69	1.41		1.00	
Incremental Delay, d2				0.9		0.0		0.0	0.5		1.2	
Delay (s)				24.3		21.7		1.8	4.6		5.5	
Level of Service				C		C		A	A		A	
Approach Delay (s)		0.0			24.0			3.9			5.5	
Approach LOS		A			C			A			A	

Intersection Summary

HCM 2000 Control Delay	7.6	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.59		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	56.4%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
47: Greenville Rd & I-580 EB Ramps

BART to Livermore Extension Project
2040 Express Bus AM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	35	0	136	0	0	0	0	437	73	0	892	30
Future Volume (vph)	35	0	136	0	0	0	0	437	73	0	892	30
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0					4.0	4.0		4.0	4.0
Lane Util. Factor	0.97		1.00					0.95	1.00		0.95	1.00
Frt	1.00		0.85					1.00	0.85		1.00	0.85
Flt Protected	0.95		1.00					1.00	1.00		1.00	1.00
Satd. Flow (prot)	3433		1583					3539	1583		3539	1583
Flt Permitted	0.95		1.00					1.00	1.00		1.00	1.00
Satd. Flow (perm)	3433		1583					3539	1583		3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	38	0	148	0	0	0	0	475	79	0	970	33
RTOR Reduction (vph)	0	0	123	0	0	0	0	0	19	0	0	8
Lane Group Flow (vph)	38	0	25	0	0	0	0	475	60	0	970	25
Turn Type	Prot		Prot					NA	Perm		NA	Perm
Protected Phases	7		7					2			6	
Permitted Phases									2			6
Actuated Green, G (s)	6.1		6.1					45.9	45.9		45.9	45.9
Effective Green, g (s)	6.1		6.1					45.9	45.9		45.9	45.9
Actuated g/C Ratio	0.10		0.10					0.76	0.76		0.76	0.76
Clearance Time (s)	4.0		4.0					4.0	4.0		4.0	4.0
Vehicle Extension (s)	3.0		3.0					3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	349		160					2707	1210		2707	1210
v/s Ratio Prot	0.01		c0.02					0.13			c0.27	
v/s Ratio Perm									0.04			0.02
v/c Ratio	0.11		0.16					0.18	0.05		0.36	0.02
Uniform Delay, d1	24.5		24.6					1.9	1.7		2.3	1.7
Progression Factor	1.00		1.00					1.00	1.00		0.78	0.77
Incremental Delay, d2	0.1		0.5					0.1	0.1		0.3	0.0
Delay (s)	24.6		25.1					2.1	1.8		2.1	1.3
Level of Service	C		C					A	A		A	A
Approach Delay (s)		25.0			0.0			2.0			2.1	
Approach LOS		C			A			A			A	
Intersection Summary												
HCM 2000 Control Delay			4.5								HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio			0.33									
Actuated Cycle Length (s)			60.0								Sum of lost time (s)	8.0
Intersection Capacity Utilization			39.7%								ICU Level of Service	A
Analysis Period (min)			15									

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 48: Greenville Rd & Northfront Road/Altamont Pass Road

BART to Livermore Extension Project
 2040 Express Bus AM



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↑	↑	↑	↑	↑
Traffic Volume (vph)	7	650	630	506	92	60
Future Volume (vph)	7	650	630	506	92	60
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	1863	1583	1770	1863	1770	1583
Flt Permitted	1.00	1.00	0.75	1.00	0.95	1.00
Satd. Flow (perm)	1863	1583	1402	1863	1770	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	8	707	685	550	100	65
RTOR Reduction (vph)	0	257	0	0	0	53
Lane Group Flow (vph)	8	450	685	550	100	12
Turn Type	NA	Perm	Perm	NA	Prot	Perm
Protected Phases	4			8	2	
Permitted Phases		4	8			2
Actuated Green, G (s)	28.6	28.6	28.6	28.6	8.3	8.3
Effective Green, g (s)	28.6	28.6	28.6	28.6	8.3	8.3
Actuated g/C Ratio	0.64	0.64	0.64	0.64	0.18	0.18
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	1186	1008	893	1186	327	292
v/s Ratio Prot	0.00			0.30	c0.06	
v/s Ratio Perm		0.28	c0.49			0.01
v/c Ratio	0.01	0.45	0.77	0.46	0.31	0.04
Uniform Delay, d1	3.0	4.1	5.8	4.2	15.8	15.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.0	0.3	4.0	0.3	0.5	0.1
Delay (s)	3.0	4.5	9.8	4.5	16.3	15.1
Level of Service	A	A	A	A	B	B
Approach Delay (s)	4.4			7.4	15.8	
Approach LOS	A			A	B	

Intersection Summary

HCM 2000 Control Delay	7.1	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.66		
Actuated Cycle Length (s)	44.9	Sum of lost time (s)	8.0
Intersection Capacity Utilization	81.8%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 49: Greenville Rd & Southfront Rd



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	119	170	126	418	755	215
Future Volume (vph)	119	170	126	418	755	215
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.2	5.2	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.88	0.97	0.95	0.95	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	3433	2787	3433	3539	3539	1583
Flt Permitted	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (perm)	3433	2787	3433	3539	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	129	185	137	454	821	234
RTOR Reduction (vph)	0	164	0	0	0	116
Lane Group Flow (vph)	129	21	137	454	821	118
Turn Type	Prot	Perm	Prot	NA	NA	Perm
Protected Phases	8		1	6	2	
Permitted Phases		8				2
Actuated Green, G (s)	5.4	5.4	3.2	27.2	20.0	20.0
Effective Green, g (s)	4.8	4.8	3.2	28.9	21.7	21.7
Actuated g/C Ratio	0.11	0.11	0.07	0.67	0.51	0.51
Clearance Time (s)	4.6	4.6	4.0	5.7	5.7	5.7
Vehicle Extension (s)	5.0	5.0	6.0	2.5	2.5	2.5
Lane Grp Cap (vph)	384	311	256	2384	1790	800
v/s Ratio Prot	c0.04		c0.04	0.13	c0.23	
v/s Ratio Perm		0.01				0.07
v/c Ratio	0.34	0.07	0.54	0.19	0.46	0.15
Uniform Delay, d1	17.6	17.0	19.1	2.6	6.8	5.7
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.1	0.2	5.0	0.0	0.1	0.1
Delay (s)	18.7	17.2	24.2	2.6	7.0	5.7
Level of Service	B	B	C	A	A	A
Approach Delay (s)	17.8			7.6	6.7	
Approach LOS	B			A	A	

Intersection Summary

HCM 2000 Control Delay	8.8	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.45		
Actuated Cycle Length (s)	42.9	Sum of lost time (s)	13.2
Intersection Capacity Utilization	38.9%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
50: Greenville Rd & Patterson Pass Rd

BART to Livermore Extension Project
2040 Express Bus AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	41	6	72	254	406	327	17	145	1	6	341	48
Future Volume (vph)	41	6	72	254	406	327	17	145	1	6	341	48
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.86		1.00	0.93		1.00	1.00		1.00	0.98	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1606		1770	1738		1770	1861		1770	1828	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	1606		1770	1738		1770	1861		1770	1828	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	45	7	78	276	441	355	18	158	1	7	371	52
RTOR Reduction (vph)	0	60	0	0	32	0	0	0	0	0	6	0
Lane Group Flow (vph)	45	25	0	276	764	0	18	159	0	7	417	0
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												
Actuated Green, G (s)	2.2	18.7		21.8	38.3		1.4	26.0		0.7	25.3	
Effective Green, g (s)	2.2	18.7		21.8	38.3		1.4	26.0		0.7	25.3	
Actuated g/C Ratio	0.03	0.22		0.26	0.46		0.02	0.31		0.01	0.30	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	46	360		463	800		29	581		14	555	
v/s Ratio Prot	0.03	0.02		c0.16	c0.44		c0.01	0.09		0.00	c0.23	
v/s Ratio Perm												
v/c Ratio	0.98	0.07		0.60	0.95		0.62	0.27		0.50	0.75	
Uniform Delay, d1	40.5	25.4		26.8	21.6		40.6	21.5		41.1	26.1	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	123.3	0.1		2.1	21.3		34.8	1.2		25.4	9.1	
Delay (s)	163.7	25.5		28.9	42.9		75.4	22.7		66.5	35.2	
Level of Service	F	C		C	D		E	C		E	D	
Approach Delay (s)		73.3			39.3			28.0			35.7	
Approach LOS		E			D			C			D	

Intersection Summary

HCM 2000 Control Delay	39.8	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.87		
Actuated Cycle Length (s)	83.2	Sum of lost time (s)	16.0
Intersection Capacity Utilization	68.9%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
1: Dougherty Rd & Amador Valley Rd



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	398	468	819	2122	1132	316
Future Volume (vph)	398	468	819	2122	1132	316
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00	0.97	0.91	0.91	
Frt	1.00	0.85	1.00	1.00	0.97	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1770	1583	3433	5085	4919	
Flt Permitted	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	1770	1583	3433	5085	4919	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	433	509	890	2307	1230	343
RTOR Reduction (vph)	0	368	0	0	41	0
Lane Group Flow (vph)	433	141	890	2307	1532	0
Turn Type	Perm	Perm	Prot	NA	NA	
Protected Phases			5	2	6	
Permitted Phases	4	4				
Actuated Green, G (s)	31.4	31.4	32.5	76.4	39.9	
Effective Green, g (s)	31.4	31.4	32.5	76.4	39.9	
Actuated g/C Ratio	0.27	0.27	0.28	0.66	0.34	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	479	429	963	3354	1694	
v/s Ratio Prot			c0.26	0.45	c0.31	
v/s Ratio Perm	c0.24	0.09				
v/c Ratio	0.90	0.33	0.92	0.69	0.90	
Uniform Delay, d1	40.7	33.8	40.5	12.3	36.1	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	20.2	0.5	14.1	0.6	7.2	
Delay (s)	61.0	34.2	54.5	12.9	43.3	
Level of Service	E	C	D	B	D	
Approach Delay (s)	46.5			24.5	43.3	
Approach LOS	D			C	D	

Intersection Summary

HCM 2000 Control Delay	33.3	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.91		
Actuated Cycle Length (s)	115.8	Sum of lost time (s)	12.0
Intersection Capacity Utilization	84.3%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
2: Hopyard Road/Dougherty Rd & Dublin Blvd

BART to Livermore Extension Project
2040 Express Bus PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↑↑↑	↖↗	↖↗↘	↑↑↑	↖	↖↗↘	↑↑↑	↖↗	↖↗	↑↑↑↘	
Traffic Volume (vph)	95	1153	896	632	1055	931	846	2009	322	704	1221	39
Future Volume (vph)	95	1153	896	632	1055	931	846	2009	322	704	1221	39
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	6.0	5.0	5.0	5.5	5.0	5.0	5.5	5.0	5.0	5.5	
Lane Util. Factor	0.97	0.91	0.88	0.94	0.91	1.00	0.94	0.91	0.88	0.97	0.86	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	3433	5085	2787	4990	5085	1583	4990	5085	2787	3433	6378	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	3433	5085	2787	4990	5085	1583	4990	5085	2787	3433	6378	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	103	1253	974	687	1147	1012	920	2184	350	765	1327	42
RTOR Reduction (vph)	0	0	60	0	0	70	0	0	57	0	4	0
Lane Group Flow (vph)	103	1253	914	687	1147	942	920	2184	293	765	1365	0
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	
Protected Phases	5	2	3	1	6	7	3	8	1	7	4	
Permitted Phases			2			6			8			
Actuated Green, G (s)	17.2	35.5	55.3	19.0	37.8	51.8	19.8	45.0	64.0	14.0	39.2	
Effective Green, g (s)	17.2	35.5	55.3	19.0	37.8	51.8	19.8	45.0	64.0	14.0	39.2	
Actuated g/C Ratio	0.13	0.26	0.41	0.14	0.28	0.38	0.15	0.33	0.47	0.10	0.29	
Clearance Time (s)	5.0	6.0	5.0	5.0	5.5	5.0	5.0	5.5	5.0	5.0	5.5	
Vehicle Extension (s)	2.0	4.5	2.0	2.0	4.5	2.0	2.0	4.5	2.0	2.0	4.5	
Lane Grp Cap (vph)	437	1337	1141	702	1423	607	731	1695	1321	356	1851	
v/s Ratio Prot	0.03	c0.25	0.12	0.14	0.23	c0.16	0.18	c0.43	0.03	c0.22	0.21	
v/s Ratio Perm			0.21			0.43			0.07			
v/c Ratio	0.24	0.94	0.80	0.98	0.81	1.55	1.26	1.29	0.22	2.15	0.74	
Uniform Delay, d1	53.0	48.7	35.0	57.8	45.2	41.6	57.6	45.0	20.9	60.5	43.3	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.1	12.7	3.9	28.2	3.8	256.7	127.3	134.4	0.0	526.3	1.8	
Delay (s)	53.1	61.4	38.9	86.0	49.0	298.3	184.9	179.4	20.9	586.8	45.0	
Level of Service	D	E	D	F	D	F	F	F	C	F	D	
Approach Delay (s)		51.6			146.6			164.8			239.2	
Approach LOS		D			F			F			F	

Intersection Summary

HCM 2000 Control Delay	150.2	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.45		
Actuated Cycle Length (s)	135.0	Sum of lost time (s)	21.5
Intersection Capacity Utilization	121.9%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 3: Dougherty Rd/Hopyard Road & I-580 WB Ramps

BART to Livermore Extension Project
 2040 Express Bus PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↔↔		↔↔		↑↑↑			↑↑↑	↔
Traffic Volume (vph)	0	0	0	323	0	660	0	2545	0	0	1652	0
Future Volume (vph)	0	0	0	323	0	660	0	2545	0	0	1652	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0		4.0		4.0			4.0	
Lane Util. Factor				0.97		0.88		0.91			0.86	
Frt				1.00		0.85		1.00			1.00	
Flt Protected				0.95		1.00		1.00			1.00	
Satd. Flow (prot)				3433		2787		5085			4806	
Flt Permitted				0.95		1.00		1.00			1.00	
Satd. Flow (perm)				3433		2787		5085			4806	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	351	0	717	0	2766	0	0	1796	0
RTOR Reduction (vph)	0	0	0	0	0	17	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	351	0	700	0	2766	0	0	1796	0
Turn Type				Prot		Prot		NA			NA	Perm
Protected Phases				4		4		2			6	
Permitted Phases												6
Actuated Green, G (s)				30.4		30.4		68.8			68.8	
Effective Green, g (s)				31.8		31.8		70.2			70.2	
Actuated g/C Ratio				0.29		0.29		0.64			0.64	
Clearance Time (s)				5.4		5.4		5.4			5.4	
Vehicle Extension (s)				3.0		3.0		3.0			3.0	
Lane Grp Cap (vph)				992		805		3245			3067	
v/s Ratio Prot				0.10		c0.25		c0.54			0.37	
v/s Ratio Perm												
v/c Ratio				0.35		0.87		0.85			0.59	
Uniform Delay, d1				31.0		37.1		15.8			11.5	
Progression Factor				1.00		1.00		1.08			1.00	
Incremental Delay, d2				0.2		9.9		0.3			0.8	
Delay (s)				31.2		47.0		17.4			12.3	
Level of Service				C		D		B			B	
Approach Delay (s)		0.0			41.8			17.4			12.3	
Approach LOS		A			D			B			B	

Intersection Summary

HCM 2000 Control Delay	20.4	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.86		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	78.9%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
4: Hopyard Rd/Dougherty Rd & I-580 EB Ramps

BART to Livermore Extension Project
2040 Express Bus PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗		↖↗					↑↑↑	↖		↑↑↑	↖
Traffic Volume (vph)	1170	0	973	0	0	0	0	2645	0	0	1308	0
Future Volume (vph)	1170	0	973	0	0	0	0	2645	0	0	1308	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0					4.0			4.0	
Lane Util. Factor	0.97		0.88					0.91			0.86	
Frt	1.00		0.85					1.00			1.00	
Flt Protected	0.95		1.00					1.00			1.00	
Satd. Flow (prot)	3433		2787					5085			4806	
Flt Permitted	0.95		1.00					1.00			1.00	
Satd. Flow (perm)	3433		2787					5085			4806	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	1272	0	1058	0	0	0	0	2875	0	0	1422	0
RTOR Reduction (vph)	0	0	41	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	1272	0	1017	0	0	0	0	2875	0	0	1422	0
Turn Type	Prot		Prot					NA	Free		NA	Perm
Protected Phases	4		4					2			6	
Permitted Phases									Free			6
Actuated Green, G (s)	38.6		38.6					60.6			60.6	
Effective Green, g (s)	40.0		40.0					62.0			62.0	
Actuated g/C Ratio	0.36		0.36					0.56			0.56	
Clearance Time (s)	5.4		5.4					5.4			5.4	
Vehicle Extension (s)	3.0		3.0					3.0			3.0	
Lane Grp Cap (vph)	1248		1013					2866			2708	
v/s Ratio Prot	c0.37		0.37					c0.57			0.30	
v/s Ratio Perm												
v/c Ratio	1.02		1.00					1.00			0.53	
Uniform Delay, d1	35.0		35.0					24.0			14.9	
Progression Factor	1.00		1.00					1.00			0.71	
Incremental Delay, d2	30.4		29.3					17.6			0.6	
Delay (s)	65.4		64.3					41.6			11.2	
Level of Service	E		E					D			B	
Approach Delay (s)		64.9			0.0			41.6			11.2	
Approach LOS		E			A			D			B	

Intersection Summary

HCM 2000 Control Delay	43.2	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	1.01		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	91.1%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

5: Hopyard Rd & Owens Rd

BART to Livermore Extension Project
2040 Express Bus PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	388	277	249	535	299	373	240	974	300	488	1576	265
Future Volume (vph)	388	277	249	535	299	373	240	974	300	488	1576	265
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	2.7	2.7		2.7	2.7	2.7	4.0	2.3	2.3	4.0	2.3	
Lane Util. Factor	0.91	0.91		1.00	0.95	0.95	1.00	0.91	1.00	0.97	0.91	
Frt	1.00	0.95		1.00	0.96	0.85	1.00	1.00	0.85	1.00	0.98	
Flt Protected	0.95	0.99		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1610	3170		1770	1695	1504	1770	5085	1583	3433	4976	
Flt Permitted	0.95	0.99		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1610	3170		1770	1695	1504	1770	5085	1583	3433	4976	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	422	301	271	582	325	405	261	1059	326	530	1713	288
RTOR Reduction (vph)	0	55	0	0	12	24	0	0	230	0	19	0
Lane Group Flow (vph)	232	707	0	582	439	255	261	1059	96	530	1982	0
Turn Type	Split	NA		Split	NA	pm+ov	Prot	NA	Perm	Prot	NA	
Protected Phases	8	8		4	4	1	5	2		1	6	
Permitted Phases						4			2			
Actuated Green, G (s)	18.0	18.0		29.0	29.0	52.5	14.0	33.5	33.5	23.5	43.0	
Effective Green, g (s)	19.3	19.3		30.3	30.3	55.1	14.0	35.2	35.2	23.5	44.7	
Actuated g/C Ratio	0.16	0.16		0.25	0.25	0.46	0.12	0.29	0.29	0.20	0.37	
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	258	509		446	427	724	206	1491	464	672	1853	
v/s Ratio Prot	0.14	c0.22		c0.33	0.26	0.07	c0.15	0.21		0.15	c0.40	
v/s Ratio Perm						0.10			0.06			
v/c Ratio	0.90	1.39		1.30	1.03	0.35	1.27	0.71	0.21	0.79	1.07	
Uniform Delay, d1	49.4	50.4		44.9	44.9	20.9	53.0	37.8	31.9	45.9	37.6	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	30.6	187.3		152.7	51.0	0.3	152.8	2.9	1.0	6.1	42.3	
Delay (s)	80.0	237.6		197.6	95.8	21.2	205.8	40.7	32.9	52.0	79.9	
Level of Service	F	F		F	F	C	F	D	C	D	E	
Approach Delay (s)		200.8			125.1			65.4			74.1	
Approach LOS		F			F			E			E	

Intersection Summary

HCM 2000 Control Delay	101.6	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.21		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	11.7
Intersection Capacity Utilization	110.6%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

6: Hopyard Rd & Stoneridge Dr

BART to Livermore Extension Project
2040 Express Bus PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	271	1172	699	121	1364	196	620	862	89	263	912	204
Future Volume (vph)	271	1172	699	121	1364	196	620	862	89	263	912	204
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.91	1.00	0.97	0.91	1.00	0.94	0.95	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5085	1583	3433	5085	1583	4990	3539	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5085	1583	3433	5085	1583	4990	3539	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	295	1274	760	132	1483	213	674	937	97	286	991	222
RTOR Reduction (vph)	0	0	158	0	0	154	0	0	68	0	0	126
Lane Group Flow (vph)	295	1274	602	132	1483	59	674	937	29	286	991	96
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8			2			6
Actuated Green, G (s)	5.0	18.6	18.6	3.2	16.8	16.8	6.0	18.0	18.0	5.0	17.0	17.0
Effective Green, g (s)	5.0	18.6	18.6	3.2	16.8	16.8	6.0	18.0	18.0	5.0	17.0	17.0
Actuated g/C Ratio	0.08	0.31	0.31	0.05	0.28	0.28	0.10	0.30	0.30	0.08	0.28	0.28
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	282	1555	484	180	1405	437	492	1047	468	282	1421	442
v/s Ratio Prot	c0.09	0.25		0.04	0.29		c0.14	c0.26		0.08	0.19	
v/s Ratio Perm			c0.38			0.04			0.02			0.06
v/c Ratio	1.05	0.82	1.24	0.73	1.06	0.13	1.37	0.89	0.06	1.01	0.70	0.22
Uniform Delay, d1	27.9	19.5	21.1	28.4	22.0	16.5	27.4	20.5	15.3	27.9	19.6	16.8
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	66.2	3.5	126.6	14.3	40.1	0.1	179.1	10.0	0.1	57.3	1.5	0.2
Delay (s)	94.1	23.0	147.7	42.7	62.1	16.7	206.5	30.5	15.4	85.2	21.1	17.0
Level of Service	F	C	F	D	E	B	F	C	B	F	C	B
Approach Delay (s)		72.7			55.4			99.1			32.7	
Approach LOS		E			E			F			C	




































Intersection Summary

HCM 2000 Control Delay	66.4	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.17		
Actuated Cycle Length (s)	60.8	Sum of lost time (s)	16.0
Intersection Capacity Utilization	78.7%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
7: Hopyard Rd & Las Positas Blvd

BART to Livermore Extension Project
2040 Express Bus PM

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations	 	 		 	 		 	  		  	  		
Traffic Volume (vph)	103	261	493	600	419	50	381	1002	264	72	1527	74	
Future Volume (vph)	103	261	493	600	419	50	381	1002	264	72	1527	74	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	0.97	0.95	1.00	0.97	0.95	1.00	0.97	0.91	1.00	0.97	0.91	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	3433	3539	1583	3433	3539	1583	3433	5085	1583	3433	5085	1583	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	3433	3539	1583	3433	3539	1583	3433	5085	1583	3433	5085	1583	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	
Adj. Flow (vph)	112	284	536	652	455	54	414	1089	287	78	1660	80	
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	52	
Lane Group Flow (vph)	112	284	536	652	455	54	414	1089	287	78	1660	28	
Turn Type	Prot	NA	Free	Prot	NA	Free	Prot	NA	Free	Prot	NA	Perm	
Protected Phases	7	4		3	8		5	2		1	6		
Permitted Phases			Free			Free			Free			6	
Actuated Green, G (s)	4.8	13.0	87.9	17.0	25.2	87.9	11.0	37.9	87.9	4.0	30.9	30.9	
Effective Green, g (s)	4.8	13.0	87.9	17.0	25.2	87.9	11.0	37.9	87.9	4.0	30.9	30.9	
Actuated g/C Ratio	0.05	0.15	1.00	0.19	0.29	1.00	0.13	0.43	1.00	0.05	0.35	0.35	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0	
Lane Grp Cap (vph)	187	523	1583	663	1014	1583	429	2192	1583	156	1787	556	
v/s Ratio Prot	0.03	c0.08		c0.19	0.13		c0.12	0.21		0.02	c0.33		
v/s Ratio Perm			0.34			0.03			0.18			0.02	
v/c Ratio	0.60	0.54	0.34	0.98	0.45	0.03	0.97	0.50	0.18	0.50	0.93	0.05	
Uniform Delay, d1	40.6	34.7	0.0	35.3	25.7	0.0	38.3	18.1	0.0	41.0	27.4	18.8	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	5.1	1.2	0.6	30.6	0.3	0.0	34.2	0.2	0.3	2.5	9.0	0.0	
Delay (s)	45.7	35.9	0.6	65.9	26.0	0.0	72.4	18.3	0.3	43.5	36.4	18.9	
Level of Service	D	D	A	E	C	A	E	B	A	D	D	B	
Approach Delay (s)		16.8			47.2			27.9			35.9		
Approach LOS		B			D			C			D		
Intersection Summary													
HCM 2000 Control Delay			32.6			HCM 2000 Level of Service			C				
HCM 2000 Volume to Capacity ratio			0.88										
Actuated Cycle Length (s)			87.9	Sum of lost time (s)					16.0				
Intersection Capacity Utilization			78.0%	ICU Level of Service			D						
Analysis Period (min)			15										

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
8: Willow Rd & Owens Rd

BART to Livermore Extension Project
2040 Express Bus PM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	86	829	191	124	690	79	188	77	0	192	67	121
Future Volume (vph)	86	829	191	124	690	79	188	77	0	192	67	121
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	5.3	4.0		5.3	4.0	4.0
Lane Util. Factor	0.97	0.91		0.97	0.91	1.00	1.00	0.95		1.00	1.00	1.00
Frt	1.00	0.97		1.00	1.00	0.85	1.00	1.00		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	4942		3433	5085	1583	1770	3539		1770	1863	1583
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.71	1.00		0.70	1.00	1.00
Satd. Flow (perm)	3433	4942		3433	5085	1583	1322	3539		1303	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	93	901	208	135	750	86	204	84	0	209	73	132
RTOR Reduction (vph)	0	25	0	0	0	39	0	0	0	0	0	102
Lane Group Flow (vph)	93	1084	0	135	750	47	204	84	0	209	73	30
Turn Type	Prot	NA		Prot	NA	Perm	Perm	NA	Perm	Perm	NA	Perm
Protected Phases	1	6		5	2			4			8	
Permitted Phases						2	4		4	8		8
Actuated Green, G (s)	13.4	60.9		10.5	58.0	58.0	23.6	23.6		23.6	23.6	23.6
Effective Green, g (s)	13.4	62.6		10.5	59.7	59.7	23.6	24.9		23.6	24.9	24.9
Actuated g/C Ratio	0.12	0.57		0.10	0.54	0.54	0.21	0.23		0.21	0.23	0.23
Clearance Time (s)	4.0	5.7		4.0	5.7	5.7	5.3	5.3		5.3	5.3	5.3
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	418	2812		327	2759	859	283	801		279	421	358
v/s Ratio Prot	c0.03	c0.22		c0.04	0.15			0.02			0.04	
v/s Ratio Perm						0.03	0.15			c0.16		0.02
v/c Ratio	0.22	0.39		0.41	0.27	0.05	0.72	0.10		0.75	0.17	0.08
Uniform Delay, d1	43.6	13.1		46.8	13.5	11.8	40.1	33.7		40.4	34.3	33.6
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	0.3	0.4		0.8	0.2	0.1	8.7	0.1		10.5	0.2	0.1
Delay (s)	43.9	13.5		47.7	13.7	12.0	48.9	33.8		50.9	34.5	33.7
Level of Service	D	B		D	B	B	D	C		D	C	C
Approach Delay (s)		15.8			18.3			44.5			42.5	
Approach LOS		B			B			D			D	

Intersection Summary		
HCM 2000 Control Delay	23.4	HCM 2000 Level of Service C
HCM 2000 Volume to Capacity ratio	0.47	
Actuated Cycle Length (s)	110.0	Sum of lost time (s) 12.0
Intersection Capacity Utilization	51.1%	ICU Level of Service A
Analysis Period (min)	15	








































c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

9: Hacienda Dr & Dublin Blvd

BART to Livermore Extension Project

2040 Express Bus PM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 	  	 	 	  		  	 	  	  	  	
Traffic Volume (vph)	49	1048	164	240	603	27	389	652	553	38	693	215
Future Volume (vph)	49	1048	164	240	603	27	389	652	553	38	693	215
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	6.0	5.0	4.5	6.0		5.0	6.0	6.0	4.5	5.5	5.5
Lane Util. Factor	0.97	0.91	0.88	0.97	0.91		0.94	0.95	0.88	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5085	2787	3433	5053		4990	3539	2787	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5085	2787	3433	5053		4990	3539	2787	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	53	1139	178	261	655	29	423	709	601	41	753	234
RTOR Reduction (vph)	0	0	62	0	4	0	0	0	200	0	0	159
Lane Group Flow (vph)	53	1139	116	261	680	0	423	709	401	41	753	75
Turn Type	Prot	NA	pm+ov	Prot	NA		Prot	NA	Perm	Prot	NA	Perm
Protected Phases	5	2	3	1	6		3	8		7	4	
Permitted Phases			2						8			4
Actuated Green, G (s)	4.1	32.3	44.6	10.0	38.2		12.3	34.1	34.1	2.2	24.0	24.0
Effective Green, g (s)	4.1	32.3	44.6	10.0	38.2		12.3	34.1	34.1	2.2	24.0	24.0
Actuated g/C Ratio	0.04	0.32	0.45	0.10	0.38		0.12	0.34	0.34	0.02	0.24	0.24
Clearance Time (s)	4.5	6.0	5.0	4.5	6.0		5.0	6.0	6.0	4.5	5.5	5.5
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	141	1649	1387	344	1937		616	1211	954	75	1225	381
v/s Ratio Prot	0.02	c0.22	0.01	c0.08	0.13		c0.08	0.20		0.01	c0.15	
v/s Ratio Perm			0.03						0.14			0.05
v/c Ratio	0.38	0.69	0.08	0.76	0.35		0.69	0.59	0.42	0.55	0.61	0.20
Uniform Delay, d1	46.5	29.3	15.8	43.6	21.9		41.8	26.9	25.2	48.2	33.7	30.1
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.7	1.3	0.0	9.2	0.1		3.2	0.7	0.3	7.9	0.9	0.3
Delay (s)	48.2	30.6	15.8	52.9	22.0		45.0	27.7	25.5	56.1	34.6	30.4
Level of Service	D	C	B	D	C		D	C	C	E	C	C
Approach Delay (s)		29.3			30.5			31.1			34.5	
Approach LOS		C			C			C			C	
Intersection Summary												
HCM 2000 Control Delay			31.2			HCM 2000 Level of Service			C			
HCM 2000 Volume to Capacity ratio			0.68									
Actuated Cycle Length (s)			99.6			Sum of lost time (s)			21.0			
Intersection Capacity Utilization			66.0%			ICU Level of Service			C			
Analysis Period (min)			15									

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 10: Hacienda Dr & Martinelli Blvd/Hacienda Crossings

BART to Livermore Extension Project
 2040 Express Bus PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗	↘	↙	↘		↖↗↘	↖↗↘	↖	↙↘	↖↗↘	
Traffic Volume (vph)	32	55	499	286	39	22	527	1572	466	56	1009	86
Future Volume (vph)	32	55	499	286	39	22	527	1572	466	56	1009	86
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	2.0	2.0	4.5	2.0		3.0	2.0	2.0	4.5	2.5	
Lane Util. Factor	1.00	0.91	0.91	0.97	1.00		0.94	0.91	1.00	0.97	0.86	
Frt	1.00	0.93	0.85	1.00	0.95		1.00	1.00	0.85	1.00	0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1770	1575	2882	3433	1761		4990	5085	1583	3433	6333	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1770	1575	2882	3433	1761		4990	5085	1583	3433	6333	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	35	60	542	311	42	24	573	1709	507	61	1097	93
RTOR Reduction (vph)	0	38	264	0	18	0	0	0	163	0	10	0
Lane Group Flow (vph)	35	76	224	311	48	0	573	1709	344	61	1180	0
Turn Type	Prot	NA	Perm	Prot	NA		Prot	NA	pm+ov	Prot	NA	
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases			2						8			
Actuated Green, G (s)	3.6	17.2	17.2	13.8	27.4		13.9	56.8	70.6	6.2	49.1	
Effective Green, g (s)	3.1	19.2	19.2	13.3	29.4		14.9	58.8	74.6	5.7	50.6	
Actuated g/C Ratio	0.03	0.17	0.17	0.12	0.27		0.14	0.53	0.68	0.05	0.46	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	4.0	4.0	2.0	4.0		3.0	4.0	2.0	3.0	4.0	
Lane Grp Cap (vph)	49	274	503	415	470		675	2718	1102	177	2913	
v/s Ratio Prot	0.02	0.05		c0.09	0.03		c0.11	c0.34	0.04	0.02	c0.19	
v/s Ratio Perm			c0.08						0.17			
v/c Ratio	0.71	0.28	0.45	0.75	0.10		0.85	0.63	0.31	0.34	0.41	
Uniform Delay, d1	53.0	39.4	40.6	46.7	30.4		46.5	17.9	7.2	50.3	19.7	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.02	1.05	1.91	1.00	1.00	
Incremental Delay, d2	39.0	0.8	0.9	6.4	0.1		6.6	0.7	0.0	1.2	0.4	
Delay (s)	92.0	40.1	41.5	53.1	30.5		54.3	19.6	13.8	51.5	20.1	
Level of Service	F	D	D	D	C		D	B	B	D	C	
Approach Delay (s)		44.0			49.2			25.6			21.7	
Approach LOS		D			D			C			C	

Intersection Summary		
HCM 2000 Control Delay	28.7	HCM 2000 Level of Service C
HCM 2000 Volume to Capacity ratio	0.61	
Actuated Cycle Length (s)	110.0	Sum of lost time (s) 13.0
Intersection Capacity Utilization	67.7%	ICU Level of Service C
Analysis Period (min)	15	

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 11: Hacienda Dr & I-580 WB Ramps

BART to Livermore Extension Project
 2040 Express Bus PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↔↔		↔↔		↑↑↑			↑↑↑	↔
Traffic Volume (vph)	0	0	0	415	0	529	0	1776	810	0	955	796
Future Volume (vph)	0	0	0	415	0	529	0	1776	810	0	955	796
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				2.6		2.6		2.1			2.1	2.1
Lane Util. Factor				0.97		0.88		0.91			0.86	0.86
Frt				1.00		0.85		0.95			0.96	0.85
Flt Protected				0.95		1.00		1.00			1.00	1.00
Satd. Flow (prot)				3433		2787		4846			4594	1362
Flt Permitted				0.95		1.00		1.00			1.00	1.00
Satd. Flow (perm)				3433		2787		4846			4594	1362
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	451	0	575	0	1930	880	0	1038	865
RTOR Reduction (vph)	0	0	0	0	0	25	0	147	0	0	135	148
Lane Group Flow (vph)	0	0	0	451	0	550	0	2663	0	0	1336	284
Turn Type				Prot		Prot		NA			NA	Perm
Protected Phases				4		4		2			6	
Permitted Phases												6
Actuated Green, G (s)				12.7		12.7		34.3			34.3	34.3
Effective Green, g (s)				14.1		14.1		36.2			36.2	36.2
Actuated g/C Ratio				0.26		0.26		0.66			0.66	0.66
Clearance Time (s)				4.0		4.0		4.0			4.0	4.0
Vehicle Extension (s)				3.0		3.0		3.0			3.0	3.0
Lane Grp Cap (vph)				880		714		3189			3023	896
v/s Ratio Prot				0.13		c0.20		c0.55			0.29	
v/s Ratio Perm												0.21
v/c Ratio				0.51		0.77		0.84			0.44	0.32
Uniform Delay, d1				17.5		18.9		7.1			4.5	4.1
Progression Factor				1.00		1.00		0.84			0.62	1.27
Incremental Delay, d2				0.5		5.0		1.7			0.4	0.9
Delay (s)				18.0		24.0		7.7			3.2	6.0
Level of Service				B		C		A			A	A
Approach Delay (s)		0.0			21.4			7.7			3.9	
Approach LOS		A			C			A			A	

Intersection Summary			
HCM 2000 Control Delay	8.9	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.81		
Actuated Cycle Length (s)	55.0	Sum of lost time (s)	4.7
Intersection Capacity Utilization	77.6%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

























HCM Signalized Intersection Capacity Analysis
 12: Hacienda Dr & I-580 EB Ramps

BART to Livermore Extension Project
 2040 Express Bus PM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	898	0	467	0	0	0	0	1847	582	0	947	313
Future Volume (vph)	898	0	467	0	0	0	0	1847	582	0	947	313
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0					4.0	4.0		4.0	
Lane Util. Factor	0.97		0.88					0.86	0.86		0.91	
Frt	1.00		0.85					0.99	0.85		0.96	
Flt Protected	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (prot)	3433		2787					4742	1362		4896	
Flt Permitted	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (perm)	3433		2787					4742	1362		4896	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	976	0	508	0	0	0	0	2008	633	0	1029	340
RTOR Reduction (vph)	0	0	108	0	0	0	0	9	180	0	50	0
Lane Group Flow (vph)	976	0	400	0	0	0	0	2195	257	0	1319	0
Turn Type	Prot		Prot					NA	Perm		NA	
Protected Phases	4		4					2			6	
Permitted Phases									2			
Actuated Green, G (s)	35.9		35.9					62.8	62.8		62.8	
Effective Green, g (s)	37.3		37.3					64.7	64.7		64.7	
Actuated g/C Ratio	0.34		0.34					0.59	0.59		0.59	
Clearance Time (s)	5.4		5.4					5.9	5.9		5.9	
Vehicle Extension (s)	2.0		2.0					2.0	2.0		2.0	
Lane Grp Cap (vph)	1164		945					2789	801		2879	
v/s Ratio Prot	c0.28		0.14					c0.46			0.27	
v/s Ratio Perm									0.19			
v/c Ratio	0.84		0.42					0.79	0.32		0.46	
Uniform Delay, d1	33.6		28.1					17.4	11.5		12.8	
Progression Factor	1.00		1.00					1.00	1.00		0.70	
Incremental Delay, d2	5.2		0.1					2.3	1.1		0.5	
Delay (s)	38.8		28.2					19.7	12.6		9.3	
Level of Service	D		C					B	B		A	
Approach Delay (s)		35.1			0.0			18.5			9.3	
Approach LOS		D			A			B			A	
Intersection Summary												
HCM 2000 Control Delay			20.7					HCM 2000 Level of Service			C	
HCM 2000 Volume to Capacity ratio			0.81									
Actuated Cycle Length (s)			110.0					Sum of lost time (s)			8.0	
Intersection Capacity Utilization			72.3%					ICU Level of Service			C	
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis
 13: Hacienda Dr & Owens Rd

BART to Livermore Extension Project
 2040 Express Bus PM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	679	977	56	148	369	874	28	731	272	609	511	278
Future Volume (vph)	679	977	56	148	369	874	28	731	272	609	511	278
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	2.3	4.0	4.0	2.3	4.0	4.0	2.7	4.0	4.0	2.7
Lane Util. Factor	0.97	0.91	1.00	0.97	0.91	1.00	0.97	0.91	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5085	1583	3433	5085	1583	3433	5085	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5085	1583	3433	5085	1583	3433	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	738	1062	61	161	401	950	30	795	296	662	555	302
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	738	1062	61	161	401	950	30	795	296	662	555	302
Turn Type	Prot	NA	Free	Prot	NA	Free	Prot	NA	Free	Prot	NA	Free
Protected Phases	1	6		5	2		7	4		3	8	
Permitted Phases			Free			Free			Free			Free
Actuated Green, G (s)	33.4	38.6	115.0	9.4	14.6	115.0	2.4	23.8	115.0	24.2	45.6	115.0
Effective Green, g (s)	33.4	40.3	115.0	9.4	16.3	115.0	2.4	25.1	115.0	24.2	46.9	115.0
Actuated g/C Ratio	0.29	0.35	1.00	0.08	0.14	1.00	0.02	0.22	1.00	0.21	0.41	1.00
Clearance Time (s)	4.0	5.7		4.0	5.7		4.0	5.3		4.0	5.3	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	997	1781	1583	280	720	1583	71	1109	1583	722	2073	1583
v/s Ratio Prot	c0.21	0.21		0.05	0.08		0.01	c0.16		c0.19	0.11	
v/s Ratio Perm			0.04			c0.60			0.19			0.19
v/c Ratio	0.74	0.60	0.04	0.57	0.56	0.60	0.42	0.72	0.19	0.92	0.27	0.19
Uniform Delay, d1	36.9	30.7	0.0	50.9	46.0	0.0	55.6	41.7	0.0	44.4	22.6	0.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	3.0	0.5	0.0	2.8	0.9	1.7	4.0	4.0	0.3	16.4	0.3	0.3
Delay (s)	39.9	31.2	0.0	53.7	46.9	1.7	59.6	45.6	0.3	60.8	23.0	0.3
Level of Service	D	C	A	D	D	A	E	D	A	E	C	A
Approach Delay (s)		33.6			19.2			34.0			34.9	
Approach LOS		C			B			C			C	
Intersection Summary												
HCM 2000 Control Delay			30.4			HCM 2000 Level of Service				C		
HCM 2000 Volume to Capacity ratio			0.79									
Actuated Cycle Length (s)			115.0			Sum of lost time (s)			16.0			
Intersection Capacity Utilization			71.3%			ICU Level of Service				C		
Analysis Period (min)			15									

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 14: Tassajara Rd & Dublin Blvd

BART to Livermore Extension Project
 2040 Express Bus PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	272	1073	460	289	364	25	397	925	643	40	803	149
Future Volume (vph)	272	1073	460	289	364	25	397	925	643	40	803	149
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	6.0	6.0	5.0	6.0		5.0	6.0	6.0	5.0	5.7	5.7
Lane Util. Factor	0.97	0.86	0.88	0.94	0.91		0.94	0.86	1.00	0.97	0.86	0.88
Frt	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	6408	2787	4990	5037		4990	6408	1583	3433	6408	2787
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	6408	2787	4990	5037		4990	6408	1583	3433	6408	2787
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	296	1166	500	314	396	27	432	1005	699	43	873	162
RTOR Reduction (vph)	0	0	282	0	5	0	0	0	229	0	0	129
Lane Group Flow (vph)	296	1166	218	314	418	0	432	1005	470	43	873	33
Turn Type	Prot	NA	Perm	Prot	NA		Prot	NA	Perm	Prot	NA	Perm
Protected Phases	5	2		1	6		3	8		7		4
Permitted Phases			2						8			4
Actuated Green, G (s)	16.4	40.6	40.6	16.4	40.6		31.7	48.9	48.9	11.2	28.7	28.7
Effective Green, g (s)	16.4	40.6	40.6	16.4	40.6		31.7	48.9	48.9	11.2	28.7	28.7
Actuated g/C Ratio	0.12	0.29	0.29	0.12	0.29		0.23	0.35	0.35	0.08	0.21	0.21
Clearance Time (s)	5.0	6.0	6.0	5.0	6.0		5.0	6.0	6.0	5.0	5.7	5.7
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	404	1870	813	588	1470		1137	2252	556	276	1322	575
v/s Ratio Prot	c0.09	c0.18		0.06	0.08		c0.09	0.16		0.01	0.14	
v/s Ratio Perm			0.08						c0.30			0.01
v/c Ratio	0.73	0.62	0.27	0.53	0.28		0.38	0.45	0.85	0.16	0.66	0.06
Uniform Delay, d1	59.2	42.6	37.8	57.8	38.0		45.4	34.7	41.6	59.5	50.7	44.3
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	6.7	0.7	0.2	0.9	0.1		0.2	0.1	11.3	0.3	1.2	0.0
Delay (s)	66.0	43.3	38.0	58.7	38.1		45.6	34.8	52.9	59.8	52.0	44.4
Level of Service	E	D	D	E	D		D	C	D	E	D	D
Approach Delay (s)		45.4			46.9			42.9			51.1	
Approach LOS		D			D			D			D	

Intersection Summary		
HCM 2000 Control Delay	45.7	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.72	D
Actuated Cycle Length (s)	139.1	Sum of lost time (s)
Intersection Capacity Utilization	82.0%	22.0
Analysis Period (min)	15	ICU Level of Service
		E

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 15: Tassajara Rd & I-580 WB Ramps

BART to Livermore Extension Project
 2040 Express Bus PM






























Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↔↔		↔↔		↑↑	↔		↑↑↔	↔
Traffic Volume (vph)	0	0	0	572	0	227	0	1659	723	0	1301	641
Future Volume (vph)	0	0	0	572	0	227	0	1659	723	0	1301	641
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0		4.0		4.0	4.0		4.0	4.0
Lane Util. Factor				0.97		0.88		0.95	1.00		0.86	0.86
Frt				1.00		0.85		1.00	0.85		0.98	0.85
Flt Protected				0.95		1.00		1.00	1.00		1.00	1.00
Satd. Flow (prot)				3433		2787		3539	1583		4708	1362
Flt Permitted				0.95		1.00		1.00	1.00		1.00	1.00
Satd. Flow (perm)				3433		2787		3539	1583		4708	1362
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	622	0	247	0	1803	786	0	1414	697
RTOR Reduction (vph)	0	0	0	0	0	18	0	0	320	0	33	193
Lane Group Flow (vph)	0	0	0	622	0	229	0	1803	466	0	1604	281
Turn Type				Perm		Perm		NA	Perm		NA	Perm
Protected Phases								2			6	
Permitted Phases				8		8			2			6
Actuated Green, G (s)				14.4		14.4		32.6	32.6		32.6	32.6
Effective Green, g (s)				14.4		14.4		32.6	32.6		32.6	32.6
Actuated g/C Ratio				0.26		0.26		0.59	0.59		0.59	0.59
Clearance Time (s)				4.0		4.0		4.0	4.0		4.0	4.0
Vehicle Extension (s)				3.0		3.0		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)				898		729		2097	938		2790	807
v/s Ratio Prot								c0.51			0.34	
v/s Ratio Perm				c0.18		0.08			0.29			0.21
v/c Ratio				0.69		0.31		0.86	0.50		0.57	0.35
Uniform Delay, d1				18.3		16.3		9.3	6.5		6.9	5.7
Progression Factor				1.00		1.00		1.00	1.00		1.00	1.00
Incremental Delay, d2				2.3		0.2		4.9	1.9		0.9	1.2
Delay (s)				20.6		16.6		14.2	8.3		7.8	6.9
Level of Service				C		B		B	A		A	A
Approach Delay (s)		0.0			19.5			12.4			7.6	
Approach LOS		A			B			B			A	

Intersection Summary			
HCM 2000 Control Delay	11.7	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.81		
Actuated Cycle Length (s)	55.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	68.8%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 16: Santa Rita Rd & I-580 EB Ramps/Pimilco Dr

BART to Livermore Extension Project
 2040 Express Bus PM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 			 		 		  			 	
Traffic Volume (vph)	435	82	258	142	0	317	0	1578	195	314	1129	0
Future Volume (vph)	435	82	258	142	0	317	0	1578	195	314	1129	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0		4.0		4.0		4.0	4.0	
Lane Util. Factor	0.97	1.00	1.00	0.97		0.88		0.86		1.00	0.95	
Frt	1.00	1.00	0.85	1.00		0.85		0.98		1.00	1.00	
Flt Protected	0.95	1.00	1.00	0.95		1.00		1.00		0.95	1.00	
Satd. Flow (prot)	3433	1863	1583	3433		2787		6302		1770	3539	
Flt Permitted	0.95	1.00	1.00	0.95		1.00		1.00		0.95	1.00	
Satd. Flow (perm)	3433	1863	1583	3433		2787		6302		1770	3539	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	473	89	280	154	0	345	0	1715	212	341	1227	0
RTOR Reduction (vph)	0	0	73	0	0	35	0	19	0	0	0	0
Lane Group Flow (vph)	473	89	207	154	0	310	0	1908	0	341	1227	0
Turn Type	Perm	NA	Perm	Prot		pm+ov		NA		Prot	NA	Perm
Protected Phases		4		3		1		2		1	6	
Permitted Phases	4		4			3						6
Actuated Green, G (s)	19.9	19.9	19.9	7.6		32.2		41.9		24.6	70.5	
Effective Green, g (s)	19.9	19.9	19.9	7.6		32.2		41.9		24.6	70.5	
Actuated g/C Ratio	0.18	0.18	0.18	0.07		0.29		0.38		0.22	0.64	
Clearance Time (s)	4.0	4.0	4.0	4.0		4.0		4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0		3.0		3.0		3.0	3.0	
Lane Grp Cap (vph)	621	337	286	237		815		2400		395	2268	
v/s Ratio Prot		0.05		c0.04		0.08		c0.30		c0.19	0.35	
v/s Ratio Perm	c0.14		0.13			0.03						
v/c Ratio	0.76	0.26	0.72	0.65		0.38		0.79		0.86	0.54	
Uniform Delay, d1	42.8	38.8	42.5	49.9		31.0		30.2		41.1	10.9	
Progression Factor	1.00	1.00	1.00	1.00		1.00		1.00		1.00	1.00	
Incremental Delay, d2	5.5	0.4	8.8	6.0		0.3		2.8		17.4	0.9	
Delay (s)	48.3	39.2	51.2	55.9		31.3		33.1		58.5	11.8	
Level of Service	D	D	D	E		C		C		E	B	
Approach Delay (s)		48.3			38.9			33.1			21.9	
Approach LOS		D			D			C			C	































Intersection Summary

HCM 2000 Control Delay	32.7	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.79		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	65.9%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 17: Santa Rita Rd & Valley Ave

BART to Livermore Extension Project
 2040 Express Bus PM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 	 			 		 	 		 	 	
Traffic Volume (vph)	369	730	122	136	373	795	144	628	158	1403	1071	270
Future Volume (vph)	369	730	122	136	373	795	144	628	158	1403	1071	270
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.97	0.95		0.97	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.97		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	3433	3432		3433	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	3433	3432		3433	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	401	793	133	148	405	864	157	683	172	1525	1164	293
RTOR Reduction (vph)	0	0	95	0	0	0	0	18	0	0	0	128
Lane Group Flow (vph)	401	793	38	148	405	864	157	837	0	1525	1164	165
Turn Type	Prot	NA	Perm	Prot	NA	Free	Prot	NA		Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			Free						6
Actuated Green, G (s)	15.0	23.0	23.0	8.0	16.0	120.0	9.5	28.0		45.0	63.5	63.5
Effective Green, g (s)	15.0	23.0	23.0	8.0	16.0	120.0	9.5	28.0		45.0	63.5	63.5
Actuated g/C Ratio	0.12	0.19	0.19	0.07	0.13	1.00	0.08	0.23		0.38	0.53	0.53
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	429	678	303	118	471	1583	271	800		1287	1872	837
v/s Ratio Prot	0.12	c0.22		c0.08	0.11		0.05	c0.24		c0.44	0.33	
v/s Ratio Perm			0.02			0.55						0.10
v/c Ratio	0.93	1.17	0.12	1.25	0.86	0.55	0.58	1.05		1.18	0.62	0.20
Uniform Delay, d1	52.0	48.5	40.2	56.0	50.9	0.0	53.3	46.0		37.5	19.8	14.8
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	27.5	91.6	0.2	166.2	14.5	1.4	3.0	44.4		91.4	0.6	0.1
Delay (s)	79.6	140.1	40.3	222.2	65.4	1.4	56.3	90.4		128.9	20.5	15.0
Level of Service	E	F	D	F	E	A	E	F		F	C	B
Approach Delay (s)		111.8			42.7			85.1			75.4	
Approach LOS		F			D			F			E	

Intersection Summary

HCM 2000 Control Delay	77.1	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.15		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	103.5%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
18: Bernal Ave/Valley Ave & Stanley Blvd

BART to Livermore Extension Project
2040 Express Bus PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↑↑	↖	↖↗	↑↑	↖	↖	↑↑	↖	↖↗	↑↑	
Traffic Volume (vph)	229	837	59	92	235	350	95	366	302	823	551	132
Future Volume (vph)	229	837	59	92	235	350	95	366	302	823	551	132
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	0.97	0.95	1.00	0.97	0.91	0.91	1.00	0.95	1.00	0.97	0.95	
Frt	1.00	1.00	0.85	1.00	0.94	0.85	1.00	1.00	0.85	1.00	0.97	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	3433	3539	1583	3433	3178	1441	1770	3539	1583	3433	3437	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	3433	3539	1583	3433	3178	1441	1770	3539	1583	3433	3437	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	249	910	64	100	255	380	103	398	328	895	599	143
RTOR Reduction (vph)	0	0	39	0	127	53	0	0	169	0	22	0
Lane Group Flow (vph)	249	910	25	100	311	145	103	398	159	895	720	0
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	
Protected Phases	7	4	5	3	8	1	5	2		1	6	
Permitted Phases			4			8			2			
Actuated Green, G (s)	10.3	25.6	33.3	3.0	18.3	43.6	7.7	15.5	15.5	25.3	33.1	
Effective Green, g (s)	10.3	25.6	33.3	3.0	18.3	43.6	7.7	15.5	15.5	25.3	33.1	
Actuated g/C Ratio	0.12	0.30	0.39	0.04	0.21	0.51	0.09	0.18	0.18	0.30	0.39	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	414	1060	691	120	681	803	159	642	287	1017	1332	
v/s Ratio Prot	c0.07	c0.26	0.00	0.03	0.10	0.05	0.06	0.11		c0.26	c0.21	
v/s Ratio Perm			0.01			0.05			0.10			
v/c Ratio	0.60	0.86	0.04	0.83	0.46	0.18	0.65	0.62	0.56	0.88	0.54	
Uniform Delay, d1	35.6	28.2	16.1	41.0	29.2	11.3	37.5	32.2	31.8	28.6	20.3	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	2.5	7.0	0.0	36.7	0.5	0.1	8.8	1.8	2.3	9.0	0.5	
Delay (s)	38.1	35.2	16.1	77.6	29.7	11.4	46.3	34.0	34.1	37.6	20.7	
Level of Service	D	D	B	E	C	B	D	C	C	D	C	
Approach Delay (s)		34.8			31.3			35.6			29.9	
Approach LOS		C			C			D			C	

Intersection Summary

HCM 2000 Control Delay	32.6	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.82		
Actuated Cycle Length (s)	85.4	Sum of lost time (s)	16.0
Intersection Capacity Utilization	75.3%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 19: Fallon Rd & Dublin Blvd/Croak Rd

BART to Livermore Extension Project
 2040 Express Bus PM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	216	905	421	81	29	93	244	805	322	184	658	30
Future Volume (vph)	216	905	421	81	29	93	244	805	322	184	658	30
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.91	0.88	0.94	0.91	1.00	0.94	0.91	0.88	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5085	2787	4990	5085	1583	4990	5085	2787	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5085	2787	4990	5085	1583	4990	5085	2787	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	235	984	458	88	32	101	265	875	350	200	715	33
RTOR Reduction (vph)	0	0	69	0	0	89	0	0	173	0	0	22
Lane Group Flow (vph)	235	984	389	88	32	12	265	875	177	200	715	11
Turn Type	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4	5	3	8		5	2		1	6	
Permitted Phases			4			8			2			6
Actuated Green, G (s)	18.3	24.7	34.9	3.2	9.6	9.6	10.2	29.8	29.8	6.3	25.9	25.9
Effective Green, g (s)	18.3	24.7	34.9	3.2	9.6	9.6	10.2	29.8	29.8	6.3	25.9	25.9
Actuated g/C Ratio	0.23	0.31	0.44	0.04	0.12	0.12	0.13	0.37	0.37	0.08	0.32	0.32
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	785	1569	1355	199	610	189	636	1894	1038	270	1646	512
v/s Ratio Prot	0.07	c0.19	0.04	c0.02	0.01		0.05	c0.17		c0.06	0.14	
v/s Ratio Perm			0.10			0.01			0.06			0.01
v/c Ratio	0.30	0.63	0.29	0.44	0.05	0.06	0.42	0.46	0.17	0.74	0.43	0.02
Uniform Delay, d1	25.5	23.7	14.5	37.5	31.2	31.2	32.2	19.0	16.8	36.1	21.3	18.4
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.15	0.92	1.01	1.00	1.00	1.00
Incremental Delay, d2	0.2	0.8	0.1	1.6	0.0	0.1	0.4	0.7	0.3	10.4	0.8	0.1
Delay (s)	25.8	24.5	14.6	39.1	31.2	31.4	37.3	18.2	17.3	46.5	22.1	18.5
Level of Service	C	C	B	D	C	C	D	B	B	D	C	B
Approach Delay (s)		22.0			34.4			21.4			27.1	
Approach LOS		C			C			C			C	

Intersection Summary

HCM 2000 Control Delay	23.5	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.55		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	53.9%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 20: El Charro Rd/Fallon Rd & I-580 WB Ramps

BART to Livermore Extension Project
 2040 Express Bus PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↙	↖	↗		↑↑↑	↗		↑↑↑	↗
Traffic Volume (vph)	0	0	0	621	0	540	0	919	245	0	852	405
Future Volume (vph)	0	0	0	621	0	540	0	919	245	0	852	405
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0	4.0	4.0		4.0	4.0		4.0	4.0
Lane Util. Factor				0.95	0.95	0.88		0.91	1.00		0.91	1.00
Frt				1.00	1.00	0.85		1.00	0.85		1.00	0.85
Flt Protected				0.95	0.95	1.00		1.00	1.00		1.00	1.00
Satd. Flow (prot)				1681	1681	2787		5085	1583		5085	1583
Flt Permitted				0.95	0.95	1.00		1.00	1.00		1.00	1.00
Satd. Flow (perm)				1681	1681	2787		5085	1583		5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	675	0	587	0	999	266	0	926	440
RTOR Reduction (vph)	0	0	0	0	0	34	0	0	143	0	0	237
Lane Group Flow (vph)	0	0	0	344	331	553	0	999	123	0	926	204
Turn Type				Perm	NA	Perm		NA	Perm		NA	Perm
Protected Phases					8			2			6	
Permitted Phases				8		8			2			6
Actuated Green, G (s)				14.0	14.0	14.0		18.5	18.5		18.5	18.5
Effective Green, g (s)				13.5	13.5	13.5		18.5	18.5		18.5	18.5
Actuated g/C Ratio				0.34	0.34	0.34		0.46	0.46		0.46	0.46
Clearance Time (s)				3.5	3.5	3.5		4.0	4.0		4.0	4.0
Vehicle Extension (s)				2.0	2.0	2.0		2.0	2.0		2.0	2.0
Lane Grp Cap (vph)				567	567	940		2351	732		2351	732
v/s Ratio Prot								c0.20			0.18	
v/s Ratio Perm				c0.20	0.20	0.20			0.08			0.13
v/c Ratio				0.61	0.58	0.59		0.42	0.17		0.39	0.28
Uniform Delay, d1				11.0	10.9	11.0		7.2	6.3		7.1	6.6
Progression Factor				1.00	1.00	1.00		1.00	1.00		1.08	3.81
Incremental Delay, d2				1.3	1.0	0.6		0.6	0.5		0.5	0.9
Delay (s)				12.3	11.9	11.6		7.8	6.8		8.1	26.2
Level of Service				B	B	B		A	A		A	C
Approach Delay (s)		0.0			11.9			7.5			13.9	
Approach LOS		A			B			A			B	

Intersection Summary		
HCM 2000 Control Delay	11.2	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.50	B
Actuated Cycle Length (s)	40.0	Sum of lost time (s)
Intersection Capacity Utilization	48.9%	8.0
Analysis Period (min)	15	ICU Level of Service
		A

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
21: El Charro Rd & I-580 EB Ramps

BART to Livermore Extension Project
2040 Express Bus PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	334	0	443	0	0	0	0	1531	281	0	1523	0
Future Volume (vph)	334	0	443	0	0	0	0	1531	281	0	1523	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0					4.0	4.0		4.0	
Lane Util. Factor	0.97		0.88					0.91	0.91		0.91	
Frt	1.00		0.85					1.00	0.85		1.00	
Flt Protected	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (prot)	3433		2787					3379	1441		3390	
Flt Permitted	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (perm)	3433		2787					3379	1441		3390	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	363	0	482	0	0	0	0	1664	305	0	1655	0
RTOR Reduction (vph)	0	0	45	0	0	0	0	2	94	0	0	0
Lane Group Flow (vph)	363	0	437	0	0	0	0	1699	174	0	1655	0
Turn Type	Prot		Perm					NA	Perm		NA	Perm
Protected Phases	4							2			6	
Permitted Phases			4						2			6
Actuated Green, G (s)	11.2		11.2					35.8	35.8		35.8	
Effective Green, g (s)	11.2		11.2					35.8	35.8		35.8	
Actuated g/C Ratio	0.20		0.20					0.65	0.65		0.65	
Clearance Time (s)	4.0		4.0					4.0	4.0		4.0	
Vehicle Extension (s)	2.0		2.0					3.0	3.0		3.0	
Lane Grp Cap (vph)	699		567					2199	937		2206	
v/s Ratio Prot	0.11							c0.50			0.49	
v/s Ratio Perm			c0.16						0.12			
v/c Ratio	0.52		0.77					0.77	0.19		0.75	
Uniform Delay, d1	19.5		20.7					6.7	3.8		6.5	
Progression Factor	1.00		1.00					1.00	1.00		1.00	
Incremental Delay, d2	0.3		5.8					2.7	0.4		2.4	
Delay (s)	19.8		26.5					9.4	4.3		8.9	
Level of Service	B		C					A	A		A	
Approach Delay (s)		23.6			0.0			8.7			8.9	
Approach LOS		C			A			A			A	

Intersection Summary

HCM 2000 Control Delay	11.6	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.77		
Actuated Cycle Length (s)	55.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	64.3%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 22: El Charro Rd & Stoneridge Dr/Jack London Blvd

BART to Livermore Extension Project
 2040 Express Bus PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	184	595	59	98	321	640	16	444	53	780	417	72
Future Volume (vph)	184	595	59	98	321	640	16	444	53	780	417	72
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	0.94	0.95	1.00	1.00	0.95	0.88	1.00	0.95		0.94	1.00	0.88
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.98		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	4491	3185	1425	1593	3185	2508	1593	3134		4491	1676	2508
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	4491	3185	1425	1593	3185	2508	1593	3134		4491	1676	2508
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	200	647	64	107	349	696	17	483	58	848	453	78
RTOR Reduction (vph)	0	0	49	0	0	83	0	15	0	0	0	44
Lane Group Flow (vph)	200	647	15	107	349	613	17	526	0	848	453	34
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Prot	NA		Prot	NA	Perm
Protected Phases	7	4		3	8	1	5	2		1	6	
Permitted Phases			4			8						6
Actuated Green, G (s)	6.0	15.3	15.3	5.0	14.3	29.6	0.8	14.4		15.3	28.9	28.9
Effective Green, g (s)	6.0	15.3	15.3	5.0	14.3	29.6	0.8	14.4		15.3	28.9	28.9
Actuated g/C Ratio	0.09	0.23	0.23	0.08	0.22	0.45	0.01	0.22		0.23	0.44	0.44
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	408	738	330	120	690	1124	19	683		1041	733	1098
v/s Ratio Prot	0.04	c0.20		c0.07	0.11	0.13	0.01	c0.17		c0.19	0.27	
v/s Ratio Perm			0.01			0.12						0.01
v/c Ratio	0.49	0.88	0.04	0.89	0.51	0.55	0.89	0.77		0.81	0.62	0.03
Uniform Delay, d1	28.5	24.4	19.7	30.2	22.7	13.3	32.6	24.2		24.0	14.3	10.6
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	0.9	11.4	0.1	50.1	0.6	0.5	155.2	5.4		5.0	1.6	0.0
Delay (s)	29.5	35.8	19.7	80.4	23.3	13.8	187.7	29.6		29.0	15.9	10.6
Level of Service	C	D	B	F	C	B	F	C		C	B	B
Approach Delay (s)		33.3			22.9			34.4			23.6	
Approach LOS		C			C			C			C	

Intersection Summary

HCM 2000 Control Delay	27.1	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.83		
Actuated Cycle Length (s)	66.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	69.6%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 23: Stanley Blvd & El Charro Rd



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	394	2719	778	11	172	390
Future Volume (vph)	394	2719	778	11	172	390
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95	0.95	1.00	0.97	0.88
Frt	1.00	1.00	1.00	0.85	1.00	0.85
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1770	3539	3539	1583	3433	2787
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1770	3539	3539	1583	3433	2787
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	428	2955	846	12	187	424
RTOR Reduction (vph)	0	0	0	6	0	383
Lane Group Flow (vph)	428	2955	846	6	187	41
Turn Type	Prot	NA	NA	Perm	Prot	Perm
Protected Phases	7	4	8		6	
Permitted Phases				8		6
Actuated Green, G (s)	35.4	106.0	66.6	66.6	12.2	12.2
Effective Green, g (s)	35.4	106.0	66.6	66.6	12.2	12.2
Actuated g/C Ratio	0.28	0.84	0.53	0.53	0.10	0.10
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	496	2972	1867	835	331	269
v/s Ratio Prot	0.24	c0.83	0.24		c0.05	
v/s Ratio Perm				0.00		0.01
v/c Ratio	0.86	0.99	0.45	0.01	0.56	0.15
Uniform Delay, d1	43.1	9.8	18.5	14.1	54.5	52.3
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	14.4	15.1	0.2	0.0	2.2	0.3
Delay (s)	57.5	24.9	18.7	14.1	56.7	52.5
Level of Service	E	C	B	B	E	D
Approach Delay (s)		29.0	18.6		53.8	
Approach LOS		C	B		D	

Intersection Summary

HCM 2000 Control Delay	30.3	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.98		
Actuated Cycle Length (s)	126.2	Sum of lost time (s)	12.0
Intersection Capacity Utilization	86.7%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
24: Airway Blvd/Driveway & N Canyons Pkwy

BART to Livermore Extension Project
2040 Express Bus PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑	↑	↑↑	↑	↑		↑	↑↑		↑	
Traffic Volume (vph)	0	834	518	970	83	0	51	0	749	0	0	0
Future Volume (vph)	0	834	518	970	83	0	51	0	749	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		2.0	2.0	2.0	2.0			4.2	2.0			
Lane Util. Factor		0.95	1.00	0.97	1.00			1.00	0.88			
Frt		1.00	0.85	1.00	1.00			1.00	0.85			
Flt Protected		1.00	1.00	0.95	1.00			0.95	1.00			
Satd. Flow (prot)		3539	1583	3433	1863			1770	2787			
Flt Permitted		1.00	1.00	0.95	1.00			0.95	1.00			
Satd. Flow (perm)		3539	1583	3433	1863			1770	2787			
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	907	563	1054	90	0	55	0	814	0	0	0
RTOR Reduction (vph)	0	0	239	0	0	0	0	0	478	0	0	0
Lane Group Flow (vph)	0	907	324	1054	90	0	0	55	336	0	0	0
Turn Type		NA	Perm	Prot	NA	Perm	Split	NA	pm+ov			
Protected Phases		2		1	6		8	8	1	4	4	
Permitted Phases			2			6			8			
Actuated Green, G (s)		62.4	62.4	34.9	101.3			10.7	45.6			
Effective Green, g (s)		64.4	64.4	36.9	103.3			10.5	49.6			
Actuated g/C Ratio		0.54	0.54	0.31	0.86			0.09	0.41			
Clearance Time (s)		4.0	4.0	4.0	4.0			4.0	4.0			
Vehicle Extension (s)		3.0	3.0	3.0	3.0			3.0	3.0			
Lane Grp Cap (vph)		1899	849	1055	1603			154	1198			
v/s Ratio Prot		c0.26		c0.31	0.05			0.03	c0.09			
v/s Ratio Perm			0.20						0.03			
v/c Ratio		0.48	0.38	1.00	0.06			0.36	0.28			
Uniform Delay, d1		17.3	16.2	41.5	1.2			51.6	23.4			
Progression Factor		1.00	1.00	1.00	1.00			1.00	1.00			
Incremental Delay, d2		0.9	1.3	27.3	0.1			1.4	0.1			
Delay (s)		18.2	17.5	68.8	1.3			53.0	23.5			
Level of Service		B	B	E	A			D	C			
Approach Delay (s)		17.9			63.5			25.4			0.0	
Approach LOS		B			E			C			A	

Intersection Summary

HCM 2000 Control Delay	34.7	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.66		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	12.2
Intersection Capacity Utilization	66.4%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
25: Airway Blvd & I-580 WB Ramps

BART to Livermore Extension Project
2040 Express Bus PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↙	↖	↗		↑↑	↗		↑↑↑	
Traffic Volume (vph)	0	0	0	128	35	179	0	689	380	0	888	700
Future Volume (vph)	0	0	0	128	35	179	0	689	380	0	888	700
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0	4.0	4.0		4.0	4.0		4.0	
Lane Util. Factor				0.95	0.95	0.88		0.95	1.00		0.91	
Frt				1.00	1.00	0.85		1.00	0.85		0.93	
Flt Protected				0.95	0.97	1.00		1.00	1.00		1.00	
Satd. Flow (prot)				1681	1715	2787		3539	1583		4749	
Flt Permitted				0.95	0.97	1.00		1.00	1.00		1.00	
Satd. Flow (perm)				1681	1715	2787		3539	1583		4749	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	139	38	195	0	749	413	0	965	761
RTOR Reduction (vph)	0	0	0	0	0	164	0	0	117	0	183	0
Lane Group Flow (vph)	0	0	0	74	103	31	0	749	296	0	1543	0
Turn Type				Split	NA	Perm		NA	Perm		NA	
Protected Phases				8	8			2			6	
Permitted Phases						8			2			
Actuated Green, G (s)				10.4	10.4	10.4		45.3	45.3		45.3	
Effective Green, g (s)				10.4	10.4	10.4		46.6	46.6		46.6	
Actuated g/C Ratio				0.16	0.16	0.16		0.72	0.72		0.72	
Clearance Time (s)				4.0	4.0	4.0		5.3	5.3		5.3	
Vehicle Extension (s)				2.0	2.0	2.0		4.0	4.0		4.0	
Lane Grp Cap (vph)				268	274	445		2537	1134		3404	
v/s Ratio Prot				0.04	c0.06			0.21			c0.32	
v/s Ratio Perm						0.01			0.19			
v/c Ratio				0.28	0.38	0.07		0.30	0.26		0.45	
Uniform Delay, d1				24.0	24.4	23.2		3.3	3.2		3.9	
Progression Factor				1.00	1.00	1.00		0.39	0.31		1.00	
Incremental Delay, d2				0.2	0.3	0.0		0.3	0.5		0.4	
Delay (s)				24.2	24.7	23.2		1.5	1.5		4.3	
Level of Service				C	C	C		A	A		A	
Approach Delay (s)		0.0			23.8			1.5			4.3	
Approach LOS		A			C			A			A	

Intersection Summary

HCM 2000 Control Delay	5.5	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.44		
Actuated Cycle Length (s)	65.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	47.9%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 26: Airway Blvd & I-580 EB Ramps/Kitty Hawk Rd

BART to Livermore Extension Project
 2040 Express Bus PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	565	187	351	65	95	123	54	456	158	122	381	467
Future Volume (vph)	565	187	351	65	95	123	54	456	158	122	381	467
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.4	4.4	4.4	4.5	2.7		4.0	2.7	
Lane Util. Factor	0.97	1.00	1.00	1.00	1.00	1.00	1.00	0.95		1.00	0.95	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.96		1.00	0.92	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	3433	1863	1583	1770	1863	1583	1770	3403		1770	3247	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	3433	1863	1583	1770	1863	1583	1770	3403		1770	3247	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	614	203	382	71	103	134	59	496	172	133	414	508
RTOR Reduction (vph)	0	0	295	0	0	80	0	22	0	0	154	0
Lane Group Flow (vph)	614	203	87	71	103	54	59	646	0	133	768	0
Turn Type	Split	NA	Perm	Split	NA	pm+ov	Prot	NA		Prot	NA	
Protected Phases	7	7		8	8	1	5	2		1	6	
Permitted Phases			7			8						
Actuated Green, G (s)	29.6	29.6	29.6	14.4	14.4	28.5	10.9	55.9		14.1	59.1	
Effective Green, g (s)	29.6	29.6	29.6	14.0	14.0	27.7	10.4	57.2		14.1	60.4	
Actuated g/C Ratio	0.23	0.23	0.23	0.11	0.11	0.21	0.08	0.44		0.11	0.46	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Vehicle Extension (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	3.5		2.0	4.0	
Lane Grp Cap (vph)	781	424	360	190	200	390	141	1497		191	1508	
v/s Ratio Prot	c0.18	0.11		0.04	c0.06	0.01	0.03	c0.19		c0.08	c0.24	
v/s Ratio Perm			0.05			0.02						
v/c Ratio	0.79	0.48	0.24	0.37	0.52	0.14	0.42	0.43		0.70	0.51	
Uniform Delay, d1	47.2	43.5	41.0	53.9	54.8	41.5	56.9	25.2		55.9	24.4	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		0.99	1.07	
Incremental Delay, d2	4.8	0.3	0.1	0.5	0.9	0.1	0.7	0.9		7.8	1.1	
Delay (s)	52.1	43.8	41.2	54.4	55.7	41.5	57.7	26.1		62.9	27.2	
Level of Service	D	D	D	D	E	D	E	C		E	C	
Approach Delay (s)		47.2			49.2			28.6			31.7	
Approach LOS		D			D			C			C	

Intersection Summary

HCM 2000 Control Delay	38.3	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.61		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	15.6
Intersection Capacity Utilization	70.8%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 27: Collier Canyon Rd & N Canyons Pkwy/Portola Ave

BART to Livermore Extension Project
 2040 Express Bus PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	424	821	188	39	205	13	57	5	191	131	14	184
Future Volume (vph)	424	821	188	39	205	13	57	5	191	131	14	184
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	2.7	2.7	4.0	2.7	2.7	4.0	3.0		4.0	4.6	4.6
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.85		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	1770	1590		1770	1863	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	1770	1590		1770	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	461	892	204	42	223	14	62	5	208	142	15	200
RTOR Reduction (vph)	0	0	119	0	0	10	0	163	0	0	0	147
Lane Group Flow (vph)	461	892	85	42	223	4	62	50	0	142	15	53
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA		Prot	NA	Perm
Protected Phases	1	6		5	2		3	8		7		4
Permitted Phases			6			2						4
Actuated Green, G (s)	14.2	29.2	29.2	3.2	18.2	18.2	4.7	14.4		10.1	19.8	19.8
Effective Green, g (s)	14.2	30.5	30.5	3.2	19.5	19.5	4.7	15.4		10.1	19.2	19.2
Actuated g/C Ratio	0.19	0.42	0.42	0.04	0.27	0.27	0.06	0.21		0.14	0.26	0.26
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	668	1480	662	77	946	423	114	335		245	490	416
v/s Ratio Prot	c0.13	c0.25		0.02	0.06		0.04	c0.03		c0.08	0.01	
v/s Ratio Perm			0.05			0.00						0.03
v/c Ratio	0.69	0.60	0.13	0.55	0.24	0.01	0.54	0.15		0.58	0.03	0.13
Uniform Delay, d1	27.3	16.5	13.0	34.1	20.9	19.6	33.1	23.4		29.4	19.9	20.5
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	3.1	0.7	0.1	7.7	0.1	0.0	5.2	0.2		3.3	0.0	0.1
Delay (s)	30.4	17.2	13.1	41.8	21.0	19.6	38.3	23.6		32.7	20.0	20.6
Level of Service	C	B	B	D	C	B	D	C		C	B	C
Approach Delay (s)		20.6			24.1			26.9			25.4	
Approach LOS		C			C			C			C	

Intersection Summary

HCM 2000 Control Delay	22.4	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.54		
Actuated Cycle Length (s)	72.9	Sum of lost time (s)	15.3
Intersection Capacity Utilization	58.7%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
28: Isabel Ave/Campus Hill Dr & Portola Ave

BART to Livermore Extension Project
2040 Express Bus PM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	3	694	468	366	136	122	176	398	155	129	232	1
Future Volume (vph)	3	694	468	366	136	122	176	398	155	129	232	1
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	5.8	5.8
Lane Util. Factor	1.00	0.95	0.88	0.94	0.95		0.97	0.95	1.00	1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	0.93		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3539	2787	4990	3288		3433	3539	1583	1770	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	3539	2787	4990	3288		3433	3539	1583	1770	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	3	754	509	398	148	133	191	433	168	140	252	1
RTOR Reduction (vph)	0	0	323	0	73	0	0	0	133	0	0	1
Lane Group Flow (vph)	3	754	186	398	208	0	191	433	35	140	252	0
Turn Type	Prot	NA	Perm	Prot	NA		Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4						2			6
Actuated Green, G (s)	1.5	30.1	30.1	9.2	37.8		9.2	16.8	16.8	11.4	19.4	19.4
Effective Green, g (s)	1.5	31.4	31.4	9.2	39.1		9.2	18.1	18.1	11.4	18.5	18.5
Actuated g/C Ratio	0.02	0.36	0.36	0.11	0.45		0.11	0.21	0.21	0.13	0.21	0.21
Clearance Time (s)	4.0	5.3	5.3	4.0	5.3		4.0	5.3	5.3	4.0	4.9	4.9
Vehicle Extension (s)	2.0	3.0	3.0	2.0	3.0		2.0	3.0	3.0	2.0	3.0	3.0
Lane Grp Cap (vph)	30	1290	1016	533	1493		366	743	332	234	760	340
v/s Ratio Prot	0.00	c0.21		c0.08	0.06		0.06	c0.12		c0.08	0.07	
v/s Ratio Perm			0.07						0.02			0.00
v/c Ratio	0.10	0.58	0.18	0.75	0.14		0.52	0.58	0.11	0.60	0.33	0.00
Uniform Delay, d1	41.6	22.1	18.6	37.3	13.7		36.4	30.6	27.5	35.2	28.6	26.5
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.5	0.7	0.1	5.0	0.0		0.6	1.2	0.1	2.7	0.3	0.0
Delay (s)	42.2	22.8	18.7	42.3	13.7		37.0	31.8	27.6	37.9	28.8	26.5
Level of Service	D	C	B	D	B		D	C	C	D	C	C
Approach Delay (s)		21.2			30.5			32.1			32.1	
Approach LOS		C			C			C			C	

Intersection Summary

HCM 2000 Control Delay	27.3	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.62		
Actuated Cycle Length (s)	86.1	Sum of lost time (s)	17.8
Intersection Capacity Utilization	59.0%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
29: Isabel Ave & I-580 WB Ramps

BART to Livermore Extension Project
2040 Express Bus PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↔↔		↗		↑↑↑	↗		↑↑↑	↗
Traffic Volume (vph)	0	0	0	681	0	438	0	433	0	0	673	476
Future Volume (vph)	0	0	0	681	0	438	0	433	0	0	673	476
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0		4.0		4.8			4.8	4.8
Lane Util. Factor				0.97		1.00		0.91			0.91	1.00
Frt				1.00		0.85		1.00			1.00	0.85
Flt Protected				0.95		1.00		1.00			1.00	1.00
Satd. Flow (prot)				3433		1583		5085			5085	1583
Flt Permitted				0.95		1.00		1.00			1.00	1.00
Satd. Flow (perm)				3433		1583		5085			5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	740	0	476	0	471	0	0	732	517
RTOR Reduction (vph)	0	0	0	0	0	197	0	0	0	0	0	221
Lane Group Flow (vph)	0	0	0	740	0	279	0	471	0	0	732	296
Turn Type				Prot		Prot		NA	Free		NA	Prot
Protected Phases				8		8		2			6	6
Permitted Phases									Free			
Actuated Green, G (s)				19.0		19.0		38.0			38.0	38.0
Effective Green, g (s)				19.0		19.0		37.2			37.2	37.2
Actuated g/C Ratio				0.29		0.29		0.57			0.57	0.57
Clearance Time (s)				4.0		4.0		4.0			4.0	4.0
Vehicle Extension (s)				2.0		2.0		4.0			4.0	4.0
Lane Grp Cap (vph)				1003		462		2910			2910	905
v/s Ratio Prot				c0.22		0.18		0.09			0.14	c0.19
v/s Ratio Perm												
v/c Ratio				0.74		0.60		0.16			0.25	0.33
Uniform Delay, d1				20.8		19.8		6.6			6.9	7.3
Progression Factor				1.00		1.00		1.08			1.00	1.00
Incremental Delay, d2				2.5		1.5		0.1			0.2	1.0
Delay (s)				23.2		21.3		7.2			7.2	8.3
Level of Service				C		C		A			A	A
Approach Delay (s)		0.0			22.5			7.2			7.6	
Approach LOS		A			C			A			A	

























Intersection Summary

HCM 2000 Control Delay	13.7	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.47		
Actuated Cycle Length (s)	65.0	Sum of lost time (s)	8.8
Intersection Capacity Utilization	42.8%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 30: Isabel Ave & I-580 EB Ramps

BART to Livermore Extension Project
 2040 Express Bus PM

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations	 		 					  			  		
Traffic Volume (vph)	192	0	386	0	0	0	0	698	678	0	907	662	
Future Volume (vph)	192	0	386	0	0	0	0	698	678	0	907	662	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)	4.0		4.0					4.0	4.0		4.0	4.0	
Lane Util. Factor	0.97		0.88					0.91	1.00		0.91	1.00	
Frt	1.00		0.85					1.00	0.85		1.00	0.85	
Flt Protected	0.95		1.00					1.00	1.00		1.00	1.00	
Satd. Flow (prot)	3433		2787					5085	1583		5085	1583	
Flt Permitted	0.95		1.00					1.00	1.00		1.00	1.00	
Satd. Flow (perm)	3433		2787					5085	1583		5085	1583	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	
Adj. Flow (vph)	209	0	420	0	0	0	0	759	737	0	986	720	
RTOR Reduction (vph)	0	0	174	0	0	0	0	0	0	0	0	0	
Lane Group Flow (vph)	209	0	246	0	0	0	0	759	737	0	986	720	
Turn Type	Prot		Perm					NA	Free		NA	Free	
Protected Phases	4							2			6		
Permitted Phases			4						Free			Free	
Actuated Green, G (s)	10.0		10.0					46.0	65.0		46.0	65.0	
Effective Green, g (s)	10.0		10.0					47.0	65.0		47.0	65.0	
Actuated g/C Ratio	0.15		0.15					0.72	1.00		0.72	1.00	
Clearance Time (s)	4.0		4.0					5.0			5.0		
Vehicle Extension (s)	2.0		2.0					4.0			4.0		
Lane Grp Cap (vph)	528		428					3676	1583		3676	1583	
v/s Ratio Prot	0.06							0.15			0.19		
v/s Ratio Perm			0.09						c0.47			0.45	
v/c Ratio	0.40		0.57					0.21	0.47		0.27	0.45	
Uniform Delay, d1	24.8		25.5					2.9	0.0		3.1	0.0	
Progression Factor	1.00		1.00					1.00	1.00		0.50	1.00	
Incremental Delay, d2	0.2		1.2					0.1	1.0		0.2	0.9	
Delay (s)	25.0		26.7					3.1	1.0		1.7	0.9	
Level of Service	C		C					A	A		A	A	
Approach Delay (s)		26.1			0.0			2.0			1.4		
Approach LOS		C			A			A			A		
Intersection Summary													
HCM 2000 Control Delay			5.7									HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio			0.53										
Actuated Cycle Length (s)			65.0									Sum of lost time (s)	8.0
Intersection Capacity Utilization			37.7%									ICU Level of Service	A
Analysis Period (min)			15										
c Critical Lane Group													

HCM Signalized Intersection Capacity Analysis
 31: Isabel Ave & Airway Blvd

BART to Livermore Extension Project
 2040 Express Bus PM

































Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↑	↗	↖	↑	↗	↖	↑↑↑	↗	↖↗	↑↑↑	↗
Traffic Volume (vph)	0	163	355	143	143	58	411	1196	66	372	1291	10
Future Volume (vph)	0	163	355	143	143	58	411	1196	66	372	1291	10
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.2	5.6	5.2	5.2	5.6	4.0	4.0	4.0	4.0	4.0	5.0
Lane Util. Factor		1.00	1.00	1.00	1.00	1.00	1.00	0.91	1.00	0.97	0.91	1.00
Frt		1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1863	1583	1770	1863	1583	1770	5085	1583	3433	5085	1583
Flt Permitted		1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)		1863	1583	1770	1863	1583	1770	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	177	386	155	155	63	447	1300	72	404	1403	11
RTOR Reduction (vph)	0	0	66	0	0	35	0	0	43	0	0	7
Lane Group Flow (vph)	0	177	320	155	155	28	447	1300	29	404	1403	4
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4	5	3	8	1	5	2		1	NA	6
Permitted Phases			4			8			2			6
Actuated Green, G (s)		14.0	35.1	8.4	27.0	41.6	21.1	35.9	35.9	14.6	29.4	29.4
Effective Green, g (s)		13.4	33.9	7.8	26.4	40.4	22.1	36.9	36.9	15.6	30.4	29.4
Actuated g/C Ratio		0.15	0.37	0.08	0.29	0.44	0.24	0.40	0.40	0.17	0.33	0.32
Clearance Time (s)		4.6	5.0	4.6	4.6	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Extension (s)		3.0	3.0	3.0	3.0	3.0	3.0	5.0	5.0	3.0	5.0	5.0
Lane Grp Cap (vph)		271	582	149	534	694	424	2037	634	581	1678	505
v/s Ratio Prot		c0.10	0.12	c0.09	0.08	0.01	c0.25	0.26		0.12	c0.28	
v/s Ratio Perm			0.08			0.01			0.02			0.00
v/c Ratio		0.65	0.55	1.04	0.29	0.04	1.05	0.64	0.05	0.70	0.84	0.01
Uniform Delay, d1		37.2	23.0	42.1	25.6	14.8	35.0	22.2	16.8	36.0	28.5	21.4
Progression Factor		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2		5.6	1.1	84.8	0.3	0.0	58.7	0.9	0.1	3.6	4.2	0.0
Delay (s)		42.7	24.1	127.0	25.9	14.8	93.7	23.1	16.9	39.6	32.8	21.4
Level of Service		D	C	F	C	B	F	C	B	D	C	C
Approach Delay (s)		30.0			66.0			40.2			34.2	
Approach LOS		C			E			D			C	

Intersection Summary		
HCM 2000 Control Delay	38.7	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.91	D
Actuated Cycle Length (s)	92.1	Sum of lost time (s)
Intersection Capacity Utilization	79.5%	20.0
Analysis Period (min)	15	ICU Level of Service
		D

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
32: Isabel Ave & Jack London Blvd

BART to Livermore Extension Project
2040 Express Bus PM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 	 			 		 	  		  		
Traffic Volume (vph)	102	881	314	296	178	283	146	1402	680	486	1269	52
Future Volume (vph)	102	881	314	296	178	283	146	1402	680	486	1269	52
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.97	0.91	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	3433	5085	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	3433	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	111	958	341	322	193	308	159	1524	739	528	1379	57
RTOR Reduction (vph)	0	0	141	0	0	31	0	0	204	0	0	36
Lane Group Flow (vph)	111	958	200	322	193	277	159	1524	535	528	1379	21
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8	1	5	2		1	NA	6
Permitted Phases			4			8			2			6
Actuated Green, G (s)	8.5	34.7	34.7	22.7	48.9	67.6	10.5	42.7	42.7	18.7	50.9	50.9
Effective Green, g (s)	8.5	34.7	34.7	22.7	48.9	67.6	10.5	42.7	42.7	18.7	50.9	50.9
Actuated g/C Ratio	0.06	0.25	0.25	0.16	0.35	0.48	0.08	0.31	0.31	0.13	0.36	0.36
Clearance Time (s)	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	208	877	392	286	1236	824	257	1550	482	458	1848	575
v/s Ratio Prot	0.03	c0.27		c0.18	0.05	0.04	0.05	0.30		c0.15	0.27	
v/s Ratio Perm			0.13			0.13			c0.34			0.01
v/c Ratio	0.53	1.09	0.51	1.13	0.16	0.34	0.62	0.98	1.11	1.15	0.75	0.04
Uniform Delay, d1	63.8	52.6	45.3	58.6	31.3	22.4	62.8	48.3	48.6	60.6	38.9	28.7
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	2.6	58.7	1.0	91.5	0.1	0.2	4.4	18.8	74.8	91.1	1.7	0.0
Delay (s)	66.4	111.4	46.4	150.1	31.4	22.6	67.2	67.1	123.4	151.8	40.6	28.8
Level of Service	E	F	D	F	C	C	E	E	F	F	D	C
Approach Delay (s)		92.1			74.6			84.3			70.1	
Approach LOS		F			E			F			E	
Intersection Summary												
HCM 2000 Control Delay			80.6		HCM 2000 Level of Service			F				
HCM 2000 Volume to Capacity ratio			1.11									
Actuated Cycle Length (s)			140.0		Sum of lost time (s)			21.2				
Intersection Capacity Utilization			99.4%		ICU Level of Service			F				
Analysis Period (min)			15									

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
33: Isabel Ave Connector & Stanley Blvd



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑	↑	↑↓	↑↑	↑↓	↑↓
Traffic Volume (vph)	2172	795	823	560	142	899
Future Volume (vph)	2172	795	823	560	142	899
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	2.3	2.3	4.0	2.3	2.5	2.5
Lane Util. Factor	0.95	1.00	0.97	0.95	0.97	0.88
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	3539	1583	3433	3539	3433	2787
Flt Permitted	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (perm)	3539	1583	3433	3539	3433	2787
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	2361	864	895	609	154	977
RTOR Reduction (vph)	0	0	0	0	0	1
Lane Group Flow (vph)	2361	864	895	609	154	976
Turn Type	NA	pm+ov	Prot	NA	Prot	pm+ov
Protected Phases	2	8	1	6	8	1
Permitted Phases		2				8
Actuated Green, G (s)	58.0	68.1	20.0	82.0	10.1	30.1
Effective Green, g (s)	59.7	71.5	20.0	83.7	11.6	33.1
Actuated g/C Ratio	0.60	0.71	0.20	0.84	0.12	0.33
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Grp Cap (vph)	2110	1167	685	2959	397	991
v/s Ratio Prot	c0.67	0.09	c0.26	0.17	0.04	c0.21
v/s Ratio Perm		0.46				0.14
v/c Ratio	1.12	0.74	1.31	0.21	0.39	0.98
Uniform Delay, d1	20.2	8.7	40.0	1.6	41.0	33.2
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	60.6	2.2	148.4	0.0	0.2	24.6
Delay (s)	80.8	10.9	188.4	1.6	41.2	57.8
Level of Service	F	B	F	A	D	E
Approach Delay (s)	62.1			112.8	55.6	
Approach LOS	E			F	E	

Intersection Summary

HCM 2000 Control Delay	73.8	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.14		
Actuated Cycle Length (s)	100.1	Sum of lost time (s)	8.8
Intersection Capacity Utilization	100.2%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 34: Murrieta Blvd/Driveway & Portola Ave

BART to Livermore Extension Project
 2040 Express Bus PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗		↖	↗		↖	↗	↗		↗	
Traffic Volume (vph)	0	1143	159	256	619	0	189	6	484	4	7	0
Future Volume (vph)	0	1143	159	256	619	0	189	6	484	4	7	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.8		4.0	5.8		5.2	5.2	5.2		4.0	
Lane Util. Factor		0.95		1.00	0.95		0.95	0.95	1.00		1.00	
Frt		0.98		1.00	1.00		1.00	1.00	0.85		1.00	
Flt Protected		1.00		0.95	1.00		0.95	0.96	1.00		0.98	
Satd. Flow (prot)		3474		1770	3539		1681	1691	1583		1832	
Flt Permitted		1.00		0.95	1.00		0.95	0.96	1.00		0.98	
Satd. Flow (perm)		3474		1770	3539		1681	1691	1583		1832	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	1242	173	278	673	0	205	7	526	4	8	0
RTOR Reduction (vph)	0	10	0	0	0	0	0	0	236	0	0	0
Lane Group Flow (vph)	0	1405	0	278	673	0	107	105	290	0	12	0
Turn Type	Prot	NA		Prot	NA		Split	NA	Perm		Split	NA
Protected Phases	5	2		1	6		8	8			4	4
Permitted Phases									8			
Actuated Green, G (s)		44.8		17.2	66.0		21.4	21.4	21.4		0.7	
Effective Green, g (s)		43.9		17.2	65.1		20.8	20.8	20.8		0.7	
Actuated g/C Ratio		0.43		0.17	0.64		0.20	0.20	0.20		0.01	
Clearance Time (s)		4.9		4.0	4.9		4.6	4.6	4.6		4.0	
Vehicle Extension (s)		2.0		2.0	2.0		2.0	2.0	2.0		2.0	
Lane Grp Cap (vph)		1501		299	2267		344	346	324		12	
v/s Ratio Prot		c0.40		c0.16	0.19		0.06	0.06			c0.01	
v/s Ratio Perm									c0.18			
v/c Ratio		0.94		0.93	0.30		0.31	0.30	0.89		1.00	
Uniform Delay, d1		27.5		41.6	8.1		34.3	34.3	39.3		50.4	
Progression Factor		1.00		1.00	1.00		1.00	1.00	1.00		1.00	
Incremental Delay, d2		11.1		33.2	0.0		0.2	0.2	24.8		259.8	
Delay (s)		38.6		74.9	8.1		34.5	34.4	64.1		310.3	
Level of Service		D		E	A		C	C	E		F	
Approach Delay (s)		38.6			27.6			55.6			310.3	
Approach LOS		D			C			E			F	

Intersection Summary

HCM 2000 Control Delay	40.3	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.92		
Actuated Cycle Length (s)	101.6	Sum of lost time (s)	19.0
Intersection Capacity Utilization	82.5%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
35: Murrieta Blvd & Jack London Blvd


























Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	427	1102	486	296	350	168
Future Volume (vph)	427	1102	486	296	350	168
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00	1.00	0.95	0.91	
Frt	1.00	0.85	1.00	1.00	0.95	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1770	1583	1770	3539	4837	
Flt Permitted	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	1770	1583	1770	3539	4837	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	464	1198	528	322	380	183
RTOR Reduction (vph)	0	395	0	0	62	0
Lane Group Flow (vph)	464	803	528	322	501	0
Turn Type	Prot	Perm	Prot	NA	NA	
Protected Phases	4		5	2	6	
Permitted Phases		4				
Actuated Green, G (s)	69.0	69.0	42.0	62.7	16.7	
Effective Green, g (s)	69.0	69.0	42.0	62.7	16.7	
Actuated g/C Ratio	0.49	0.49	0.30	0.45	0.12	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	874	781	532	1588	578	
v/s Ratio Prot	0.26		c0.30	0.09	c0.10	
v/s Ratio Perm		c0.51				
v/c Ratio	0.53	1.03	0.99	0.20	0.87	
Uniform Delay, d1	24.2	35.3	48.7	23.3	60.4	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.6	39.5	36.9	0.1	13.0	
Delay (s)	24.9	74.9	85.6	23.4	73.4	
Level of Service	C	E	F	C	E	
Approach Delay (s)	60.9			62.0	73.4	
Approach LOS	E			E	E	

Intersection Summary

HCM 2000 Control Delay	63.5	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	0.99		
Actuated Cycle Length (s)	139.7	Sum of lost time (s)	12.0
Intersection Capacity Utilization	85.4%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
36: Murrieta Blvd & Stanley Blvd

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	329	1501	812	78	1047	218	293	342	19	232	359	204
Future Volume (vph)	329	1501	812	78	1047	218	293	342	19	232	359	204
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	5.8	5.8	4.0	5.8	4.9	4.9	5.8		4.9	5.8	4.9
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.97	0.95		1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	3433	3511		1770	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	3433	3511		1770	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	358	1632	883	85	1138	237	318	372	21	252	390	222
RTOR Reduction (vph)	0	0	211	0	0	54	0	3	0	0	0	133
Lane Group Flow (vph)	358	1632	672	85	1138	183	318	390	0	252	390	89
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Prot	NA		Prot	NA	custom
Protected Phases	1	6		5	2	3	7	4		3	8	
Permitted Phases			6			2						4
Actuated Green, G (s)	13.0	53.3	53.3	4.0	44.3	59.3	13.5	18.3		15.0	19.8	18.3
Effective Green, g (s)	13.0	52.4	52.4	4.0	43.4	57.5	12.6	17.4		14.1	18.9	18.3
Actuated g/C Ratio	0.12	0.48	0.48	0.04	0.40	0.53	0.12	0.16		0.13	0.17	0.17
Clearance Time (s)	4.0	4.9	4.9	4.0	4.9	4.0	4.0	4.9		4.0	4.9	4.9
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	411	1710	765	65	1416	839	399	563		230	617	267
v/s Ratio Prot	c0.10	c0.46		c0.05	0.32	0.03	0.09	c0.11		c0.14	0.11	
v/s Ratio Perm			0.42			0.09						0.06
v/c Ratio	0.87	0.95	0.88	1.31	0.80	0.22	0.80	0.69		1.10	0.63	0.33
Uniform Delay, d1	46.9	26.9	25.1	52.2	28.7	13.5	46.7	43.0		47.2	41.5	39.7
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	17.9	12.6	11.2	214.5	3.4	0.1	10.6	3.7		87.3	2.1	0.7
Delay (s)	64.8	39.4	36.3	266.7	32.1	13.7	57.2	46.6		134.4	43.6	40.4
Level of Service	E	D	D	F	C	B	E	D		F	D	D
Approach Delay (s)		41.6			42.8			51.4			69.3	
Approach LOS		D			D			D			E	

Intersection Summary		
HCM 2000 Control Delay	47.1	HCM 2000 Level of Service D
HCM 2000 Volume to Capacity ratio	0.94	
Actuated Cycle Length (s)	108.4	Sum of lost time (s) 20.5
Intersection Capacity Utilization	85.8%	ICU Level of Service E
Analysis Period (min)	15	
c Critical Lane Group		

HCM Signalized Intersection Capacity Analysis
37: Livermore Ave & I-580 WB Ramps

BART to Livermore Extension Project
2040 Express Bus PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↖	↔		↗	↑			↕	
Traffic Volume (vph)	0	0	0	701	23	32	580	452	0	0	111	0
Future Volume (vph)	0	0	0	701	23	32	580	452	0	0	111	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)					4.0		4.0	4.0			4.0	
Lane Util. Factor					0.95		0.97	1.00			0.95	
Frt					0.99		1.00	1.00			1.00	
Flt Protected					0.96		0.95	1.00			1.00	
Satd. Flow (prot)					1680		3433	1863			3539	
Flt Permitted					0.96		0.95	1.00			1.00	
Satd. Flow (perm)					1680		3433	1863			3539	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	762	25	35	630	491	0	0	121	0
RTOR Reduction (vph)	0	0	0	0	1	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	0	821	0	630	491	0	0	121	0
Turn Type				Split	NA		Prot	NA			NA	
Protected Phases				8	8		5	2			6	
Permitted Phases												
Actuated Green, G (s)					71.1		27.3	49.2			18.4	
Effective Green, g (s)					71.1		26.8	50.9			20.1	
Actuated g/C Ratio					0.55		0.21	0.39			0.15	
Clearance Time (s)					4.0		3.5	5.7			5.7	
Vehicle Extension (s)					2.0		2.0	2.5			2.5	
Lane Grp Cap (vph)					918		707	729			547	
v/s Ratio Prot					c0.49		c0.18	c0.26			0.03	
v/s Ratio Perm												
v/c Ratio					0.89		0.89	0.67			0.22	
Uniform Delay, d1					26.1		50.2	32.7			48.1	
Progression Factor					1.00		0.39	0.26			1.00	
Incremental Delay, d2					10.8		1.5	0.5			0.9	
Delay (s)					36.9		20.9	8.9			49.0	
Level of Service					D		C	A			D	
Approach Delay (s)		0.0			36.9			15.7			49.0	
Approach LOS		A			D			B			D	

Intersection Summary

HCM 2000 Control Delay	26.1	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.86		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	112.9%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 38: Livermore Ave & I-580 EB Ramps



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕	↗					↕		↘	↕	
Traffic Volume (vph)	229	11	1389	0	0	0	0	819	234	113	695	0
Future Volume (vph)	229	11	1389	0	0	0	0	819	234	113	695	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0					3.0		5.0	3.0	
Lane Util. Factor		0.95	0.95					0.95		1.00	0.95	
Frt		0.89	0.85					0.97		1.00	1.00	
Flt Protected		0.99	1.00					1.00		0.95	1.00	
Satd. Flow (prot)		1554	1504					3421		1770	3539	
Flt Permitted		0.99	1.00					1.00		0.95	1.00	
Satd. Flow (perm)		1554	1504					3421		1770	3539	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	249	12	1510	0	0	0	0	890	254	123	755	0
RTOR Reduction (vph)	0	67	67	0	0	0	0	20	0	0	0	0
Lane Group Flow (vph)	0	934	703	0	0	0	0	1124	0	123	755	0
Turn Type	Prot	NA	Perm					NA		Prot	NA	
Protected Phases	7	4						2		1	6	
Permitted Phases			4									
Actuated Green, G (s)		62.8	62.8					44.3		10.9	59.2	
Effective Green, g (s)		62.8	62.8					45.3		9.9	60.2	
Actuated g/C Ratio		0.48	0.48					0.35		0.08	0.46	
Clearance Time (s)		4.0	4.0					4.0		4.0	4.0	
Vehicle Extension (s)		2.0	2.0					2.5		2.0	2.5	
Lane Grp Cap (vph)		750	726					1192		134	1638	
v/s Ratio Prot								c0.33		c0.07	0.21	
v/s Ratio Perm		0.60	0.47									
v/c Ratio		1.25	0.97					0.94		0.92	0.46	
Uniform Delay, d1		33.6	32.6					41.1		59.6	23.8	
Progression Factor		1.00	1.00					1.00		0.80	1.15	
Incremental Delay, d2		121.4	25.3					15.5		38.6	0.6	
Delay (s)		155.0	57.9					56.6		86.1	28.0	
Level of Service		F	E					E		F	C	
Approach Delay (s)		112.8			0.0			56.6			36.2	
Approach LOS		F			A			E			D	

Intersection Summary

HCM 2000 Control Delay	78.1	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.10		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	112.9%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 39: Livermore Ave & Portola Ave

BART to Livermore Extension Project
 2040 Express Bus PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↖↖	↗	↖	↖↖	↗	↖	↖↖		↖	↖↖	↗
Traffic Volume (vph)	830	624	184	17	307	73	179	650	79	243	1054	495
Future Volume (vph)	830	624	184	17	307	73	179	650	79	243	1054	495
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	2.7	4.0	4.0	2.7	4.0	4.0	4.9		4.0	4.9	4.9
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	1.00	0.95		1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.98		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	1770	3482		1770	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	1770	3482		1770	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	902	678	200	18	334	79	195	707	86	264	1146	538
RTOR Reduction (vph)	0	0	125	0	0	67	0	7	0	0	0	64
Lane Group Flow (vph)	902	678	75	18	334	12	195	786	0	264	1146	474
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA		Prot	NA	pm+ov
Protected Phases	3	8		7	4		1	6		5	2	3
Permitted Phases			8			4						2
Actuated Green, G (s)	34.0	47.2	47.2	6.5	19.7	19.7	14.0	32.9		23.1	42.0	76.0
Effective Green, g (s)	34.0	48.5	47.2	6.5	21.0	19.7	14.0	32.0		23.1	41.1	74.2
Actuated g/C Ratio	0.27	0.39	0.38	0.05	0.17	0.16	0.11	0.25		0.18	0.33	0.59
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	928	1365	594	91	591	248	197	886		325	1157	934
v/s Ratio Prot	c0.26	c0.19		0.01	c0.09		c0.11	0.23		0.15	c0.32	0.13
v/s Ratio Perm			0.05			0.01						0.17
v/c Ratio	0.97	0.50	0.13	0.20	0.57	0.05	0.99	0.89		0.81	0.99	0.51
Uniform Delay, d1	45.4	29.3	25.7	57.1	48.2	45.0	55.8	45.1		49.2	42.1	15.1
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	22.8	0.3	0.1	1.1	1.2	0.1	60.5	10.7		14.3	24.1	0.4
Delay (s)	68.2	29.6	25.8	58.2	49.4	45.1	116.3	55.8		63.5	66.2	15.5
Level of Service	E	C	C	E	D	D	F	E		E	E	B
Approach Delay (s)		48.7			49.0			67.7			51.8	
Approach LOS		D			D			E			D	

Intersection Summary

HCM 2000 Control Delay	53.6	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.91		
Actuated Cycle Length (s)	125.7	Sum of lost time (s)	16.5
Intersection Capacity Utilization	85.3%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
40: First St/Springtown Blvd & I-580 WB Ramps

BART to Livermore Extension Project
2040 Express Bus PM
























Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations			TT			T	TT	T			TT	T
Traffic Volume (vph)	0	0	262	0	0	0	385	1439	0	0	421	181
Future Volume (vph)	0	0	262	0	0	0	385	1439	0	0	421	181
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)			4.5				4.5	4.0			4.5	4.5
Lane Util. Factor			0.88				0.97	1.00			0.95	1.00
Frt			0.85				1.00	1.00			1.00	0.85
Flt Protected			1.00				0.95	1.00			1.00	1.00
Satd. Flow (prot)			2787				3433	1863			3539	1583
Flt Permitted			1.00				0.95	1.00			1.00	1.00
Satd. Flow (perm)			2787				3433	1863			3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	285	0	0	0	418	1564	0	0	458	197
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	9
Lane Group Flow (vph)	0	0	285	0	0	0	418	1564	0	0	458	188
Turn Type			Over			Free	Prot	NA			NA	Perm
Protected Phases			5				5	2			6	
Permitted Phases						Free						6
Actuated Green, G (s)			19.7				19.7	130.0			102.3	102.3
Effective Green, g (s)			19.2				19.2	130.0			101.8	101.8
Actuated g/C Ratio			0.15				0.15	1.00			0.78	0.78
Clearance Time (s)			4.0				4.0	4.0			4.0	4.0
Vehicle Extension (s)			2.0				2.0	0.2			4.0	4.0
Lane Grp Cap (vph)			411				507	1863			2771	1239
v/s Ratio Prot			0.10				0.12	c0.84			0.13	
v/s Ratio Perm												0.12
v/c Ratio			0.69				0.82	0.84			0.17	0.15
Uniform Delay, d1			52.6				53.8	0.0			3.5	3.5
Progression Factor			1.00				0.82	1.00			1.00	1.00
Incremental Delay, d2			4.1				1.0	0.5			0.1	0.3
Delay (s)			56.7				45.0	0.5			3.6	3.7
Level of Service			E				D	A			A	A
Approach Delay (s)		56.7			0.0			9.8			3.7	
Approach LOS		E			A			A			A	

Intersection Summary		
HCM 2000 Control Delay	13.0	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.90	B
Actuated Cycle Length (s)	130.0	Sum of lost time (s)
Intersection Capacity Utilization	79.1%	9.0
Analysis Period (min)	15	ICU Level of Service
		D

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
41: First St & I-580 EB Ramps

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations			 					 			 		
Traffic Volume (vph)	536	3	682	0	0	0	0	1696	446	97	1179	0	
Future Volume (vph)	536	3	682	0	0	0	0	1696	446	97	1179	0	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)		4.0	4.0					5.0	5.0	5.0	5.0		
Lane Util. Factor		1.00	0.88					0.95	1.00	1.00	0.95		
Frt		1.00	0.85					1.00	0.85	1.00	1.00		
Flt Protected		0.95	1.00					1.00	1.00	0.95	1.00		
Satd. Flow (prot)		1774	2787					3539	1583	1770	3539		
Flt Permitted		0.95	1.00					1.00	1.00	0.95	1.00		
Satd. Flow (perm)		1774	2787					3539	1583	1770	3539		
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	
Adj. Flow (vph)	583	3	741	0	0	0	0	1843	485	105	1282	0	
RTOR Reduction (vph)	0	0	81	0	0	0	0	0	152	0	0	0	
Lane Group Flow (vph)	0	586	660	0	0	0	0	1843	333	105	1282	0	
Turn Type	Perm	NA	Perm					NA	Perm	Prot	NA		
Protected Phases		4						2		1	6		
Permitted Phases	4		4						2				
Actuated Green, G (s)		41.5	41.5					67.5	67.5	9.0	80.5		
Effective Green, g (s)		41.0	41.0					67.0	67.0	8.0	80.0		
Actuated g/C Ratio		0.32	0.32					0.52	0.52	0.06	0.62		
Clearance Time (s)		3.5	3.5					4.5	4.5	4.0	4.5		
Vehicle Extension (s)		2.5	2.5					4.0	4.0	2.0	4.0		
Lane Grp Cap (vph)		559	878					1823	815	108	2177		
v/s Ratio Prot								c0.52		c0.06	0.36		
v/s Ratio Perm		0.33	0.24						0.21				
v/c Ratio		1.05	0.75					1.01	0.41	0.97	0.59		
Uniform Delay, d1		44.5	39.9					31.5	19.3	60.9	15.1		
Progression Factor		1.00	1.00					1.00	1.00	0.93	0.97		
Incremental Delay, d2		51.3	3.5					23.8	1.5	76.7	1.2		
Delay (s)		95.8	43.4					55.3	20.9	133.3	15.8		
Level of Service		F	D					E	C	F	B		
Approach Delay (s)		66.6			0.0			48.1			24.7		
Approach LOS		E			A			D			C		
Intersection Summary													
HCM 2000 Control Delay			46.5									HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio			1.02										
Actuated Cycle Length (s)			130.0									Sum of lost time (s)	14.0
Intersection Capacity Utilization			93.8%									ICU Level of Service	F
Analysis Period (min)			15										

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
42: 1st St & Mines Rd

BART to Livermore Extension Project
2040 Express Bus PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	74	244	77	434	223	326	69	1536	867	382	1175	50
Future Volume (vph)	74	244	77	434	223	326	69	1536	867	382	1175	50
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	0.97	1.00	1.00	1.00	0.91	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	1863	1583	3433	1863	1583	1770	5085	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	1863	1583	3433	1863	1583	1770	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	80	265	84	472	242	354	75	1670	942	415	1277	54
RTOR Reduction (vph)	0	0	72	0	0	34	0	0	150	0	0	26
Lane Group Flow (vph)	80	265	12	472	242	320	75	1670	792	415	1277	28
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8	1	5	2		1	NA	6
Permitted Phases			4			8			2			6
Actuated Green, G (s)	7.0	16.0	16.0	14.0	23.0	36.0	7.7	51.8	51.8	13.0	57.1	57.1
Effective Green, g (s)	7.0	16.0	16.0	14.0	23.0	36.0	7.7	51.8	51.8	13.0	57.1	57.1
Actuated g/C Ratio	0.06	0.14	0.14	0.13	0.21	0.32	0.07	0.47	0.47	0.12	0.52	0.52
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	111	269	228	433	386	571	123	2377	740	402	2620	815
v/s Ratio Prot	0.05	c0.14		c0.14	0.13	0.07	0.04	0.33		c0.12	0.25	
v/s Ratio Perm			0.01			0.14			c0.50			0.02
v/c Ratio	0.72	0.99	0.05	1.09	0.63	0.56	0.61	0.70	1.07	1.03	0.49	0.03
Uniform Delay, d1	50.9	47.3	40.9	48.4	40.0	30.9	50.1	23.4	29.5	48.9	17.4	13.2
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	20.4	50.3	0.1	69.8	3.2	1.3	8.3	1.0	53.4	53.5	0.1	0.0
Delay (s)	71.4	97.6	41.0	118.2	43.2	32.1	58.4	24.4	82.9	102.4	17.5	13.3
Level of Service	E	F	D	F	D	C	E	C	F	F	B	B
Approach Delay (s)		81.6			72.7			45.8			37.6	
Approach LOS		F			E			D			D	























Intersection Summary

HCM 2000 Control Delay	50.8	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	1.05		
Actuated Cycle Length (s)	110.8	Sum of lost time (s)	16.0
Intersection Capacity Utilization	87.4%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group























HCM Unsignalized Intersection Capacity Analysis
43: Vasco Rd & I-580 WB Ramps

BART to Livermore Extension Project
2040 Express Bus PM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations								  			  	
Traffic Volume (veh/h)	0	0	0	0	0	149	0	2459	0	0	584	0
Future Volume (Veh/h)	0	0	0	0	0	149	0	2459	0	0	584	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	0	0	0	162	0	2673	0	0	635	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage (veh)												
Upstream signal (ft)											524	
pX, platoon unblocked												
vC, conflicting volume	1688	3308	212	2885	3308	891	635			2673		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1688	3308	212	2885	3308	891	635			2673		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	100	100	43	100			100		
cM capacity (veh/h)	26	8	794	7	8	285	944			153		
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	NB 4	SB 1	SB 2	SB 3	SB 4		
Volume Total	0	162	891	891	891	0	212	212	212	0		
Volume Left	0	0	0	0	0	0	0	0	0	0		
Volume Right	0	162	0	0	0	0	0	0	0	0		
cSH	1700	285	1700	1700	1700	1700	1700	1700	1700	1700		
Volume to Capacity	0.00	0.57	0.52	0.52	0.52	0.00	0.12	0.12	0.12	0.00		
Queue Length 95th (ft)	0	81	0	0	0	0	0	0	0	0		
Control Delay (s)	0.0	33.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
Lane LOS	A	D										
Approach Delay (s)	0.0	33.0	0.0				0.0					
Approach LOS	A	D										
Intersection Summary												
Average Delay			1.5									
Intersection Capacity Utilization			63.4%		ICU Level of Service					B		
Analysis Period (min)			15									






















HCM Unsignalized Intersection Capacity Analysis
44: Vasco Rd & I-580 EB Ramps

BART to Livermore Extension Project
2040 Express Bus PM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations								  			  	
Traffic Volume (veh/h)	0	0	0	0	0	0	0	2860	0	64	726	0
Future Volume (Veh/h)	0	0	0	0	0	0	0	2860	0	64	726	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	0	0	0	0	0	3109	0	70	789	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1965	4038	263	3512	4038	1036	789			3109		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1965	4038	263	3512	4038	1036	789			3109		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	100	100	100	100			31		
cM capacity (veh/h)	17	1	735	1	1	228	827			102		
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	NB 4	SB 1	SB 2	SB 3	SB 4		
Volume Total	0	0	1036	1036	1036	0	70	263	263	263		
Volume Left	0	0	0	0	0	0	70	0	0	0		
Volume Right	0	0	0	0	0	0	0	0	0	0		
cSH	1700	1700	1700	1700	1700	1700	102	1700	1700	1700		
Volume to Capacity	0.00	0.00	0.61	0.61	0.61	0.00	0.69	0.15	0.15	0.15		
Queue Length 95th (ft)	0	0	0	0	0	0	87	0	0	0		
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	95.6	0.0	0.0	0.0		
Lane LOS	A	A					F					
Approach Delay (s)	0.0	0.0	0.0				7.8					
Approach LOS	A	A										
Intersection Summary												
Average Delay			1.7									
Intersection Capacity Utilization			58.6%		ICU Level of Service					B		
Analysis Period (min)			15									

HCM Signalized Intersection Capacity Analysis
45: Vasco Rd & East Ave

BART to Livermore Extension Project
2040 Express Bus PM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	733	39	117	136	396	287	112	416	14	16	380	449
Future Volume (vph)	733	39	117	136	396	287	112	416	14	16	380	449
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	0.95		0.97	1.00	1.00
Frt	1.00	0.89		1.00	0.94		1.00	1.00		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	3140		1770	3316		1770	3522		3433	1863	1583
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1770	3140		1770	3316		1770	3522		3433	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	797	42	127	148	430	312	122	452	15	17	413	488
RTOR Reduction (vph)	0	71	0	0	119	0	0	2	0	0	0	373
Lane Group Flow (vph)	797	98	0	148	623	0	122	465	0	17	413	115
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												6
Actuated Green, G (s)	45.0	49.2		13.8	18.0		7.0	31.8		1.6	26.4	26.4
Effective Green, g (s)	45.0	49.2		13.8	18.0		7.0	31.8		1.6	26.4	26.4
Actuated g/C Ratio	0.40	0.44		0.12	0.16		0.06	0.28		0.01	0.23	0.23
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	708	1374		217	531		110	996		48	437	371
v/s Ratio Prot	c0.45	0.03		0.08	c0.19		c0.07	0.13		0.00	c0.22	
v/s Ratio Perm												0.07
v/c Ratio	1.13	0.07		0.68	1.17		1.11	0.47		0.35	0.95	0.31
Uniform Delay, d1	33.7	18.3		47.2	47.2		52.7	33.3		54.9	42.3	35.5
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	74.0	0.0		8.5	96.3		118.2	0.3		4.5	29.3	0.5
Delay (s)	107.7	18.4		55.7	143.5		170.9	33.6		59.3	71.6	36.0
Level of Service	F	B		E	F		F	C		E	E	D
Approach Delay (s)		92.1			128.9			62.1			52.4	
Approach LOS		F			F			E			D	
Intersection Summary												
HCM 2000 Control Delay			85.7									F
HCM 2000 Volume to Capacity ratio			1.08									
Actuated Cycle Length (s)			112.4							16.0		
Intersection Capacity Utilization			100.3%									G
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis
46: Greenville Rd & I-580 WB Ramps

BART to Livermore Extension Project
2040 Express Bus PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↖↗		↖		↕↕	↖		↕↔	
Traffic Volume (vph)	0	0	0	105	0	32	0	1315	557	0	166	25
Future Volume (vph)	0	0	0	105	0	32	0	1315	557	0	166	25
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0		4.0		4.0	4.0		4.0	
Lane Util. Factor				0.97		1.00		0.95	1.00		0.95	
Frt				1.00		0.85		1.00	0.85		0.98	
Flt Protected				0.95		1.00		1.00	1.00		1.00	
Satd. Flow (prot)				3433		1583		3539	1583		3470	
Flt Permitted				0.95		1.00		1.00	1.00		1.00	
Satd. Flow (perm)				3433		1583		3539	1583		3470	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	114	0	35	0	1429	605	0	180	27
RTOR Reduction (vph)	0	0	0	0	0	32	0	0	82	0	4	0
Lane Group Flow (vph)	0	0	0	114	0	3	0	1429	523	0	203	0
Turn Type				Prot		Prot		NA	Perm		NA	
Protected Phases				3		3		2			6	
Permitted Phases									2			
Actuated Green, G (s)				9.7		9.7		112.3	112.3		112.3	
Effective Green, g (s)				9.7		9.7		112.3	112.3		112.3	
Actuated g/C Ratio				0.07		0.07		0.86	0.86		0.86	
Clearance Time (s)				4.0		4.0		4.0	4.0		4.0	
Vehicle Extension (s)				3.0		3.0		3.0	3.0		3.0	
Lane Grp Cap (vph)				256		118		3057	1367		2997	
v/s Ratio Prot				c0.03		0.00		c0.40			0.06	
v/s Ratio Perm									0.33			
v/c Ratio				0.45		0.02		0.47	0.38		0.07	
Uniform Delay, d1				57.6		55.8		2.0	1.8		1.3	
Progression Factor				1.00		1.00		0.84	0.36		1.00	
Incremental Delay, d2				1.2		0.1		0.5	0.8		0.0	
Delay (s)				58.8		55.8		2.2	1.4		1.3	
Level of Service				E		E		A	A		A	
Approach Delay (s)		0.0			58.1			1.9			1.3	
Approach LOS		A			E			A			A	






















Intersection Summary

HCM 2000 Control Delay	5.4	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.47		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	46.4%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
47: Greenville Rd & I-580 EB Ramps

BART to Livermore Extension Project
2040 Express Bus PM

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations	 							 			 		
Traffic Volume (vph)	193	0	80	0	0	0	0	1378	382	0	198	65	
Future Volume (vph)	193	0	80	0	0	0	0	1378	382	0	198	65	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)	4.0		4.0					4.0	4.0		4.0	4.0	
Lane Util. Factor	0.97		1.00					0.95	1.00		0.95	1.00	
Frt	1.00		0.85					1.00	0.85		1.00	0.85	
Flt Protected	0.95		1.00					1.00	1.00		1.00	1.00	
Satd. Flow (prot)	3433		1583					3539	1583		3539	1583	
Flt Permitted	0.95		1.00					1.00	1.00		1.00	1.00	
Satd. Flow (perm)	3433		1583					3539	1583		3539	1583	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	
Adj. Flow (vph)	210	0	87	0	0	0	0	1498	415	0	215	71	
RTOR Reduction (vph)	0	0	78	0	0	0	0	0	68	0	0	12	
Lane Group Flow (vph)	210	0	9	0	0	0	0	1498	347	0	215	59	
Turn Type	Prot		Prot					NA	Perm		NA	Perm	
Protected Phases	7		7					2			6		
Permitted Phases									2			6	
Actuated Green, G (s)	13.3		13.3					108.7	108.7		108.7	108.7	
Effective Green, g (s)	13.3		13.3					108.7	108.7		108.7	108.7	
Actuated g/C Ratio	0.10		0.10					0.84	0.84		0.84	0.84	
Clearance Time (s)	4.0		4.0					4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0		3.0					3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	351		161					2959	1323		2959	1323	
v/s Ratio Prot	c0.06		0.01					c0.42			0.06		
v/s Ratio Perm									0.22			0.04	
v/c Ratio	0.60		0.06					0.51	0.26		0.07	0.04	
Uniform Delay, d1	55.8		52.7					3.0	2.2		1.9	1.8	
Progression Factor	1.00		1.00					1.00	1.00		0.60	0.10	
Incremental Delay, d2	2.7		0.1					0.6	0.5		0.0	0.1	
Delay (s)	58.5		52.8					3.6	2.7		1.2	0.2	
Level of Service	E		D					A	A		A	A	
Approach Delay (s)		56.9			0.0			3.4			0.9		
Approach LOS		E			A			A			A		
Intersection Summary													
HCM 2000 Control Delay			9.5									HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio			0.52										
Actuated Cycle Length (s)			130.0									Sum of lost time (s)	8.0
Intersection Capacity Utilization			50.3%									ICU Level of Service	A
Analysis Period (min)			15										
c Critical Lane Group													

HCM Signalized Intersection Capacity Analysis
 48: Greenville Rd & Northfront Road/Altamont Pass Road

BART to Livermore Extension Project
 2040 Express Bus PM



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↑	↑	↑	↑	↑
Traffic Volume (vph)	555	179	2	73	267	1150
Future Volume (vph)	555	179	2	73	267	1150
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	1863	1583	1770	1863	1770	1583
Flt Permitted	1.00	1.00	0.11	1.00	0.95	1.00
Satd. Flow (perm)	1863	1583	213	1863	1770	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	603	195	2	79	290	1250
RTOR Reduction (vph)	0	87	0	0	0	25
Lane Group Flow (vph)	603	108	2	79	290	1225
Turn Type	NA	Perm	Perm	NA	Prot	Perm
Protected Phases	4			8	2	
Permitted Phases		4	8			2
Actuated Green, G (s)	35.0	35.0	35.0	35.0	77.0	77.0
Effective Green, g (s)	35.0	35.0	35.0	35.0	77.0	77.0
Actuated g/C Ratio	0.29	0.29	0.29	0.29	0.64	0.64
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	543	461	62	543	1135	1015
v/s Ratio Prot	c0.32			0.04	0.16	
v/s Ratio Perm		0.07	0.01			c0.77
v/c Ratio	1.11	0.23	0.03	0.15	0.26	1.21
Uniform Delay, d1	42.5	32.3	30.4	31.4	9.2	21.5
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	72.6	0.3	0.2	0.1	0.1	102.6
Delay (s)	115.1	32.6	30.6	31.6	9.3	124.1
Level of Service	F	C	C	C	A	F
Approach Delay (s)	94.9			31.5	102.5	
Approach LOS	F			C	F	

Intersection Summary

HCM 2000 Control Delay	97.6	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.18		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	107.1%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	401	112	227	1152	143	134
Future Volume (vph)	401	112	227	1152	143	134
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.2	5.2	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.88	0.97	0.95	0.95	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	3433	2787	3433	3539	3539	1583
Flt Permitted	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (perm)	3433	2787	3433	3539	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	436	122	247	1252	155	146
RTOR Reduction (vph)	0	95	0	0	0	84
Lane Group Flow (vph)	436	27	247	1252	155	62
Turn Type	Prot	Perm	Prot	NA	NA	Perm
Protected Phases	8		1	6	2	
Permitted Phases		8				2
Actuated Green, G (s)	16.2	16.2	11.5	43.5	28.0	28.0
Effective Green, g (s)	15.6	15.6	11.5	45.2	29.7	29.7
Actuated g/C Ratio	0.22	0.22	0.16	0.65	0.42	0.42
Clearance Time (s)	4.6	4.6	4.0	5.7	5.7	5.7
Vehicle Extension (s)	5.0	5.0	6.0	2.5	2.5	2.5
Lane Grp Cap (vph)	765	621	563	2285	1501	671
v/s Ratio Prot	c0.13		0.07	c0.35	0.04	
v/s Ratio Perm		0.01				0.04
v/c Ratio	0.57	0.04	0.44	0.55	0.10	0.09
Uniform Delay, d1	24.2	21.3	26.3	6.8	12.1	12.1
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.6	0.1	1.5	1.0	0.1	0.3
Delay (s)	25.8	21.4	27.9	7.7	12.3	12.3
Level of Service	C	C	C	A	B	B
Approach Delay (s)	24.9			11.1	12.3	
Approach LOS	C			B	B	

Intersection Summary

HCM 2000 Control Delay	14.5	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.59		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	13.2
Intersection Capacity Utilization	51.0%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
50: Greenville Rd & Patterson Pass Rd

BART to Livermore Extension Project
2040 Express Bus PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	39	540	66	6	12	8	70	478	352	411	216	40
Future Volume (vph)	39	540	66	6	12	8	70	478	352	411	216	40
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.98		1.00	0.94		1.00	0.94		1.00	0.98	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1832		1770	1748		1770	1744		1770	1820	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	1832		1770	1748		1770	1744		1770	1820	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	42	587	72	7	13	9	76	520	383	447	235	43
RTOR Reduction (vph)	0	3	0	0	7	0	0	18	0	0	4	0
Lane Group Flow (vph)	42	656	0	7	15	0	76	885	0	447	274	0
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												
Actuated Green, G (s)	4.7	39.0		0.8	35.1		8.8	55.8		26.0	73.0	
Effective Green, g (s)	4.7	39.0		0.8	35.1		8.8	55.8		26.0	73.0	
Actuated g/C Ratio	0.03	0.28		0.01	0.26		0.06	0.41		0.19	0.53	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	60	519		10	445		113	707		334	965	
v/s Ratio Prot	c0.02	c0.36		0.00	0.01		0.04	c0.51		c0.25	0.15	
v/s Ratio Perm												
v/c Ratio	0.70	1.26		0.70	0.03		0.67	1.25		1.34	0.28	
Uniform Delay, d1	65.8	49.3		68.3	38.5		63.0	40.9		55.8	17.9	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	30.0	133.7		117.6	0.0		14.6	124.5		171.2	0.7	
Delay (s)	95.8	183.0		185.9	38.5		77.6	165.4		227.0	18.6	
Level of Service	F	F		F	D		E	F		F	B	
Approach Delay (s)		177.7			74.1			158.6			147.1	
Approach LOS		F			E			F			F	

Intersection Summary

HCM 2000 Control Delay	159.7	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.28		
Actuated Cycle Length (s)	137.6	Sum of lost time (s)	16.0
Intersection Capacity Utilization	111.8%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
1: Dougherty Rd & Amador Valley Rd



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	99	777	466	822	2144	132
Future Volume (vph)	99	777	466	822	2144	132
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00	0.97	0.91	0.91	
Frt	1.00	0.85	1.00	1.00	0.99	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1770	1583	3433	5085	5041	
Flt Permitted	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	1770	1583	3433	5085	5041	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	108	845	507	893	2330	143
RTOR Reduction (vph)	0	158	0	0	6	0
Lane Group Flow (vph)	108	687	507	893	2467	0
Turn Type	Perm	Perm	Prot	NA	NA	
Protected Phases			5	2	6	
Permitted Phases	4	4				
Actuated Green, G (s)	40.0	40.0	14.0	67.0	49.0	
Effective Green, g (s)	40.0	40.0	14.0	67.0	49.0	
Actuated g/C Ratio	0.35	0.35	0.12	0.58	0.43	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	615	550	417	2962	2147	
v/s Ratio Prot			c0.15	0.18	c0.49	
v/s Ratio Perm	0.06	c0.43				
v/c Ratio	0.18	1.25	1.22	0.30	1.15	
Uniform Delay, d1	26.0	37.5	50.5	12.2	33.0	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.1	126.3	117.3	0.1	73.1	
Delay (s)	26.2	163.8	167.8	12.2	106.1	
Level of Service	C	F	F	B	F	
Approach Delay (s)	148.2			68.5	106.1	
Approach LOS	F			E	F	

Intersection Summary

HCM 2000 Control Delay	103.5	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.20		
Actuated Cycle Length (s)	115.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	99.1%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
2: Hopyard Road/Dougherty Rd & Dublin Blvd

BART to Livermore Extension Project
2040 Enhanced Bus AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	54	508	534	342	894	478	742	1066	133	929	2178	108
Future Volume (vph)	54	508	534	342	894	478	742	1066	133	929	2178	108
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	6.0	5.0	5.0	5.5	5.0	5.0	5.5	5.0	5.0	5.5	
Lane Util. Factor	0.97	0.91	0.88	0.94	0.91	1.00	0.94	0.91	0.88	0.97	0.86	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	3433	5085	2787	4990	5085	1583	4990	5085	2787	3433	6363	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	3433	5085	2787	4990	5085	1583	4990	5085	2787	3433	6363	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	59	552	580	372	972	520	807	1159	145	1010	2367	117
RTOR Reduction (vph)	0	0	63	0	0	81	0	0	60	0	4	0
Lane Group Flow (vph)	59	552	517	372	972	439	807	1159	85	1010	2480	0
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	
Protected Phases	5	2	3	1	6	7	3	8	1	7	4	
Permitted Phases			2			6			8			
Actuated Green, G (s)	12.0	32.3	49.3	15.0	35.8	62.0	17.0	45.0	60.0	26.2	54.2	
Effective Green, g (s)	12.0	32.3	49.3	15.0	35.8	62.0	17.0	45.0	60.0	26.2	54.2	
Actuated g/C Ratio	0.09	0.23	0.35	0.11	0.26	0.44	0.12	0.32	0.43	0.19	0.39	
Clearance Time (s)	5.0	6.0	5.0	5.0	5.5	5.0	5.0	5.5	5.0	5.0	5.5	
Vehicle Extension (s)	2.0	4.5	2.0	2.0	4.5	2.0	2.0	4.5	2.0	2.0	4.5	
Lane Grp Cap (vph)	294	1173	981	534	1300	701	605	1634	1194	642	2463	
v/s Ratio Prot	0.02	0.11	c0.06	0.07	c0.19	0.12	c0.16	0.23	0.01	c0.29	c0.39	
v/s Ratio Perm			0.12			0.16			0.02			
v/c Ratio	0.20	0.47	0.53	0.70	0.75	0.63	1.33	0.71	0.07	1.57	1.01	
Uniform Delay, d1	59.5	46.5	36.1	60.3	47.9	30.1	61.5	41.8	23.6	56.9	42.9	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.12	1.15	0.96	1.00	1.00	
Incremental Delay, d2	0.1	1.4	0.2	3.2	4.0	1.3	159.1	1.3	0.0	265.4	19.8	
Delay (s)	59.7	47.8	36.3	63.5	51.9	31.3	228.0	49.2	22.7	322.3	62.7	
Level of Service	E	D	D	E	D	C	F	D	C	F	E	
Approach Delay (s)		42.8			48.5			115.7			137.7	
Approach LOS		D			D			F			F	

Intersection Summary

HCM 2000 Control Delay	100.1	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.04		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	21.5
Intersection Capacity Utilization	94.7%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 3: Dougherty Rd/Hopyard Road & I-580 WB Ramps



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↔↔		↔↔		↑↑↑			↑↑↑	↔
Traffic Volume (vph)	0	0	0	391	0	637	0	1727	0	0	2196	0
Future Volume (vph)	0	0	0	391	0	637	0	1727	0	0	2196	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0		4.0		4.0			4.0	
Lane Util. Factor				0.97		0.88		0.91			0.86	
Frt				1.00		0.85		1.00			1.00	
Flt Protected				0.95		1.00		1.00			1.00	
Satd. Flow (prot)				3433		2787		5085			4806	
Flt Permitted				0.95		1.00		1.00			1.00	
Satd. Flow (perm)				3433		2787		5085			4806	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	425	0	692	0	1877	0	0	2387	0
RTOR Reduction (vph)	0	0	0	0	0	22	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	425	0	670	0	1877	0	0	2387	0
Turn Type				Prot		Prot		NA			NA	Perm
Protected Phases				4		4		2			6	
Permitted Phases												6
Actuated Green, G (s)				39.1		39.1		90.1			90.1	
Effective Green, g (s)				40.5		40.5		91.5			91.5	
Actuated g/C Ratio				0.29		0.29		0.65			0.65	
Clearance Time (s)				5.4		5.4		5.4			5.4	
Vehicle Extension (s)				3.0		3.0		3.0			3.0	
Lane Grp Cap (vph)				993		806		3323			3141	
v/s Ratio Prot				0.12		c0.24		0.37			c0.50	
v/s Ratio Perm												
v/c Ratio				0.43		0.83		0.56			0.76	
Uniform Delay, d1				40.4		46.6		13.3			16.7	
Progression Factor				1.00		1.00		0.89			0.44	
Incremental Delay, d2				0.3		7.3		0.6			0.8	
Delay (s)				40.7		53.9		12.4			8.2	
Level of Service				D		D		B			A	
Approach Delay (s)		0.0			48.8			12.4			8.2	
Approach LOS		A			D			B			A	

Intersection Summary

HCM 2000 Control Delay	18.1	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.78		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	62.3%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
4: Hopyard Rd/Dougherty Rd & I-580 EB Ramps

BART to Livermore Extension Project
2040 Enhanced Bus AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗		↖↗					↑↑↑	↖		↑↑↑	↖
Traffic Volume (vph)	895	0	1416	0	0	0	0	938	0	0	1787	0
Future Volume (vph)	895	0	1416	0	0	0	0	938	0	0	1787	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0					4.0			4.0	
Lane Util. Factor	0.97		0.88					0.91			0.86	
Frt	1.00		0.85					1.00			1.00	
Flt Protected	0.95		1.00					1.00			1.00	
Satd. Flow (prot)	3433		2787					5085			4806	
Flt Permitted	0.95		1.00					1.00			1.00	
Satd. Flow (perm)	3433		2787					5085			4806	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	973	0	1539	0	0	0	0	1020	0	0	1942	0
RTOR Reduction (vph)	0	0	9	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	973	0	1530	0	0	0	0	1020	0	0	1942	0
Turn Type	Prot		Prot					NA	Free		NA	Perm
Protected Phases	4		4					2			6	
Permitted Phases									Free			6
Actuated Green, G (s)	71.6		71.6					57.6			57.6	
Effective Green, g (s)	73.0		73.0					59.0			59.0	
Actuated g/C Ratio	0.52		0.52					0.42			0.42	
Clearance Time (s)	5.4		5.4					5.4			5.4	
Vehicle Extension (s)	3.0		3.0					3.0			3.0	
Lane Grp Cap (vph)	1790		1453					2142			2025	
v/s Ratio Prot	0.28		c0.55					0.20			c0.40	
v/s Ratio Perm												
v/c Ratio	0.54		1.05					0.48			0.96	
Uniform Delay, d1	22.4		33.5					29.3			39.3	
Progression Factor	1.00		1.00					1.00			0.68	
Incremental Delay, d2	0.3		38.9					0.8			9.6	
Delay (s)	22.7		72.4					30.1			36.2	
Level of Service	C		E					C			D	
Approach Delay (s)		53.2			0.0			30.1			36.2	
Approach LOS		D			A			C			D	

Intersection Summary

HCM 2000 Control Delay	42.8	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	1.01		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	90.7%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
5: Hopyard Rd & Owens Rd

BART to Livermore Extension Project
2040 Enhanced Bus AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	213	87	48	119	125	236	138	848	150	899	1789	564
Future Volume (vph)	213	87	48	119	125	236	138	848	150	899	1789	564
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	2.7	2.7		2.7	2.7	2.7	4.0	2.3	2.3	4.0	2.3	
Lane Util. Factor	0.91	0.91		1.00	0.95	0.95	1.00	0.91	1.00	0.97	0.91	
Frt	1.00	0.97		1.00	0.94	0.85	1.00	1.00	0.85	1.00	0.96	
Flt Protected	0.95	0.98		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1610	3218		1770	1671	1504	1770	5085	1583	3433	4902	
Flt Permitted	0.95	0.98		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1610	3218		1770	1671	1504	1770	5085	1583	3433	4902	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	232	95	52	129	136	257	150	922	163	977	1945	613
RTOR Reduction (vph)	0	25	0	0	24	31	0	0	114	0	63	0
Lane Group Flow (vph)	128	226	0	129	192	146	150	922	49	977	2495	0
Turn Type	Split	NA		Split	NA	pm+ov	Prot	NA	Perm	Prot	NA	
Protected Phases	8	8		4	4	1	5	2		1	6	
Permitted Phases						4			2			
Actuated Green, G (s)	7.0	7.0		9.0	9.0	41.7	9.0	25.3	25.3	32.7	49.0	
Effective Green, g (s)	8.3	8.3		10.3	10.3	44.3	9.0	27.0	27.0	32.7	50.7	
Actuated g/C Ratio	0.09	0.09		0.11	0.11	0.49	0.10	0.30	0.30	0.36	0.56	
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	148	296		202	191	785	177	1525	474	1247	2761	
v/s Ratio Prot	c0.08	0.07		0.07	c0.11	0.07	0.08	0.18		c0.28	c0.51	
v/s Ratio Perm						0.03			0.03			
v/c Ratio	0.86	0.77		0.64	1.01	0.19	0.85	0.60	0.10	0.78	0.90	
Uniform Delay, d1	40.3	39.9		38.1	39.9	12.8	39.8	26.9	22.8	25.5	17.5	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	37.4	11.2		6.5	66.6	0.1	29.4	1.8	0.4	3.3	5.4	
Delay (s)	77.7	51.1		44.6	106.5	12.9	69.2	28.7	23.2	28.8	22.9	
Level of Service	E	D		D	F	B	E	C	C	C	C	
Approach Delay (s)		60.1			59.4			32.9			24.5	
Approach LOS		E			E			C			C	

Intersection Summary

HCM 2000 Control Delay	31.9	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.92		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	11.7
Intersection Capacity Utilization	86.3%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
6: Hopyard Rd & Stoneridge Dr

BART to Livermore Extension Project
2040 Enhanced Bus AM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	205	786	468	71	982	130	631	805	74	296	1025	282
Future Volume (vph)	205	786	468	71	982	130	631	805	74	296	1025	282
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.91	1.00	0.97	0.91	1.00	0.94	0.95	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5085	1583	3433	5085	1583	4990	3539	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5085	1583	3433	5085	1583	4990	3539	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	223	854	509	77	1067	141	686	875	80	322	1114	307
RTOR Reduction (vph)	0	0	201	0	0	101	0	0	57	0	0	127
Lane Group Flow (vph)	223	854	308	77	1067	40	686	875	23	322	1114	180
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	NA	6
Permitted Phases			4			8			2			6
Actuated Green, G (s)	4.0	19.1	19.1	2.4	17.5	17.5	8.0	18.0	18.0	6.0	16.0	16.0
Effective Green, g (s)	4.0	19.1	19.1	2.4	17.5	17.5	8.0	18.0	18.0	6.0	16.0	16.0
Actuated g/C Ratio	0.07	0.31	0.31	0.04	0.28	0.28	0.13	0.29	0.29	0.10	0.26	0.26
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	223	1579	491	133	1446	450	649	1035	463	334	1322	411
v/s Ratio Prot	c0.06	0.17		0.02	c0.21		c0.14	c0.25		0.09	0.22	
v/s Ratio Perm			0.19			0.03			0.01			0.11
v/c Ratio	1.00	0.54	0.63	0.58	0.74	0.09	1.06	0.85	0.05	0.96	0.84	0.44
Uniform Delay, d1	28.8	17.6	18.2	29.1	19.9	16.1	26.8	20.4	15.6	27.6	21.6	19.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	60.3	0.4	2.5	6.0	2.0	0.1	51.3	6.5	0.0	39.4	5.1	0.8
Delay (s)	89.0	17.9	20.7	35.0	21.9	16.2	78.1	26.9	15.7	67.0	26.6	19.8
Level of Service	F	B	C	D	C	B	E	C	B	E	C	B
Approach Delay (s)		28.8			22.1			47.8			32.9	
Approach LOS		C			C			D			C	

Intersection Summary		
HCM 2000 Control Delay	33.5	HCM 2000 Level of Service C
HCM 2000 Volume to Capacity ratio	0.88	
Actuated Cycle Length (s)	61.5	Sum of lost time (s) 16.0
Intersection Capacity Utilization	70.0%	ICU Level of Service C
Analysis Period (min)	15	

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
7: Hopyard Rd & Las Positas Blvd

BART to Livermore Extension Project
2040 Enhanced Bus AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔↔	↑↑	↗	↔↔	↑↑	↗	↔↔	↑↑↑	↗	↔↔	↑↑↑	↗
Traffic Volume (vph)	153	487	411	361	456	54	462	1197	395	113	1077	95
Future Volume (vph)	153	487	411	361	456	54	462	1197	395	113	1077	95
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.95	1.00	0.97	0.95	1.00	0.97	0.91	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	3433	3539	1583	3433	5085	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	3433	3539	1583	3433	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	166	529	447	392	496	59	502	1301	429	123	1171	103
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	75
Lane Group Flow (vph)	166	529	447	392	496	59	502	1301	429	123	1171	28
Turn Type	Prot	NA	Free	Prot	NA	Free	Prot	NA	Free	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1		6
Permitted Phases			Free			Free			Free			6
Actuated Green, G (s)	6.9	14.5	69.4	9.0	16.6	69.4	11.0	26.7	69.4	3.2	18.9	18.9
Effective Green, g (s)	6.9	14.5	69.4	9.0	16.6	69.4	11.0	26.7	69.4	3.2	18.9	18.9
Actuated g/C Ratio	0.10	0.21	1.00	0.13	0.24	1.00	0.16	0.38	1.00	0.05	0.27	0.27
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	341	739	1583	445	846	1583	544	1956	1583	158	1384	431
v/s Ratio Prot	0.05	c0.15		c0.11	0.14		c0.15	0.26		0.04	c0.23	
v/s Ratio Perm			c0.28			0.04			0.27			0.02
v/c Ratio	0.49	0.72	0.28	0.88	0.59	0.04	0.92	0.67	0.27	0.78	0.85	0.07
Uniform Delay, d1	29.6	25.5	0.0	29.7	23.4	0.0	28.8	17.7	0.0	32.7	23.9	18.7
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.1	3.3	0.4	18.1	1.0	0.0	21.4	0.9	0.4	21.1	5.0	0.1
Delay (s)	30.7	28.8	0.4	47.7	24.4	0.0	50.1	18.5	0.4	53.8	28.8	18.8
Level of Service	C	C	A	D	C	A	D	B	A	D	C	B
Approach Delay (s)		18.0			32.6			22.2			30.3	
Approach LOS		B			C			C			C	

Intersection Summary

HCM 2000 Control Delay	25.0	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.83		
Actuated Cycle Length (s)	69.4	Sum of lost time (s)	16.0
Intersection Capacity Utilization	71.1%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

8: Willow Rd & Owens Rd

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	103	484	220	120	334	79	116	100	0	141	97	87
Future Volume (vph)	103	484	220	120	334	79	116	100	0	141	97	87
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	5.3	4.0		5.3	4.0	4.0
Lane Util. Factor	0.97	0.91		0.97	0.91	1.00	1.00	0.95		1.00	1.00	1.00
Frt	1.00	0.95		1.00	1.00	0.85	1.00	1.00		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	4847		3433	5085	1583	1770	3539		1770	1863	1583
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.69	1.00		0.68	1.00	1.00
Satd. Flow (perm)	3433	4847		3433	5085	1583	1284	3539		1273	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	112	526	239	130	363	86	126	109	0	153	105	95
RTOR Reduction (vph)	0	111	0	0	0	49	0	0	0	0	0	73
Lane Group Flow (vph)	112	654	0	130	363	37	126	109	0	153	105	22
Turn Type	Prot	NA		Prot	NA	Perm	Perm	NA	Perm	Perm	NA	Perm
Protected Phases	1	6		5	2			4			8	
Permitted Phases						2	4		4	8		8
Actuated Green, G (s)	3.7	17.2		4.5	18.0	18.0	9.3	9.3		9.3	9.3	9.3
Effective Green, g (s)	3.7	18.9		4.5	19.7	19.7	9.3	10.6		9.3	10.6	10.6
Actuated g/C Ratio	0.08	0.41		0.10	0.43	0.43	0.20	0.23		0.20	0.23	0.23
Clearance Time (s)	4.0	5.7		4.0	5.7	5.7	5.3	5.3		5.3	5.3	5.3
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	276	1991		335	2177	677	259	815		257	429	364
v/s Ratio Prot	0.03	c0.13		c0.04	0.07			0.03			0.06	
v/s Ratio Perm						0.02	0.10			c0.12		0.01
v/c Ratio	0.41	0.33		0.39	0.17	0.05	0.49	0.13		0.60	0.24	0.06
Uniform Delay, d1	20.1	9.2		19.5	8.1	7.7	16.2	14.1		16.6	14.4	13.8
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	1.0	0.1		0.7	0.0	0.0	1.4	0.1		3.7	0.3	0.1
Delay (s)	21.1	9.3		20.2	8.1	7.7	17.7	14.1		20.3	14.7	13.9
Level of Service	C	A		C	A	A	B	B		C	B	B
Approach Delay (s)		10.8			10.8			16.0			16.9	
Approach LOS		B			B			B			B	
Intersection Summary												
HCM 2000 Control Delay			12.5			HCM 2000 Level of Service				B		
HCM 2000 Volume to Capacity ratio			0.40									
Actuated Cycle Length (s)			46.0			Sum of lost time (s)				12.0		
Intersection Capacity Utilization			42.2%			ICU Level of Service				A		
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

9: Hacienda Dr & Dublin Blvd

BART to Livermore Extension Project

2040 Enhanced Bus AM

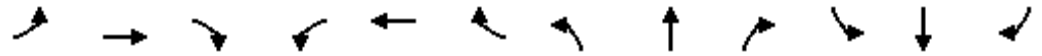
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	86	384	118	288	791	80	187	709	125	11	393	133
Future Volume (vph)	86	384	118	288	791	80	187	709	125	11	393	133
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	6.0	5.0	4.5	6.0		5.0	6.0	6.0	4.5	5.5	5.5
Lane Util. Factor	0.97	0.91	0.88	0.97	0.91		0.94	0.95	0.88	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5085	2787	3433	5015		4990	3539	2787	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5085	2787	3433	5015		4990	3539	2787	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	93	417	128	313	860	87	203	771	136	12	427	145
RTOR Reduction (vph)	0	0	52	0	8	0	0	0	98	0	0	126
Lane Group Flow (vph)	93	417	76	313	939	0	203	771	38	12	427	19
Turn Type	Prot	NA	pm+ov	Prot	NA		Prot	NA	Perm	Prot	NA	Perm
Protected Phases	5	2	3	1	6		3	8		7	NA	4
Permitted Phases			2						8			4
Actuated Green, G (s)	9.2	59.5	82.6	18.0	68.3		23.1	38.9	38.9	2.6	18.4	18.4
Effective Green, g (s)	9.2	59.5	82.6	18.0	68.3		23.1	38.9	38.9	2.6	18.4	18.4
Actuated g/C Ratio	0.07	0.42	0.59	0.13	0.49		0.17	0.28	0.28	0.02	0.13	0.13
Clearance Time (s)	4.5	6.0	5.0	4.5	6.0		5.0	6.0	6.0	4.5	5.5	5.5
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	225	2161	1644	441	2446		823	983	774	63	668	208
v/s Ratio Prot	0.03	0.08	0.01	c0.09	c0.19		0.04	c0.22		0.00	c0.08	
v/s Ratio Perm			0.02						0.01			0.01
v/c Ratio	0.41	0.19	0.05	0.71	0.38		0.25	0.78	0.05	0.19	0.64	0.09
Uniform Delay, d1	62.8	25.2	12.1	58.5	22.6		50.9	46.7	37.0	67.7	57.7	53.5
Progression Factor	1.00	1.00	1.00	1.00	1.00		0.78	0.77	0.43	1.00	1.00	1.00
Incremental Delay, d2	1.2	0.2	0.0	5.2	0.5		0.2	4.1	0.0	1.5	2.0	0.2
Delay (s)	64.0	25.4	12.1	63.7	23.1		40.0	39.8	15.9	69.1	59.7	53.6
Level of Service	E	C	B	E	C		D	D	B	E	E	D
Approach Delay (s)		28.4			33.1			36.9			58.4	
Approach LOS		C			C			D			E	

Intersection Summary			
HCM 2000 Control Delay	37.6	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.59		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	21.0
Intersection Capacity Utilization	60.8%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 10: Hacienda Dr & Martinelli Blvd/Hacienda Crossings

BART to Livermore Extension Project
 2040 Enhanced Bus AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗	↘	↙	↘		↖↗↘	↖↗↘	↖	↙	↖↗↘	
Traffic Volume (vph)	16	11	225	107	13	10	256	977	109	18	737	56
Future Volume (vph)	16	11	225	107	13	10	256	977	109	18	737	56
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	2.0	2.0	4.5	2.0		3.0	2.0	2.0	4.5	2.5	
Lane Util. Factor	1.00	0.91	0.91	0.97	1.00		0.94	0.91	1.00	0.97	0.86	
Frt	1.00	0.90	0.85	1.00	0.93		1.00	1.00	0.85	1.00	0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1770	1523	2882	3433	1740		4990	5085	1583	3433	6340	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1770	1523	2882	3433	1740		4990	5085	1583	3433	6340	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	17	12	245	116	14	11	278	1062	118	20	801	61
RTOR Reduction (vph)	0	23	198	0	9	0	0	0	26	0	5	0
Lane Group Flow (vph)	17	15	22	116	16	0	278	1062	92	20	857	0
Turn Type	Prot	NA	Perm	Prot	NA		Prot	NA	pm+ov	Prot	NA	
Protected Phases	5	2		1	6		3	8	1	7	4	
Permitted Phases			2						8			
Actuated Green, G (s)	4.8	12.0	12.0	11.5	18.7		13.1	93.1	104.6	7.4	87.4	
Effective Green, g (s)	4.3	14.0	14.0	11.0	20.7		14.1	95.1	108.6	6.9	88.9	
Actuated g/C Ratio	0.03	0.10	0.10	0.08	0.15		0.10	0.68	0.78	0.05	0.64	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	4.0	4.0	2.0	4.0		3.0	4.0	2.0	3.0	4.0	
Lane Grp Cap (vph)	54	152	288	269	257		502	3454	1250	169	4025	
v/s Ratio Prot	0.01	c0.01		c0.03	0.01		c0.06	c0.21	0.01	0.01	c0.14	
v/s Ratio Perm			0.01						0.05			
v/c Ratio	0.31	0.10	0.08	0.43	0.06		0.55	0.31	0.07	0.12	0.21	
Uniform Delay, d1	66.4	57.2	57.1	61.5	51.3		60.0	9.1	3.7	63.6	10.8	
Progression Factor	1.00	1.00	1.00	1.00	1.00		0.99	1.03	2.01	0.79	0.16	
Incremental Delay, d2	3.3	0.4	0.2	0.4	0.1		1.2	0.2	0.0	0.3	0.1	
Delay (s)	69.7	57.6	57.3	61.9	51.4		60.6	9.6	7.5	50.3	1.8	
Level of Service	E	E	E	E	D		E	A	A	D	A	
Approach Delay (s)		58.1			60.1			19.2			2.9	
Approach LOS		E			E			B			A	

Intersection Summary			
HCM 2000 Control Delay	19.9	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.32		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	13.0
Intersection Capacity Utilization	44.3%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 11: Hacienda Dr & I-580 WB Ramps

BART to Livermore Extension Project
 2040 Enhanced Bus AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↔↔		↔↔		↑↑↑			↑↑↑	↔
Traffic Volume (vph)	0	0	0	279	0	452	0	1248	274	0	734	416
Future Volume (vph)	0	0	0	279	0	452	0	1248	274	0	734	416
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				2.6		2.6		2.1			2.1	2.1
Lane Util. Factor				0.97		0.88		0.91			0.86	0.86
Frt				1.00		0.85		0.97			0.97	0.85
Flt Protected				0.95		1.00		1.00			1.00	1.00
Satd. Flow (prot)				3433		2787		4948			4647	1362
Flt Permitted				0.95		1.00		1.00			1.00	1.00
Satd. Flow (perm)				3433		2787		4948			4647	1362
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	303	0	491	0	1357	298	0	798	452
RTOR Reduction (vph)	0	0	0	0	0	69	0	40	0	0	54	72
Lane Group Flow (vph)	0	0	0	303	0	422	0	1615	0	0	970	154
Turn Type				Prot		Prot		NA			NA	Perm
Protected Phases				4		4		2			6	
Permitted Phases												6
Actuated Green, G (s)				16.2		16.2		45.8			45.8	45.8
Effective Green, g (s)				17.6		17.6		47.7			47.7	47.7
Actuated g/C Ratio				0.25		0.25		0.68			0.68	0.68
Clearance Time (s)				4.0		4.0		4.0			4.0	4.0
Vehicle Extension (s)				3.0		3.0		3.0			3.0	3.0
Lane Grp Cap (vph)				863		700		3371			3166	928
v/s Ratio Prot				0.09		c0.15		c0.33			0.21	
v/s Ratio Perm												0.11
v/c Ratio				0.35		0.60		0.48			0.31	0.17
Uniform Delay, d1				21.5		23.1		5.3			4.5	4.0
Progression Factor				1.00		1.00		0.68			0.42	0.66
Incremental Delay, d2				0.2		1.5		0.4			0.2	0.4
Delay (s)				21.8		24.6		4.0			2.1	3.0
Level of Service				C		C		A			A	A
Approach Delay (s)		0.0			23.5			4.0			2.3	
Approach LOS		A			C			A			A	

Intersection Summary		
HCM 2000 Control Delay	7.6	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.51	A
Actuated Cycle Length (s)	70.0	Sum of lost time (s)
Intersection Capacity Utilization	52.7%	4.7
Analysis Period (min)	15	ICU Level of Service
		A

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 12: Hacienda Dr & I-580 EB Ramps

BART to Livermore Extension Project
 2040 Enhanced Bus AM





































Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗		↖↗					↖↗↘	↖		↖↗↘	
Traffic Volume (vph)	819	0	1168	0	0	0	0	668	275	0	1068	199
Future Volume (vph)	819	0	1168	0	0	0	0	668	275	0	1068	199
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0					4.0	4.0		4.0	
Lane Util. Factor	0.97		0.88					0.86	0.86		0.91	
Frt	1.00		0.85					0.98	0.85		0.98	
Flt Protected	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (prot)	3433		2787					4724	1362		4966	
Flt Permitted	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (perm)	3433		2787					4724	1362		4966	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	890	0	1270	0	0	0	0	726	299	0	1161	216
RTOR Reduction (vph)	0	0	23	0	0	0	0	21	122	0	39	0
Lane Group Flow (vph)	890	0	1247	0	0	0	0	798	84	0	1338	0
Turn Type	Prot		Prot					NA	Perm		NA	
Protected Phases	4		4					2			6	
Permitted Phases									2			
Actuated Green, G (s)	32.2		32.2					26.5	26.5		26.5	
Effective Green, g (s)	33.6		33.6					28.4	28.4		28.4	
Actuated g/C Ratio	0.48		0.48					0.41	0.41		0.41	
Clearance Time (s)	5.4		5.4					5.9	5.9		5.9	
Vehicle Extension (s)	2.0		2.0					2.0	2.0		2.0	
Lane Grp Cap (vph)	1647		1337					1916	552		2014	
v/s Ratio Prot	0.26		c0.45					0.17			c0.27	
v/s Ratio Perm									0.06			
v/c Ratio	0.54		0.93					0.42	0.15		0.66	
Uniform Delay, d1	12.8		17.1					14.9	13.2		16.9	
Progression Factor	1.00		1.00					1.00	1.00		0.89	
Incremental Delay, d2	0.2		11.7					0.7	0.6		1.7	
Delay (s)	13.0		28.8					15.5	13.8		16.8	
Level of Service	B		C					B	B		B	
Approach Delay (s)		22.3			0.0			15.2			16.8	
Approach LOS		C			A			B			B	

Intersection Summary		
HCM 2000 Control Delay	19.0	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.81	B
Actuated Cycle Length (s)	70.0	Sum of lost time (s)
Intersection Capacity Utilization	72.6%	8.0
Analysis Period (min)	15	ICU Level of Service
		C

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 13: Hacienda Dr & Owens Rd

BART to Livermore Extension Project
 2040 Enhanced Bus AM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 	  		 	  		 	  		  		
Traffic Volume (vph)	178	273	26	133	415	441	27	319	127	659	924	627
Future Volume (vph)	178	273	26	133	415	441	27	319	127	659	924	627
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	2.3	4.0	4.0	2.3	4.0	4.0	2.7	4.0	4.0	2.7
Lane Util. Factor	0.97	0.91	1.00	0.97	0.91	1.00	0.97	0.91	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5085	1583	3433	5085	1583	3433	5085	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5085	1583	3433	5085	1583	3433	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	193	297	28	145	451	479	29	347	138	716	1004	682
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	193	297	28	145	451	479	29	347	138	716	1004	682
Turn Type	Prot	NA	Free	Prot	NA	Free	Prot	NA	Free	Prot	NA	Free
Protected Phases	1	6		5	2		7	4		3	8	
Permitted Phases			Free			Free			Free			Free
Actuated Green, G (s)	14.0	18.5	115.0	11.4	15.9	115.0	4.2	32.1	115.0	34.0	61.9	115.0
Effective Green, g (s)	14.0	20.2	115.0	11.4	17.6	115.0	4.2	33.4	115.0	34.0	63.2	115.0
Actuated g/C Ratio	0.12	0.18	1.00	0.10	0.15	1.00	0.04	0.29	1.00	0.30	0.55	1.00
Clearance Time (s)	4.0	5.7		4.0	5.7		4.0	5.3		4.0	5.3	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	417	893	1583	340	778	1583	125	1476	1583	1014	2794	1583
v/s Ratio Prot	0.06	0.06		0.04	c0.09		0.01	0.07		c0.21	0.20	
v/s Ratio Perm			0.02			0.30			0.09			c0.43
v/c Ratio	0.46	0.33	0.02	0.43	0.58	0.30	0.23	0.24	0.09	0.71	0.36	0.43
Uniform Delay, d1	47.0	41.5	0.0	48.7	45.3	0.0	53.8	31.1	0.0	36.1	14.5	0.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.8	0.2	0.0	0.9	1.1	0.5	1.0	0.4	0.1	2.3	0.4	0.9
Delay (s)	47.8	41.7	0.0	49.6	46.3	0.5	54.8	31.4	0.1	38.3	14.9	0.9
Level of Service	D	D	A	D	D	A	D	C	A	D	B	A
Approach Delay (s)		41.7			26.3			24.3			17.9	
Approach LOS		D			C			C			B	
Intersection Summary												
HCM 2000 Control Delay			23.4				HCM 2000 Level of Service			C		
HCM 2000 Volume to Capacity ratio			0.59									
Actuated Cycle Length (s)			115.0				Sum of lost time (s)			16.0		
Intersection Capacity Utilization			51.4%				ICU Level of Service			A		
Analysis Period (min)			15									

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 14: Tassajara Rd & Dublin Blvd

BART to Livermore Extension Project
 2040 Enhanced Bus AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	101	202	141	652	1280	67	269	485	171	35	1145	330
Future Volume (vph)	101	202	141	652	1280	67	269	485	171	35	1145	330
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	6.0	6.0	5.0	6.0		5.0	6.0	6.0	5.0	5.7	5.7
Lane Util. Factor	0.97	0.86	0.88	0.94	0.91		0.94	0.86	1.00	0.97	0.86	0.88
Frt	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	6408	2787	4990	5047		4990	6408	1583	3433	6408	2787
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	6408	2787	4990	5047		4990	6408	1583	3433	6408	2787
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	110	220	153	709	1391	73	292	527	186	38	1245	359
RTOR Reduction (vph)	0	0	112	0	4	0	0	0	139	0	0	256
Lane Group Flow (vph)	110	220	41	709	1460	0	292	527	47	38	1245	103
Turn Type	Prot	NA	Perm	Prot	NA		Prot	NA	Perm	Prot	NA	Perm
Protected Phases	5	2		1	6		3	8		7	NA	4
Permitted Phases			2						8			4
Actuated Green, G (s)	16.1	39.5	39.5	24.9	48.3		18.2	36.9	36.9	22.8	41.8	41.8
Effective Green, g (s)	16.1	39.5	39.5	24.9	48.3		18.2	36.9	36.9	22.8	41.8	41.8
Actuated g/C Ratio	0.11	0.27	0.27	0.17	0.33		0.12	0.25	0.25	0.16	0.29	0.29
Clearance Time (s)	5.0	6.0	6.0	5.0	6.0		5.0	6.0	6.0	5.0	5.7	5.7
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	378	1732	753	850	1668		621	1618	399	535	1833	797
v/s Ratio Prot	0.03	0.03		c0.14	c0.29		c0.06	0.08		c0.01	c0.19	
v/s Ratio Perm			0.01						0.03			0.04
v/c Ratio	0.29	0.13	0.05	0.83	0.88		0.47	0.33	0.12	0.07	0.68	0.13
Uniform Delay, d1	59.8	40.3	39.5	58.6	46.1		59.5	44.5	42.1	52.6	46.2	38.7
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.4	0.0	0.0	7.1	5.5		0.6	0.1	0.1	0.1	1.0	0.1
Delay (s)	60.2	40.3	39.5	65.7	51.5		60.0	44.6	42.2	52.7	47.2	38.7
Level of Service	E	D	D	E	D		E	D	D	D	D	D
Approach Delay (s)		44.6			56.1			48.6			45.5	
Approach LOS		D			E			D			D	

Intersection Summary		
HCM 2000 Control Delay	50.4	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.76	D
Actuated Cycle Length (s)	146.1	Sum of lost time (s)
Intersection Capacity Utilization	87.6%	22.0
Analysis Period (min)	15	ICU Level of Service
		E

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 15: Tassajara Rd & I-580 WB Ramps

BART to Livermore Extension Project
 2040 Enhanced Bus AM






























Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↔↔		↔↔		↑↑	↔		↑↑↔	↔
Traffic Volume (vph)	0	0	0	592	0	296	0	1189	476	0	1037	935
Future Volume (vph)	0	0	0	592	0	296	0	1189	476	0	1037	935
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0		4.0		4.0	4.0		4.0	4.0
Lane Util. Factor				0.97		0.88		0.95	1.00		0.86	0.86
Frt				1.00		0.85		1.00	0.85		0.95	0.85
Flt Protected				0.95		1.00		1.00	1.00		1.00	1.00
Satd. Flow (prot)				3433		2787		3539	1583		4582	1362
Flt Permitted				0.95		1.00		1.00	1.00		1.00	1.00
Satd. Flow (perm)				3433		2787		3539	1583		4582	1362
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	643	0	322	0	1292	517	0	1127	1016
RTOR Reduction (vph)	0	0	0	0	0	68	0	0	197	0	103	194
Lane Group Flow (vph)	0	0	0	643	0	254	0	1292	320	0	1532	314
Turn Type				Perm		Perm		NA	Perm		NA	Perm
Protected Phases								2			6	
Permitted Phases				8		8			2			6
Actuated Green, G (s)				18.7		18.7		43.3	43.3		43.3	43.3
Effective Green, g (s)				18.7		18.7		43.3	43.3		43.3	43.3
Actuated g/C Ratio				0.27		0.27		0.62	0.62		0.62	0.62
Clearance Time (s)				4.0		4.0		4.0	4.0		4.0	4.0
Vehicle Extension (s)				3.0		3.0		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)				917		744		2189	979		2834	842
v/s Ratio Prot								c0.37			0.33	
v/s Ratio Perm				c0.19		0.09			0.20			0.23
v/c Ratio				0.70		0.34		0.59	0.33		0.54	0.37
Uniform Delay, d1				23.1		20.7		8.0	6.4		7.6	6.6
Progression Factor				1.00		1.00		1.00	1.00		1.00	1.00
Incremental Delay, d2				2.4		0.3		1.2	0.9		0.7	1.3
Delay (s)				25.6		21.0		9.2	7.3		8.4	7.9
Level of Service				C		C		A	A		A	A
Approach Delay (s)		0.0			24.0			8.6			8.3	
Approach LOS		A			C			A			A	

Intersection Summary			
HCM 2000 Control Delay	11.5	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.62		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	56.4%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 16: Santa Rita Rd & I-580 EB Ramps/Pimilco Dr
























BART to Livermore Extension Project
 2040 Enhanced Bus AM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 			 		 		  			 	
Traffic Volume (vph)	566	116	745	186	0	188	0	885	119	183	1349	0
Future Volume (vph)	566	116	745	186	0	188	0	885	119	183	1349	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0		4.0		4.0		4.0	4.0	
Lane Util. Factor	0.97	1.00	1.00	0.97		0.88		0.86		1.00	0.95	
Frt	1.00	1.00	0.85	1.00		0.85		0.98		1.00	1.00	
Flt Protected	0.95	1.00	1.00	0.95		1.00		1.00		0.95	1.00	
Satd. Flow (prot)	3433	1863	1583	3433		2787		6294		1770	3539	
Flt Permitted	0.95	1.00	1.00	0.95		1.00		1.00		0.95	1.00	
Satd. Flow (perm)	3433	1863	1583	3433		2787		6294		1770	3539	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	615	126	810	202	0	204	0	962	129	199	1466	0
RTOR Reduction (vph)	0	0	0	0	0	71	0	40	0	0	0	0
Lane Group Flow (vph)	615	126	810	202	0	133	0	1051	0	199	1466	0
Turn Type	Perm	NA	Free	Prot		pm+ov		NA		Prot	NA	Perm
Protected Phases		4		3		1		2		1	6	
Permitted Phases	4		Free			3						6
Actuated Green, G (s)	14.9	14.9	60.0	4.5		12.9		16.2		8.4	28.6	
Effective Green, g (s)	14.9	14.9	60.0	4.5		12.9		16.2		8.4	28.6	
Actuated g/C Ratio	0.25	0.25	1.00	0.08		0.22		0.27		0.14	0.48	
Clearance Time (s)	4.0	4.0		4.0		4.0		4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0		3.0		3.0		3.0	3.0	
Lane Grp Cap (vph)	852	462	1583	257		599		1699		247	1686	
v/s Ratio Prot		0.07		0.06		0.03		0.17		0.11	c0.41	
v/s Ratio Perm	c0.18		c0.51			0.02						
v/c Ratio	0.72	0.27	0.51	0.79		0.22		0.62		0.81	0.87	
Uniform Delay, d1	20.7	18.2	0.0	27.3		19.4		19.2		25.0	14.0	
Progression Factor	1.00	1.00	1.00	1.00		1.00		1.00		1.00	1.00	
Incremental Delay, d2	3.0	0.3	1.2	14.6		0.2		1.7		17.2	6.4	
Delay (s)	23.7	18.5	1.2	41.8		19.6		20.9		42.2	20.4	
Level of Service	C	B	A	D		B		C		D	C	
Approach Delay (s)		11.5			30.7			20.9			23.0	
Approach LOS		B			C			C			C	
Intersection Summary												
HCM 2000 Control Delay			19.4			HCM 2000 Level of Service				B		
HCM 2000 Volume to Capacity ratio			0.91									
Actuated Cycle Length (s)			60.0			Sum of lost time (s)			16.0			
Intersection Capacity Utilization			60.1%			ICU Level of Service				B		
Analysis Period (min)			15									

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 17: Santa Rita Rd & Valley Ave

BART to Livermore Extension Project
 2040 Enhanced Bus AM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	211	254	84	197	450	965	121	533	82	596	894	186
Future Volume (vph)	211	254	84	197	450	965	121	533	82	596	894	186
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.97	0.95		0.97	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.98		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	3433	3468		3433	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	3433	3468		3433	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	229	276	91	214	489	1049	132	579	89	648	972	202
RTOR Reduction (vph)	0	0	73	0	0	0	0	17	0	0	0	124
Lane Group Flow (vph)	229	276	18	214	489	1049	132	651	0	648	972	78
Turn Type	Prot	NA	Perm	Prot	NA	Free	Prot	NA		Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			Free						6
Actuated Green, G (s)	8.5	13.4	13.4	9.0	13.9	67.7	3.1	16.2		13.1	26.2	26.2
Effective Green, g (s)	8.5	13.4	13.4	9.0	13.9	67.7	3.1	16.2		13.1	26.2	26.2
Actuated g/C Ratio	0.13	0.20	0.20	0.13	0.21	1.00	0.05	0.24		0.19	0.39	0.39
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	431	700	313	235	726	1583	157	829		664	1369	612
v/s Ratio Prot	0.07	0.08		0.12	0.14		0.04	0.19		c0.19	0.27	
v/s Ratio Perm			0.01			c0.66						0.05
v/c Ratio	0.53	0.39	0.06	0.91	0.67	0.66	0.84	0.78		0.98	0.71	0.13
Uniform Delay, d1	27.7	23.6	22.0	29.0	24.8	0.0	32.1	24.1		27.1	17.5	13.4
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	1.3	0.4	0.1	35.5	2.5	2.2	31.3	4.9		28.7	1.8	0.1
Delay (s)	29.0	24.0	22.1	64.4	27.3	2.2	63.4	29.0		55.8	19.3	13.5
Level of Service	C	C	C	E	C	A	E	C		E	B	B
Approach Delay (s)		25.6			16.8			34.7			31.6	
Approach LOS		C			B			C			C	
Intersection Summary												
HCM 2000 Control Delay			26.2			HCM 2000 Level of Service				C		
HCM 2000 Volume to Capacity ratio			0.90									
Actuated Cycle Length (s)			67.7			Sum of lost time (s)			16.0			
Intersection Capacity Utilization			66.1%			ICU Level of Service				C		
Analysis Period (min)			15									

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
18: Bernal Ave/Valley Ave & Stanley Blvd

BART to Livermore Extension Project
2040 Enhanced Bus AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	216	203	54	247	898	954	174	479	102	142	363	124
Future Volume (vph)	216	203	54	247	898	954	174	479	102	142	363	124
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.95	1.00	0.97	0.91	0.91	1.00	0.95	1.00	0.97	0.95	0.95
Frt	1.00	1.00	0.85	1.00	0.96	0.85	1.00	1.00	0.85	1.00	0.96	0.96
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	3433	3238	1441	1770	3539	1583	3433	3404	3404
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	3433	3238	1441	1770	3539	1583	3433	3404	3404
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	235	221	59	268	976	1037	189	521	111	154	395	135
RTOR Reduction (vph)	0	0	29	0	47	28	0	0	88	0	38	0
Lane Group Flow (vph)	235	221	30	268	1344	594	189	521	23	154	492	0
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	NA
Protected Phases	7	4	5	3	8	1	5	2		1	6	
Permitted Phases			4			8			2			
Actuated Green, G (s)	7.0	33.0	44.6	11.0	37.0	46.9	11.6	18.1	18.1	9.9	16.4	16.4
Effective Green, g (s)	7.0	33.0	44.6	11.0	37.0	46.9	11.6	18.1	18.1	9.9	16.4	16.4
Actuated g/C Ratio	0.08	0.38	0.51	0.12	0.42	0.53	0.13	0.21	0.21	0.11	0.19	0.19
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	273	1327	874	429	1361	833	233	727	325	386	634	634
v/s Ratio Prot	c0.07	0.06	0.00	0.08	c0.42	0.08	c0.11	c0.15		0.04	0.14	0.14
v/s Ratio Perm			0.01			0.33			0.01			
v/c Ratio	0.86	0.17	0.03	0.62	0.99	0.71	0.81	0.72	0.07	0.40	0.78	0.78
Uniform Delay, d1	40.0	18.3	10.9	36.5	25.3	15.5	37.1	32.6	28.2	36.3	34.1	34.1
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	23.1	0.1	0.0	2.8	21.2	2.9	18.9	3.4	0.1	0.7	5.9	5.9
Delay (s)	63.1	18.4	10.9	39.4	46.5	18.4	56.0	35.9	28.3	37.0	40.0	40.0
Level of Service	E	B	B	D	D	B	E	D	C	D	D	D
Approach Delay (s)		37.9			38.0			39.5			39.3	
Approach LOS		D			D			D			D	

Intersection Summary		
HCM 2000 Control Delay	38.5	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.90	D
Actuated Cycle Length (s)	88.0	Sum of lost time (s)
Intersection Capacity Utilization	78.1%	16.0
Analysis Period (min)	15	ICU Level of Service
		D

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 19: Fallon Rd & Dublin Blvd/Croak Rd

BART to Livermore Extension Project
 2040 Enhanced Bus AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↑↑↑	↖↗	↖↗↖	↑↑↑	↖	↖↗↖	↑↑↑	↖↗	↖↗	↑↑↑	↖
Traffic Volume (vph)	49	79	93	354	1293	419	828	276	43	80	715	325
Future Volume (vph)	49	79	93	354	1293	419	828	276	43	80	715	325
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.91	0.88	0.94	0.91	1.00	0.94	0.91	0.88	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5085	2787	4990	5085	1583	4990	5085	2787	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5085	2787	4990	5085	1583	4990	5085	2787	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	53	86	101	385	1405	455	900	300	47	87	777	353
RTOR Reduction (vph)	0	0	42	0	0	229	0	0	32	0	0	133
Lane Group Flow (vph)	53	86	59	385	1405	226	900	300	15	87	777	220
Turn Type	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4	5	3	8		5	2		1	6	
Permitted Phases			4			8			2			6
Actuated Green, G (s)	2.4	9.6	28.4	31.2	38.4	38.4	18.8	28.8	28.8	4.4	14.4	14.4
Effective Green, g (s)	2.4	9.6	28.4	31.2	38.4	38.4	18.8	28.8	28.8	4.4	14.4	14.4
Actuated g/C Ratio	0.03	0.11	0.32	0.35	0.43	0.43	0.21	0.32	0.32	0.05	0.16	0.16
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	91	542	879	1729	2169	675	1042	1627	891	167	813	253
v/s Ratio Prot	c0.02	0.02	0.01	0.08	c0.28		c0.18	0.06		0.03	c0.15	
v/s Ratio Perm			0.01			0.14			0.01			0.14
v/c Ratio	0.58	0.16	0.07	0.22	0.65	0.33	0.86	0.18	0.02	0.52	0.96	0.87
Uniform Delay, d1	43.3	36.5	21.5	20.8	20.4	17.3	34.4	22.1	20.9	41.8	37.5	36.9
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	9.2	0.1	0.0	0.1	0.7	0.3	7.6	0.2	0.0	2.9	22.5	31.2
Delay (s)	52.5	36.7	21.6	20.9	21.1	17.5	41.9	22.4	21.0	44.7	59.9	68.1
Level of Service	D	D	C	C	C	B	D	C	C	D	E	E
Approach Delay (s)		33.8			20.4			36.4			61.2	
Approach LOS		C			C			D			E	

Intersection Summary		
HCM 2000 Control Delay	35.1	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.76	D
Actuated Cycle Length (s)	90.0	Sum of lost time (s)
Intersection Capacity Utilization	70.9%	16.0
Analysis Period (min)	15	ICU Level of Service
		C

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 20: El Charro Rd/Fallon Rd & I-580 WB Ramps

BART to Livermore Extension Project
 2040 Enhanced Bus AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↙	↖	↗		↑↑↑	↗		↑↑↑	↗
Traffic Volume (vph)	0	0	0	169	0	613	0	860	478	0	651	399
Future Volume (vph)	0	0	0	169	0	613	0	860	478	0	651	399
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0	4.0	4.0		4.0	4.0		4.0	4.0
Lane Util. Factor				0.95	0.95	0.88		0.91	1.00		0.91	1.00
Frt				1.00	1.00	0.85		1.00	0.85		1.00	0.85
Flt Protected				0.95	0.95	1.00		1.00	1.00		1.00	1.00
Satd. Flow (prot)				1681	1681	2787		5085	1583		5085	1583
Flt Permitted				0.95	0.95	1.00		1.00	1.00		1.00	1.00
Satd. Flow (perm)				1681	1681	2787		5085	1583		5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	184	0	666	0	935	520	0	708	434
RTOR Reduction (vph)	0	0	0	0	0	69	0	0	268	0	0	224
Lane Group Flow (vph)	0	0	0	94	90	597	0	935	252	0	708	210
Turn Type				Perm	NA	Perm		NA	Perm		NA	Perm
Protected Phases					8			2			6	
Permitted Phases				8		8			2			6
Actuated Green, G (s)				13.1	13.1	13.1		19.4	19.4		19.4	19.4
Effective Green, g (s)				12.6	12.6	12.6		19.4	19.4		19.4	19.4
Actuated g/C Ratio				0.31	0.31	0.31		0.48	0.48		0.48	0.48
Clearance Time (s)				3.5	3.5	3.5		4.0	4.0		4.0	4.0
Vehicle Extension (s)				2.0	2.0	2.0		2.0	2.0		2.0	2.0
Lane Grp Cap (vph)				529	529	877		2466	767		2466	767
v/s Ratio Prot								c0.18			0.14	
v/s Ratio Perm				0.06	0.05	c0.21			0.16			0.13
v/c Ratio				0.18	0.17	0.68		0.38	0.33		0.29	0.27
Uniform Delay, d1				9.9	9.9	11.9		6.5	6.3		6.2	6.1
Progression Factor				1.00	1.00	1.00		1.00	1.00		1.00	1.00
Incremental Delay, d2				0.1	0.1	1.7		0.4	1.1		0.3	0.9
Delay (s)				10.0	10.0	13.7		6.9	7.5		6.5	7.0
Level of Service				A	A	B		A	A		A	A
Approach Delay (s)		0.0			12.9			7.1			6.7	
Approach LOS		A			B			A			A	

Intersection Summary			
HCM 2000 Control Delay	8.4	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.50		
Actuated Cycle Length (s)	40.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	44.7%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 21: El Charro Rd & I-580 EB Ramps

BART to Livermore Extension Project
 2040 Enhanced Bus AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔↔		↔↔					↕↕	↔		↕↕	↔
Traffic Volume (vph)	278	0	619	0	0	0	0	1350	427	0	469	0
Future Volume (vph)	278	0	619	0	0	0	0	1350	427	0	469	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0					4.0	4.0		4.0	
Lane Util. Factor	0.97		0.88					0.91	0.91		0.91	
Frt	1.00		0.85					0.99	0.85		1.00	
Flt Protected	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (prot)	3433		2787					3371	1441		3390	
Flt Permitted	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (perm)	3433		2787					3371	1441		3390	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	302	0	673	0	0	0	0	1467	464	0	510	0
RTOR Reduction (vph)	0	0	572	0	0	0	0	3	108	0	0	0
Lane Group Flow (vph)	302	0	101	0	0	0	0	1520	300	0	510	0
Turn Type	Prot		Perm					NA	Perm		NA	Perm
Protected Phases	4							2			6	
Permitted Phases			4						2			6
Actuated Green, G (s)	10.5		10.5					51.5	51.5		51.5	
Effective Green, g (s)	10.5		10.5					51.5	51.5		51.5	
Actuated g/C Ratio	0.15		0.15					0.74	0.74		0.74	
Clearance Time (s)	4.0		4.0					4.0	4.0		4.0	
Vehicle Extension (s)	2.0		2.0					3.0	3.0		3.0	
Lane Grp Cap (vph)	514		418					2480	1060		2494	
v/s Ratio Prot	c0.09							c0.45			0.15	
v/s Ratio Perm			0.04						0.21			
v/c Ratio	0.59		0.24					0.61	0.28		0.20	
Uniform Delay, d1	27.7		26.2					4.5	3.1		2.9	
Progression Factor	1.00		1.00					1.00	1.00		1.00	
Incremental Delay, d2	1.1		0.1					1.1	0.7		0.2	
Delay (s)	28.8		26.3					5.6	3.8		3.1	
Level of Service	C		C					A	A		A	
Approach Delay (s)		27.1			0.0			5.2			3.1	
Approach LOS		C			A			A			A	

Intersection Summary		
HCM 2000 Control Delay	11.1	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.61	B
Actuated Cycle Length (s)	70.0	Sum of lost time (s)
Intersection Capacity Utilization	56.4%	8.0
Analysis Period (min)	15	ICU Level of Service
		B

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 22: El Charro Rd & Stoneridge Dr/Jack London Blvd

BART to Livermore Extension Project
 2040 Enhanced Bus AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔↔↔	↑↑	↗	↖	↑↑	↗↖	↖	↑↑		↗↖	↑	↗↖
Traffic Volume (vph)	93	131	16	66	633	809	31	539	28	325	212	108
Future Volume (vph)	93	131	16	66	633	809	31	539	28	325	212	108
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	0.94	0.95	1.00	1.00	0.95	0.88	1.00	0.95		0.94	1.00	0.88
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	4491	3185	1425	1593	3185	2508	1593	3162		4491	1676	2508
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	4491	3185	1425	1593	3185	2508	1593	3162		4491	1676	2508
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	101	142	17	72	688	879	34	586	30	353	230	117
RTOR Reduction (vph)	0	0	13	0	0	100	0	6	0	0	0	72
Lane Group Flow (vph)	101	142	4	72	688	779	34	610	0	353	230	45
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Prot	NA		Prot	NA	Perm
Protected Phases	7	4		3	8	1	5	2		1	6	
Permitted Phases			4			8						6
Actuated Green, G (s)	3.0	15.1	15.1	3.0	15.1	23.3	2.5	17.2		8.2	22.9	22.9
Effective Green, g (s)	3.0	15.1	15.1	3.0	15.1	23.3	2.5	17.2		8.2	22.9	22.9
Actuated g/C Ratio	0.05	0.25	0.25	0.05	0.25	0.39	0.04	0.29		0.14	0.38	0.38
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	226	808	361	80	808	982	66	914		618	645	965
v/s Ratio Prot	c0.02	0.04		0.05	c0.22	c0.11	0.02	c0.19		0.08	0.14	
v/s Ratio Perm			0.00			0.20						0.02
v/c Ratio	0.45	0.18	0.01	0.90	0.85	0.79	0.52	0.67		0.57	0.36	0.05
Uniform Delay, d1	27.4	17.3	16.6	28.1	21.1	16.0	27.9	18.6		24.0	13.0	11.5
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	1.4	0.1	0.0	67.8	8.6	4.5	6.6	1.9		1.3	0.3	0.0
Delay (s)	28.9	17.4	16.6	95.9	29.7	20.5	34.5	20.5		25.3	13.4	11.5
Level of Service	C	B	B	F	C	C	C	C		C	B	B
Approach Delay (s)		21.8			27.7			21.2			19.1	
Approach LOS		C			C			C			B	

Intersection Summary

HCM 2000 Control Delay	24.1	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.74		
Actuated Cycle Length (s)	59.5	Sum of lost time (s)	16.0
Intersection Capacity Utilization	62.3%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 23: Stanley Blvd & El Charro Rd



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	↖	↗↗	↖↖↖	↗	↖↖	↗↗
Traffic Volume (vph)	401	458	2732	122	28	115
Future Volume (vph)	401	458	2732	122	28	115
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95	0.91	1.00	0.97	0.88
Frt	1.00	1.00	1.00	0.85	1.00	0.85
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1770	3539	5085	1583	3433	2787
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1770	3539	5085	1583	3433	2787
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	436	498	2970	133	30	125
RTOR Reduction (vph)	0	0	0	30	0	117
Lane Group Flow (vph)	436	498	2970	103	30	8
Turn Type	Prot	NA	NA	Perm	Prot	Perm
Protected Phases	7	4	8		6	
Permitted Phases				8		6
Actuated Green, G (s)	27.0	95.0	64.0	64.0	6.7	6.7
Effective Green, g (s)	27.0	95.0	64.0	64.0	6.7	6.7
Actuated g/C Ratio	0.25	0.87	0.58	0.58	0.06	0.06
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	435	3064	2966	923	209	170
v/s Ratio Prot	c0.25	0.14	c0.58		c0.01	
v/s Ratio Perm				0.07		0.00
v/c Ratio	1.00	0.16	1.00	0.11	0.14	0.04
Uniform Delay, d1	41.4	1.1	22.9	10.2	48.8	48.5
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	43.7	0.0	16.8	0.1	0.3	0.1
Delay (s)	85.1	1.2	39.7	10.2	49.1	48.6
Level of Service	F	A	D	B	D	D
Approach Delay (s)		40.3	38.4		48.7	
Approach LOS		D	D		D	

Intersection Summary

HCM 2000 Control Delay	39.2	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.94		
Actuated Cycle Length (s)	109.7	Sum of lost time (s)	12.0
Intersection Capacity Utilization	88.3%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
24: Airway Blvd/Driveway & N Canyons Pkwy

BART to Livermore Extension Project
2040 Enhanced Bus AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑	↑	↑↑	↑	↑		↑	↑↑		↑	
Traffic Volume (vph)	0	94	50	719	1034	0	957	0	972	0	0	0
Future Volume (vph)	0	94	50	719	1034	0	957	0	972	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		2.0	2.0	2.0	2.0			4.2	2.0			
Lane Util. Factor		0.95	1.00	0.97	1.00			1.00	0.88			
Frt		1.00	0.85	1.00	1.00			1.00	0.85			
Flt Protected		1.00	1.00	0.95	1.00			0.95	1.00			
Satd. Flow (prot)		3539	1583	3433	1863			1770	2787			
Flt Permitted		1.00	1.00	0.95	1.00			0.95	1.00			
Satd. Flow (perm)		3539	1583	3433	1863			1770	2787			
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	102	54	782	1124	0	1040	0	1057	0	0	0
RTOR Reduction (vph)	0	0	48	0	0	0	0	0	87	0	0	0
Lane Group Flow (vph)	0	102	6	782	1124	0	0	1040	970	0	0	0
Turn Type		NA	Perm	Prot	NA	Perm	Split	NA	pm+ov			
Protected Phases		2		1	6		8	8	1	4	4	
Permitted Phases			2			6			8			
Actuated Green, G (s)		10.0	10.0	41.0	55.0			39.0	80.0			
Effective Green, g (s)		12.0	12.0	43.0	57.0			38.8	84.0			
Actuated g/C Ratio		0.12	0.12	0.42	0.56			0.38	0.82			
Clearance Time (s)		4.0	4.0	4.0	4.0			4.0	4.0			
Vehicle Extension (s)		3.0	3.0	3.0	3.0			3.0	3.0			
Lane Grp Cap (vph)		416	186	1447	1041			673	2349			
v/s Ratio Prot		0.03		0.23	c0.60			c0.59	0.17			
v/s Ratio Perm			0.00						0.17			
v/c Ratio		0.25	0.03	0.54	1.08			1.55	0.41			
Uniform Delay, d1		40.9	39.9	22.1	22.5			31.6	2.4			
Progression Factor		1.00	1.00	1.00	1.00			1.00	1.00			
Incremental Delay, d2		0.3	0.1	0.4	52.0			252.8	0.1			
Delay (s)		41.2	39.9	22.5	74.5			284.4	2.5			
Level of Service		D	D	C	E			F	A			
Approach Delay (s)		40.8			53.2			142.3			0.0	
Approach LOS		D			D			F			A	

Intersection Summary

HCM 2000 Control Delay	97.7	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.35		
Actuated Cycle Length (s)	102.0	Sum of lost time (s)	12.2
Intersection Capacity Utilization	114.3%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
25: Airway Blvd & I-580 WB Ramps

BART to Livermore Extension Project
2040 Enhanced Bus AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↙	↖	↗		↕	↗		↕	↘
Traffic Volume (vph)	0	0	0	67	43	798	0	1239	343	0	296	553
Future Volume (vph)	0	0	0	67	43	798	0	1239	343	0	296	553
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0	4.0	4.0		4.0	4.0		4.0	
Lane Util. Factor				0.95	0.95	0.88		0.95	1.00		0.91	
Frt				1.00	1.00	0.85		1.00	0.85		0.90	
Flt Protected				0.95	0.98	1.00		1.00	1.00		1.00	
Satd. Flow (prot)				1681	1733	2787		3539	1583		4589	
Flt Permitted				0.95	0.98	1.00		1.00	1.00		1.00	
Satd. Flow (perm)				1681	1733	2787		3539	1583		4589	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	73	47	867	0	1347	373	0	322	601
RTOR Reduction (vph)	0	0	0	0	0	32	0	0	184	0	296	0
Lane Group Flow (vph)	0	0	0	39	81	835	0	1347	189	0	627	0
Turn Type				Split	NA	Perm		NA	Perm		NA	
Protected Phases				8	8			2			6	
Permitted Phases						8			2			
Actuated Green, G (s)				19.8	19.8	19.8		27.3	27.3		27.3	
Effective Green, g (s)				19.8	19.8	19.8		28.6	28.6		28.6	
Actuated g/C Ratio				0.35	0.35	0.35		0.51	0.51		0.51	
Clearance Time (s)				4.0	4.0	4.0		5.3	5.3		5.3	
Vehicle Extension (s)				2.0	2.0	2.0		4.0	4.0		4.0	
Lane Grp Cap (vph)				590	608	978		1794	802		2327	
v/s Ratio Prot				0.02	0.05			c0.38			0.14	
v/s Ratio Perm						c0.30			0.12			
v/c Ratio				0.07	0.13	0.85		0.75	0.24		0.27	
Uniform Delay, d1				12.2	12.5	17.0		11.1	7.8		7.9	
Progression Factor				1.00	1.00	1.00		1.00	1.00		1.00	
Incremental Delay, d2				0.0	0.0	7.1		1.9	0.2		0.1	
Delay (s)				12.2	12.5	24.0		13.0	8.0		8.0	
Level of Service				B	B	C		B	A		A	
Approach Delay (s)		0.0			22.6			11.9			8.0	
Approach LOS		A			C			B			A	

Intersection Summary

HCM 2000 Control Delay	13.8	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.79		
Actuated Cycle Length (s)	56.4	Sum of lost time (s)	8.0
Intersection Capacity Utilization	68.8%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 26: Airway Blvd & I-580 EB Ramps/Kitty Hawk Rd

BART to Livermore Extension Project
 2040 Enhanced Bus AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↑	↖	↖	↑	↖	↖	↕↔		↖	↕↔	
Traffic Volume (vph)	643	194	225	27	37	92	32	517	164	74	143	164
Future Volume (vph)	643	194	225	27	37	92	32	517	164	74	143	164
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.4	4.4	4.4	4.5	2.7		4.0	2.7	
Lane Util. Factor	0.97	1.00	1.00	1.00	1.00	1.00	1.00	0.95		1.00	0.95	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.96		1.00	0.92	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	3433	1863	1583	1770	1863	1583	1770	3412		1770	3255	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	3433	1863	1583	1770	1863	1583	1770	3412		1770	3255	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	699	211	245	29	40	100	35	562	178	80	155	178
RTOR Reduction (vph)	0	0	182	0	0	84	0	40	0	0	119	0
Lane Group Flow (vph)	699	211	63	29	40	16	35	700	0	80	214	0
Turn Type	Split	NA	Perm	Split	NA	pm+ov	Prot	NA		Prot	NA	
Protected Phases	7	7		8	8	1	5	2		1	6	
Permitted Phases			7			8						
Actuated Green, G (s)	17.0	17.0	17.0	7.1	7.1	11.3	5.5	22.0		4.2	20.7	
Effective Green, g (s)	17.0	17.0	17.0	6.7	6.7	10.5	5.0	23.3		4.2	22.0	
Actuated g/C Ratio	0.26	0.26	0.26	0.10	0.10	0.16	0.08	0.35		0.06	0.33	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Vehicle Extension (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	3.5		2.0	4.0	
Lane Grp Cap (vph)	880	477	405	178	188	355	133	1199		112	1080	
v/s Ratio Prot	c0.20	0.11		0.02	c0.02	0.00	0.02	c0.21		c0.05	0.07	
v/s Ratio Perm			0.04			0.01						
v/c Ratio	0.79	0.44	0.16	0.16	0.21	0.04	0.26	0.58		0.71	0.20	
Uniform Delay, d1	23.0	20.7	19.1	27.2	27.4	23.6	28.9	17.5		30.5	15.8	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	4.7	0.2	0.1	0.2	0.2	0.0	0.4	0.8		16.4	0.1	
Delay (s)	27.7	20.9	19.2	27.4	27.6	23.7	29.3	18.3		46.9	16.0	
Level of Service	C	C	B	C	C	C	C	B		D	B	
Approach Delay (s)		24.6			25.2			18.8			21.9	
Approach LOS		C			C			B			C	

Intersection Summary

HCM 2000 Control Delay	22.4	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.62		
Actuated Cycle Length (s)	66.3	Sum of lost time (s)	15.6
Intersection Capacity Utilization	58.6%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 27: Collier Canyon Rd & N Canyons Pkwy/Portola Ave

BART to Livermore Extension Project
 2040 Enhanced Bus AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	266	188	99	150	900	57	80	8	103	56	14	207
Future Volume (vph)	266	188	99	150	900	57	80	8	103	56	14	207
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	2.7	2.7	4.0	2.7	2.7	4.0	3.0		4.0	4.6	4.6
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.86		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	1770	1604		1770	1863	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	1770	1604		1770	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	289	204	108	163	978	62	87	9	112	61	15	225
RTOR Reduction (vph)	0	0	69	0	0	37	0	87	0	0	0	183
Lane Group Flow (vph)	289	204	39	163	978	25	87	34	0	61	15	42
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA		Prot	NA	Perm
Protected Phases	1	6		5	2		3	8		7		4
Permitted Phases			6			2						4
Actuated Green, G (s)	7.0	22.6	22.6	10.1	25.7	25.7	4.0	13.9		3.1	13.0	13.0
Effective Green, g (s)	7.0	23.9	23.9	10.1	27.0	27.0	4.0	14.9		3.1	12.4	12.4
Actuated g/C Ratio	0.11	0.36	0.36	0.15	0.41	0.41	0.06	0.23		0.05	0.19	0.19
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	365	1287	575	272	1454	650	107	363		83	351	298
v/s Ratio Prot	c0.08	0.06		0.09	c0.28		c0.05	0.02		0.03	0.01	
v/s Ratio Perm			0.02			0.02						c0.03
v/c Ratio	0.79	0.16	0.07	0.60	0.67	0.04	0.81	0.09		0.73	0.04	0.14
Uniform Delay, d1	28.6	14.1	13.6	25.9	15.8	11.6	30.5	20.1		30.9	21.8	22.2
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	11.2	0.1	0.1	3.5	1.2	0.0	35.7	0.1		28.3	0.1	0.2
Delay (s)	39.8	14.2	13.7	29.4	17.0	11.6	66.2	20.2		59.2	21.8	22.4
Level of Service	D	B	B	C	B	B	E	C		E	C	C
Approach Delay (s)		26.4			18.4			39.4			29.9	
Approach LOS		C			B			D			C	
























Intersection Summary

HCM 2000 Control Delay	23.9	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.57		
Actuated Cycle Length (s)	65.7	Sum of lost time (s)	15.3
Intersection Capacity Utilization	53.6%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
28: Isabel Ave/Campus Hill Dr & Portola Ave

BART to Livermore Extension Project
2040 Enhanced Bus AM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	1	198	223	501	608	143	502	298	81	66	199	2
Future Volume (vph)	1	198	223	501	608	143	502	298	81	66	199	2
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	5.8	5.8
Lane Util. Factor	1.00	0.95	0.88	0.94	0.95		0.97	0.95	1.00	1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	0.97		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3539	2787	4990	3438		3433	3539	1583	1770	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	3539	2787	4990	3438		3433	3539	1583	1770	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	1	215	242	545	661	155	546	324	88	72	216	2
RTOR Reduction (vph)	0	0	187	0	13	0	0	0	60	0	0	2
Lane Group Flow (vph)	1	215	55	545	803	0	546	324	28	72	216	0
Turn Type	Prot	NA	Perm	Prot	NA		Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4						2			6
Actuated Green, G (s)	1.5	18.4	18.4	15.1	32.0		21.0	26.3	26.3	7.7	13.4	13.4
Effective Green, g (s)	1.5	19.7	19.7	15.1	33.3		21.0	27.6	27.6	7.7	12.5	12.5
Actuated g/C Ratio	0.02	0.23	0.23	0.18	0.39		0.24	0.32	0.32	0.09	0.15	0.15
Clearance Time (s)	4.0	5.3	5.3	4.0	5.3		4.0	5.3	5.3	4.0	4.9	4.9
Vehicle Extension (s)	2.0	3.0	3.0	2.0	3.0		2.0	3.0	3.0	2.0	3.0	3.0
Lane Grp Cap (vph)	30	809	637	875	1329		837	1134	507	158	513	229
v/s Ratio Prot	0.00	0.06		c0.11	c0.23		c0.16	0.09		0.04	c0.06	
v/s Ratio Perm			0.02						0.02			0.00
v/c Ratio	0.03	0.27	0.09	0.62	0.60		0.65	0.29	0.06	0.46	0.42	0.00
Uniform Delay, d1	41.6	27.3	26.1	32.9	21.1		29.3	21.9	20.2	37.2	33.5	31.5
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.2	0.2	0.1	1.0	0.8		1.4	0.1	0.0	0.8	0.6	0.0
Delay (s)	41.8	27.4	26.2	33.9	21.9		30.7	22.0	20.3	38.0	34.1	31.5
Level of Service	D	C	C	C	C		C	C	C	D	C	C
Approach Delay (s)		26.8			26.7			26.8			35.0	
Approach LOS		C			C			C			D	
Intersection Summary												
HCM 2000 Control Delay			27.5			HCM 2000 Level of Service			C			
HCM 2000 Volume to Capacity ratio			0.61									
Actuated Cycle Length (s)			86.1			Sum of lost time (s)			17.8			
Intersection Capacity Utilization			68.0%			ICU Level of Service			C			
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis
 29: Isabel Ave & I-580 WB Ramps

BART to Livermore Extension Project
 2040 Enhanced Bus AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↔↔		↗		↑↑↑	↗		↑↑↑	↗
Traffic Volume (vph)	0	0	0	653	0	435	0	504	0	0	672	437
Future Volume (vph)	0	0	0	653	0	435	0	504	0	0	672	437
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0		4.0		4.8			4.8	4.8
Lane Util. Factor				0.97		1.00		0.91			0.91	1.00
Frt				1.00		0.85		1.00			1.00	0.85
Flt Protected				0.95		1.00		1.00			1.00	1.00
Satd. Flow (prot)				3433		1583		5085			5085	1583
Flt Permitted				0.95		1.00		1.00			1.00	1.00
Satd. Flow (perm)				3433		1583		5085			5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	710	0	473	0	548	0	0	730	475
RTOR Reduction (vph)	0	0	0	0	0	128	0	0	0	0	0	215
Lane Group Flow (vph)	0	0	0	710	0	345	0	548	0	0	730	260
Turn Type				Prot		Prot		NA	Free		NA	Prot
Protected Phases				8		8		2			6	6
Permitted Phases									Free			
Actuated Green, G (s)				18.4		18.4		33.6			33.6	33.6
Effective Green, g (s)				18.4		18.4		32.8			32.8	32.8
Actuated g/C Ratio				0.31		0.31		0.55			0.55	0.55
Clearance Time (s)				4.0		4.0		4.0			4.0	4.0
Vehicle Extension (s)				2.0		2.0		4.0			4.0	4.0
Lane Grp Cap (vph)				1052		485		2779			2779	865
v/s Ratio Prot				0.21		c0.22		0.11			0.14	c0.16
v/s Ratio Perm												
v/c Ratio				0.67		0.71		0.20			0.26	0.30
Uniform Delay, d1				18.2		18.5		6.9			7.2	7.4
Progression Factor				1.00		1.00		0.99			1.00	1.00
Incremental Delay, d2				1.4		4.1		0.2			0.2	0.9
Delay (s)				19.5		22.5		7.0			7.4	8.3
Level of Service				B		C		A			A	A
Approach Delay (s)		0.0			20.7			7.0			7.8	
Approach LOS		A			C			A			A	

Intersection Summary		
HCM 2000 Control Delay	12.8	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.45	B
Actuated Cycle Length (s)	60.0	Sum of lost time (s)
Intersection Capacity Utilization	44.0%	8.8
Analysis Period (min)	15	ICU Level of Service
		A

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 30: Isabel Ave & I-580 EB Ramps

BART to Livermore Extension Project
 2040 Enhanced Bus AM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations													
Traffic Volume (vph)	235	0	503	0	0	0	0	720	521	0	993	365	
Future Volume (vph)	235	0	503	0	0	0	0	720	521	0	993	365	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)	4.0		4.0					4.0	4.0		4.0	4.0	
Lane Util. Factor	0.97		0.88					0.91	1.00		0.91	1.00	
Frt	1.00		0.85					1.00	0.85		1.00	0.85	
Flt Protected	0.95		1.00					1.00	1.00		1.00	1.00	
Satd. Flow (prot)	3433		2787					5085	1583		5085	1583	
Flt Permitted	0.95		1.00					1.00	1.00		1.00	1.00	
Satd. Flow (perm)	3433		2787					5085	1583		5085	1583	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	
Adj. Flow (vph)	255	0	547	0	0	0	0	783	566	0	1079	397	
RTOR Reduction (vph)	0	0	119	0	0	0	0	0	0	0	0	0	
Lane Group Flow (vph)	255	0	428	0	0	0	0	783	566	0	1079	397	
Turn Type	Prot		Perm					NA	Free		NA	Free	
Protected Phases	4							2			6		
Permitted Phases			4						Free			Free	
Actuated Green, G (s)	13.2		13.2					37.8	60.0		37.8	60.0	
Effective Green, g (s)	13.2		13.2					38.8	60.0		38.8	60.0	
Actuated g/C Ratio	0.22		0.22					0.65	1.00		0.65	1.00	
Clearance Time (s)	4.0		4.0					5.0			5.0		
Vehicle Extension (s)	2.0		2.0					4.0			4.0		
Lane Grp Cap (vph)	755		613					3288	1583		3288	1583	
v/s Ratio Prot	0.07							0.15			0.21		
v/s Ratio Perm			c0.15						c0.36			0.25	
v/c Ratio	0.34		0.70					0.24	0.36		0.33	0.25	
Uniform Delay, d1	19.7		21.6					4.4	0.0		4.8	0.0	
Progression Factor	1.00		1.00					1.00	1.00		0.49	1.00	
Incremental Delay, d2	0.1		2.8					0.2	0.6		0.3	0.4	
Delay (s)	19.8		24.4					4.6	0.6		2.6	0.4	
Level of Service	B		C					A	A		A	A	
Approach Delay (s)		22.9			0.0			2.9			2.0		
Approach LOS		C			A			A			A		
Intersection Summary													
HCM 2000 Control Delay			7.0									HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio			0.47										
Actuated Cycle Length (s)			60.0									Sum of lost time (s)	8.0
Intersection Capacity Utilization			43.4%									ICU Level of Service	A
Analysis Period (min)			15										
c Critical Lane Group													

HCM Signalized Intersection Capacity Analysis
 31: Isabel Ave & Airway Blvd

BART to Livermore Extension Project
 2040 Enhanced Bus AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↑	↗	↖	↑	↗	↖	↑↑↑	↗	↖↗	↑↑↑	↗
Traffic Volume (vph)	0	75	267	203	299	133	339	1067	23	252	1422	17
Future Volume (vph)	0	75	267	203	299	133	339	1067	23	252	1422	17
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.2	5.6	5.2	5.2	5.6	4.0	4.0	4.0	4.0	4.0	5.0
Lane Util. Factor		1.00	1.00	1.00	1.00	1.00	1.00	0.91	1.00	0.97	0.91	1.00
Frt		1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1863	1583	1770	1863	1583	1770	5085	1583	3433	5085	1583
Flt Permitted		1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)		1863	1583	1770	1863	1583	1770	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	82	290	221	325	145	368	1160	25	274	1546	18
RTOR Reduction (vph)	0	0	109	0	0	79	0	0	14	0	0	11
Lane Group Flow (vph)	0	82	181	221	325	66	368	1160	11	274	1546	7
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4	5	3	8	1	5	2		1	NA	6
Permitted Phases			4			8			2			6
Actuated Green, G (s)		7.7	23.8	11.8	24.1	34.7	16.1	37.0	37.0	10.6	31.5	31.5
Effective Green, g (s)		7.1	22.6	11.2	23.5	33.5	17.1	38.0	38.0	11.6	32.5	31.5
Actuated g/C Ratio		0.08	0.26	0.13	0.27	0.39	0.20	0.44	0.44	0.13	0.38	0.37
Clearance Time (s)		4.6	5.0	4.6	4.6	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Extension (s)		3.0	3.0	3.0	3.0	3.0	3.0	5.0	5.0	3.0	5.0	5.0
Lane Grp Cap (vph)		153	414	229	507	614	350	2239	697	461	1914	577
v/s Ratio Prot		0.04	0.08	c0.12	c0.17	0.01	c0.21	0.23		0.08	c0.30	
v/s Ratio Perm			0.04			0.03			0.01			0.00
v/c Ratio		0.54	0.44	0.97	0.64	0.11	1.05	0.52	0.02	0.59	0.81	0.01
Uniform Delay, d1		38.0	26.6	37.4	27.7	16.9	34.6	17.5	13.6	35.1	24.1	17.5
Progression Factor		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2		3.6	0.7	49.2	2.8	0.1	62.2	0.4	0.0	2.1	3.0	0.0
Delay (s)		41.6	27.3	86.6	30.4	16.9	96.8	17.9	13.6	37.2	27.1	17.5
Level of Service		D	C	F	C	B	F	B	B	D	C	B
Approach Delay (s)		30.5			45.6			36.5			28.5	
Approach LOS		C			D			D			C	

Intersection Summary		
HCM 2000 Control Delay	34.1	HCM 2000 Level of Service C
HCM 2000 Volume to Capacity ratio	0.92	
Actuated Cycle Length (s)	86.3	Sum of lost time (s) 20.0
Intersection Capacity Utilization	75.2%	ICU Level of Service D
Analysis Period (min)	15	

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
32: Isabel Ave & Jack London Blvd

BART to Livermore Extension Project
2040 Enhanced Bus AM



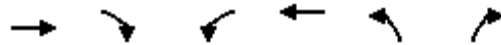
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↖↖	↖	↖	↖↖	↖	↖↖	↖↖↖	↖	↖↖	↖↖↖	↖
Traffic Volume (vph)	23	55	61	328	1038	366	414	880	117	169	1377	297
Future Volume (vph)	23	55	61	328	1038	366	414	880	117	169	1377	297
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.97	0.91	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	3433	5085	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	3433	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	25	60	66	357	1128	398	450	957	127	184	1497	323
RTOR Reduction (vph)	0	0	54	0	0	53	0	0	81	0	0	97
Lane Group Flow (vph)	25	60	12	357	1128	345	450	957	46	184	1497	226
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8	1	5	2		1	NA	6
Permitted Phases			4			8			2			6
Actuated Green, G (s)	3.9	23.3	23.3	27.0	46.4	58.6	17.9	47.5	47.5	12.2	41.8	41.8
Effective Green, g (s)	3.9	23.3	23.3	27.0	46.4	58.6	17.9	47.5	47.5	12.2	41.8	41.8
Actuated g/C Ratio	0.03	0.18	0.18	0.21	0.35	0.45	0.14	0.36	0.36	0.09	0.32	0.32
Clearance Time (s)	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	102	628	281	364	1251	770	468	1840	573	319	1620	504
v/s Ratio Prot	0.01	0.02		c0.20	c0.32	0.04	c0.13	0.19		0.05	c0.29	
v/s Ratio Perm			0.01			0.18			0.03			0.14
v/c Ratio	0.25	0.10	0.04	0.98	0.90	0.45	0.96	0.52	0.08	0.58	0.92	0.45
Uniform Delay, d1	62.2	45.1	44.7	51.8	40.2	25.1	56.3	32.9	27.5	57.0	43.2	35.5
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.3	0.1	0.1	41.8	9.2	0.4	31.8	0.3	0.1	2.5	9.3	0.6
Delay (s)	63.5	45.2	44.8	93.7	49.4	25.5	88.1	33.2	27.6	59.5	52.4	36.2
Level of Service	E	D	D	F	D	C	F	C	C	E	D	D
Approach Delay (s)		48.0			52.8			48.8			50.5	
Approach LOS		D			D			D			D	

Intersection Summary

HCM 2000 Control Delay	50.7	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.96		
Actuated Cycle Length (s)	131.2	Sum of lost time (s)	21.2
Intersection Capacity Utilization	80.4%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 33: Isabel Ave Connector & Stanley Blvd



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑	↑	↔	↑↑	↔	↔
Traffic Volume (vph)	327	153	782	2475	577	619
Future Volume (vph)	327	153	782	2475	577	619
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	2.3	2.3	4.0	2.3	2.5	2.5
Lane Util. Factor	0.95	1.00	0.97	0.95	0.97	0.88
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	3539	1583	3433	3539	3433	2787
Flt Permitted	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (perm)	3539	1583	3433	3539	3433	2787
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	355	166	850	2690	627	673
RTOR Reduction (vph)	0	12	0	0	0	232
Lane Group Flow (vph)	355	154	850	2690	627	441
Turn Type	NA	pm+ov	Prot	NA	Prot	pm+ov
Protected Phases	2	8	1	6	8	1
Permitted Phases		2				8
Actuated Green, G (s)	45.1	69.8	33.0	82.1	24.7	57.7
Effective Green, g (s)	46.8	73.2	33.0	83.8	26.2	60.7
Actuated g/C Ratio	0.41	0.64	0.29	0.73	0.23	0.53
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Grp Cap (vph)	1442	1041	986	2583	783	1534
v/s Ratio Prot	0.10	0.03	0.25	c0.76	c0.18	0.09
v/s Ratio Perm		0.06				0.07
v/c Ratio	0.25	0.15	0.86	1.04	0.80	0.29
Uniform Delay, d1	22.4	8.3	38.7	15.5	41.8	15.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.0	0.0	7.6	29.7	5.6	0.0
Delay (s)	22.4	8.3	46.3	45.2	47.4	15.1
Level of Service	C	A	D	D	D	B
Approach Delay (s)	17.9			45.4	30.7	
Approach LOS	B			D	C	

Intersection Summary

HCM 2000 Control Delay	39.2	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	1.02		
Actuated Cycle Length (s)	114.8	Sum of lost time (s)	8.8
Intersection Capacity Utilization	91.5%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 34: Murrieta Blvd/Driveway & Portola Ave

BART to Livermore Extension Project
 2040 Enhanced Bus AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗		↖	↗		↖	↗	↗		↗	
Traffic Volume (vph)	0	438	102	268	1249	1	188	6	148	1	3	0
Future Volume (vph)	0	438	102	268	1249	1	188	6	148	1	3	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.8		4.0	5.8		5.2	5.2	5.2		4.0	
Lane Util. Factor		0.95		1.00	0.95		0.95	0.95	1.00		1.00	
Frt		0.97		1.00	1.00		1.00	1.00	0.85		1.00	
Flt Protected		1.00		0.95	1.00		0.95	0.96	1.00		0.99	
Satd. Flow (prot)		3439		1770	3539		1681	1691	1583		1840	
Flt Permitted		1.00		0.95	1.00		0.95	0.96	1.00		0.99	
Satd. Flow (perm)		3439		1770	3539		1681	1691	1583		1840	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	476	111	291	1358	1	204	7	161	1	3	0
RTOR Reduction (vph)	0	25	0	0	0	0	0	0	138	0	0	0
Lane Group Flow (vph)	0	562	0	291	1359	0	106	105	23	0	4	0
Turn Type	Prot	NA		Prot	NA		Split	NA	Perm		Split	NA
Protected Phases	5	2		1	6		8	8		4	4	
Permitted Phases									8			
Actuated Green, G (s)		13.5		14.5	32.0		8.2	8.2	8.2		0.6	
Effective Green, g (s)		12.6		14.5	31.1		7.6	7.6	7.6		0.6	
Actuated g/C Ratio		0.23		0.27	0.57		0.14	0.14	0.14		0.01	
Clearance Time (s)		4.9		4.0	4.9		4.6	4.6	4.6		4.0	
Vehicle Extension (s)		2.0		2.0	2.0		2.0	2.0	2.0		2.0	
Lane Grp Cap (vph)		798		472	2026		235	236	221		20	
v/s Ratio Prot		0.16		0.16	c0.38		c0.06	0.06			c0.00	
v/s Ratio Perm									0.01			
v/c Ratio		0.70		0.62	0.67		0.45	0.44	0.10		0.20	
Uniform Delay, d1		19.1		17.5	8.0		21.4	21.4	20.4		26.6	
Progression Factor		1.00		1.00	1.00		1.00	1.00	1.00		1.00	
Incremental Delay, d2		2.3		1.7	0.7		0.5	0.5	0.1		1.8	
Delay (s)		21.5		19.1	8.7		21.9	21.9	20.4		28.4	
Level of Service		C		B	A		C	C	C		C	
Approach Delay (s)		21.5			10.6			21.3			28.4	
Approach LOS		C			B			C			C	

Intersection Summary		
HCM 2000 Control Delay	14.6	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.69	B
Actuated Cycle Length (s)	54.3	Sum of lost time (s)
Intersection Capacity Utilization	62.4%	19.0
Analysis Period (min)	15	ICU Level of Service
		B

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
35: Murrieta Blvd & Jack London Blvd

BART to Livermore Extension Project
2040 Enhanced Bus AM



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	69	297	867	214	243	175
Future Volume (vph)	69	297	867	214	243	175
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00	1.00	0.95	0.91	
Frt	1.00	0.85	1.00	1.00	0.94	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1770	1583	1770	3539	4766	
Flt Permitted	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	1770	1583	1770	3539	4766	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	75	323	942	233	264	190
RTOR Reduction (vph)	0	285	0	0	154	0
Lane Group Flow (vph)	75	38	942	233	300	0
Turn Type	Prot	Perm	Prot	NA	NA	
Protected Phases	4		5	2	6	
Permitted Phases		4				
Actuated Green, G (s)	9.2	9.2	46.3	60.6	10.3	
Effective Green, g (s)	9.2	9.2	46.3	60.6	10.3	
Actuated g/C Ratio	0.12	0.12	0.60	0.78	0.13	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	209	187	1053	2756	630	
v/s Ratio Prot	c0.04		c0.53	0.07	c0.06	
v/s Ratio Perm		0.02				
v/c Ratio	0.36	0.20	0.89	0.08	0.48	
Uniform Delay, d1	31.6	31.0	13.6	2.0	31.2	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	1.1	0.5	9.9	0.0	0.6	
Delay (s)	32.6	31.5	23.5	2.0	31.8	
Level of Service	C	C	C	A	C	
Approach Delay (s)	31.7			19.3	31.8	
Approach LOS	C			B	C	

Intersection Summary

HCM 2000 Control Delay	24.5	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.75		
Actuated Cycle Length (s)	77.8	Sum of lost time (s)	12.0
Intersection Capacity Utilization	70.5%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
36: Murrieta Blvd & Stanley Blvd

BART to Livermore Extension Project
2040 Enhanced Bus AM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	215	750	259	24	1385	138	698	391	17	195	192	467
Future Volume (vph)	215	750	259	24	1385	138	698	391	17	195	192	467
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	5.8	5.8	4.0	5.8	4.9	4.9	5.8		4.9	5.8	4.9
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.97	0.95		1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	3433	3518		1770	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	3433	3518		1770	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	234	815	282	26	1505	150	759	425	18	212	209	508
RTOR Reduction (vph)	0	0	133	0	0	33	0	2	0	0	0	60
Lane Group Flow (vph)	234	815	149	26	1505	117	759	441	0	212	209	448
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Prot	NA		Prot	NA	Perm
Protected Phases	1	6		5	2	3	7	4		3	8	
Permitted Phases			6			2						8
Actuated Green, G (s)	7.0	61.1	61.1	3.6	57.7	79.2	25.0	37.6		21.5	34.1	34.1
Effective Green, g (s)	7.0	60.2	60.2	3.6	56.8	77.4	24.1	36.7		20.6	33.2	34.1
Actuated g/C Ratio	0.05	0.43	0.43	0.03	0.40	0.55	0.17	0.26		0.15	0.23	0.24
Clearance Time (s)	4.0	4.9	4.9	4.0	4.9	4.0	4.0	4.9		4.0	4.9	4.9
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	169	1504	672	45	1419	865	584	911		257	829	381
v/s Ratio Prot	c0.07	c0.23		0.01	c0.43	0.02	c0.22	c0.13		0.12	0.06	
v/s Ratio Perm			0.09			0.05						c0.28
v/c Ratio	1.38	0.54	0.22	0.58	1.06	0.14	1.30	0.48		0.82	0.25	1.18
Uniform Delay, d1	67.3	30.4	25.8	68.2	42.4	15.7	58.8	44.4		58.7	44.1	53.8
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	205.4	0.4	0.2	16.7	41.8	0.1	147.1	0.4		18.9	0.2	103.4
Delay (s)	272.7	30.8	26.0	85.0	84.2	15.8	205.9	44.8		77.7	44.3	157.1
Level of Service	F	C	C	F	F	B	F	D		E	D	F
Approach Delay (s)		72.3			78.1			146.5			113.6	
Approach LOS		E			E			F			F	

Intersection Summary

HCM 2000 Control Delay	99.0	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.14		
Actuated Cycle Length (s)	141.6	Sum of lost time (s)	20.5
Intersection Capacity Utilization	100.1%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
37: Livermore Ave & I-580 WB Ramps

BART to Livermore Extension Project
2040 Enhanced Bus AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↵	↔		↵↵	↑			↕↔	
Traffic Volume (vph)	0	0	0	344	91	27	481	82	0	0	151	0
Future Volume (vph)	0	0	0	344	91	27	481	82	0	0	151	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)					4.0		4.0	4.0			4.0	
Lane Util. Factor					0.95		0.97	1.00			0.95	
Frt					0.99		1.00	1.00			1.00	
Flt Protected					0.96		0.95	1.00			1.00	
Satd. Flow (prot)					1691		3433	1863			3539	
Flt Permitted					0.96		0.95	1.00			1.00	
Satd. Flow (perm)					1691		3433	1863			3539	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	374	99	29	523	89	0	0	164	0
RTOR Reduction (vph)	0	0	0	0	4	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	0	498	0	523	89	0	0	164	0
Turn Type				Split	NA		Prot	NA			NA	
Protected Phases				8	8		5	2			6	
Permitted Phases												
Actuated Green, G (s)					20.8		12.5	29.5			13.5	
Effective Green, g (s)					20.8		12.0	31.2			15.2	
Actuated g/C Ratio					0.35		0.20	0.52			0.25	
Clearance Time (s)					4.0		3.5	5.7			5.7	
Vehicle Extension (s)					2.0		2.0	2.5			2.5	
Lane Grp Cap (vph)					586		686	968			896	
v/s Ratio Prot					c0.29		c0.15	0.05			c0.05	
v/s Ratio Perm												
v/c Ratio					0.85		0.76	0.09			0.18	
Uniform Delay, d1					18.2		22.7	7.3			17.5	
Progression Factor					1.00		0.75	0.42			1.00	
Incremental Delay, d2					10.7		4.0	0.2			0.4	
Delay (s)					28.9		21.0	3.2			18.0	
Level of Service					C		C	A			B	
Approach Delay (s)		0.0			28.9			18.4			18.0	
Approach LOS		A			C			B			B	

Intersection Summary

HCM 2000 Control Delay	22.5	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.62		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	56.4%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
38: Livermore Ave & I-580 EB Ramps

BART to Livermore Extension Project
2040 Enhanced Bus AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕	↗					↕		↘	↕	
Traffic Volume (vph)	14	2	697	0	0	0	0	543	374	23	478	0
Future Volume (vph)	14	2	697	0	0	0	0	543	374	23	478	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0					3.0		5.0	3.0	
Lane Util. Factor		0.95	0.95					0.95		1.00	0.95	
Frt		0.86	0.85					0.94		1.00	1.00	
Flt Protected		1.00	1.00					1.00		0.95	1.00	
Satd. Flow (prot)		1513	1504					3322		1770	3539	
Flt Permitted		1.00	1.00					1.00		0.95	1.00	
Satd. Flow (perm)		1513	1504					3322		1770	3539	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	15	2	758	0	0	0	0	590	407	25	520	0
RTOR Reduction (vph)	0	236	236	0	0	0	0	168	0	0	0	0
Lane Group Flow (vph)	0	152	151	0	0	0	0	829	0	25	520	0
Turn Type	Prot	NA	Perm					NA		Prot	NA	
Protected Phases	7	4						2		1	6	
Permitted Phases			4									
Actuated Green, G (s)		15.8	15.8					30.6		1.6	36.2	
Effective Green, g (s)		15.8	15.8					31.6		0.6	37.2	
Actuated g/C Ratio		0.26	0.26					0.53		0.01	0.62	
Clearance Time (s)		4.0	4.0					4.0		4.0	4.0	
Vehicle Extension (s)		2.0	2.0					2.5		2.0	2.5	
Lane Grp Cap (vph)		398	396					1749		17	2194	
v/s Ratio Prot								c0.25		c0.01	0.15	
v/s Ratio Perm		0.10	0.10									
v/c Ratio		0.38	0.38					0.47		1.47	0.24	
Uniform Delay, d1		18.1	18.1					9.0		29.7	5.1	
Progression Factor		1.00	1.00					1.00		1.13	0.23	
Incremental Delay, d2		0.2	0.2					0.9		369.9	0.2	
Delay (s)		18.3	18.3					9.9		403.5	1.4	
Level of Service		B	B					A		F	A	
Approach Delay (s)		18.3			0.0			9.9			19.8	
Approach LOS		B			A			A			B	





























Intersection Summary

HCM 2000 Control Delay	15.0	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.46		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	56.4%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
39: Livermore Ave & Portola Ave

BART to Livermore Extension Project
2040 Enhanced Bus AM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 	 			 			 			 	
Traffic Volume (vph)	283	247	91	32	734	96	247	496	70	137	742	436
Future Volume (vph)	283	247	91	32	734	96	247	496	70	137	742	436
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	2.7	4.0	4.0	2.7	4.0	4.0	4.9		4.0	4.9	4.9
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	1.00	0.95		1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.98		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	1770	3474		1770	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	1770	3474		1770	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	308	268	99	35	798	104	268	539	76	149	807	474
RTOR Reduction (vph)	0	0	62	0	0	74	0	9	0	0	0	46
Lane Group Flow (vph)	308	268	37	35	798	30	268	606	0	149	807	428
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA		Prot	NA	pm+ov
Protected Phases	3	8		7	4		1	6		5	2	3
Permitted Phases			8			4						2
Actuated Green, G (s)	13.4	42.3	42.3	3.3	32.2	32.2	20.0	36.3		14.2	30.5	43.9
Effective Green, g (s)	13.4	43.6	42.3	3.3	33.5	32.2	20.0	35.4		14.2	29.6	42.1
Actuated g/C Ratio	0.12	0.39	0.38	0.03	0.30	0.29	0.18	0.32		0.13	0.26	0.38
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	410	1376	597	52	1057	454	315	1097		224	934	663
v/s Ratio Prot	c0.09	0.08		0.02	c0.23		c0.15	0.17		0.08	c0.23	c0.07
v/s Ratio Perm			0.02			0.02						0.20
v/c Ratio	0.75	0.19	0.06	0.67	0.75	0.07	0.85	0.55		0.67	0.86	0.65
Uniform Delay, d1	47.7	22.6	22.3	53.9	35.6	29.0	44.6	31.8		46.7	39.3	28.9
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	7.6	0.1	0.0	29.2	3.1	0.1	19.2	0.6		7.3	8.4	2.2
Delay (s)	55.3	22.7	22.3	83.1	38.7	29.1	63.9	32.4		53.9	47.7	31.0
Level of Service	E	C	C	F	D	C	E	C		D	D	C
Approach Delay (s)		37.5			39.3			41.9			42.8	
Approach LOS		D			D			D			D	

Intersection Summary		
HCM 2000 Control Delay	40.9	HCM 2000 Level of Service D
HCM 2000 Volume to Capacity ratio	0.83	
Actuated Cycle Length (s)	112.1	Sum of lost time (s) 16.5
Intersection Capacity Utilization	76.6%	ICU Level of Service D
Analysis Period (min)	15	

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
40: First St/Springtown Blvd & I-580 WB Ramps

BART to Livermore Extension Project
2040 Enhanced Bus AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations			↗↘			↗	↗↘	↑			↗↘	↗
Traffic Volume (vph)	0	0	443	0	0	0	341	375	0	0	875	528
Future Volume (vph)	0	0	443	0	0	0	341	375	0	0	875	528
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)			4.5				4.5	4.0			4.5	4.5
Lane Util. Factor			0.88				0.97	1.00			0.95	1.00
Frt			0.85				1.00	1.00			1.00	0.85
Flt Protected			1.00				0.95	1.00			1.00	1.00
Satd. Flow (prot)			2787				3433	1863			3539	1583
Flt Permitted			1.00				0.95	1.00			1.00	1.00
Satd. Flow (perm)			2787				3433	1863			3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	482	0	0	0	371	408	0	0	951	574
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	70
Lane Group Flow (vph)	0	0	482	0	0	0	371	408	0	0	951	504
Turn Type			Over			Free	Prot	NA			NA	Perm
Protected Phases			5				5	2			6	
Permitted Phases						Free						6
Actuated Green, G (s)			14.2				14.2	60.0			37.8	37.8
Effective Green, g (s)			13.7				13.7	60.0			37.3	37.3
Actuated g/C Ratio			0.23				0.23	1.00			0.62	0.62
Clearance Time (s)			4.0				4.0	4.0			4.0	4.0
Vehicle Extension (s)			2.0				2.0	0.2			4.0	4.0
Lane Grp Cap (vph)			636				783	1863			2200	984
v/s Ratio Prot			c0.17				0.11	0.22			0.27	
v/s Ratio Perm												c0.32
v/c Ratio			0.76				0.47	0.22			0.43	0.51
Uniform Delay, d1			21.6				20.0	0.0			5.9	6.3
Progression Factor			1.00				0.67	1.00			1.00	1.00
Incremental Delay, d2			4.6				0.1	0.2			0.6	1.9
Delay (s)			26.2				13.5	0.2			6.5	8.2
Level of Service			C				B	A			A	A
Approach Delay (s)		26.2			0.0			6.6			7.1	
Approach LOS		C			A			A			A	

Intersection Summary

HCM 2000 Control Delay	10.3	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.58		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	49.9%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
41: First St & I-580 EB Ramps

BART to Livermore Extension Project
2040 Enhanced Bus AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕	↗↘					↕↕	↗	↘	↕↕	
Traffic Volume (vph)	73	2	379	0	0	0	0	885	876	91	1200	0
Future Volume (vph)	73	2	379	0	0	0	0	885	876	91	1200	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0					5.0	5.0	5.0	5.0	
Lane Util. Factor		1.00	0.88					0.95	1.00	1.00	0.95	
Frt		1.00	0.85					1.00	0.85	1.00	1.00	
Flt Protected		0.95	1.00					1.00	1.00	0.95	1.00	
Satd. Flow (prot)		1776	2787					3539	1583	1770	3539	
Flt Permitted		0.95	1.00					1.00	1.00	0.95	1.00	
Satd. Flow (perm)		1776	2787					3539	1583	1770	3539	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	79	2	412	0	0	0	0	962	952	99	1304	0
RTOR Reduction (vph)	0	0	150	0	0	0	0	0	315	0	0	0
Lane Group Flow (vph)	0	81	262	0	0	0	0	962	637	99	1304	0
Turn Type	Perm	NA	Perm					NA	Perm	Prot	NA	
Protected Phases		4						2		1	6	
Permitted Phases	4		4						2			
Actuated Green, G (s)		8.1	8.1					34.4	34.4	5.5	43.9	
Effective Green, g (s)		7.6	7.6					33.9	33.9	4.5	43.4	
Actuated g/C Ratio		0.13	0.13					0.56	0.56	0.08	0.72	
Clearance Time (s)		3.5	3.5					4.5	4.5	4.0	4.5	
Vehicle Extension (s)		2.5	2.5					4.0	4.0	2.0	4.0	
Lane Grp Cap (vph)		224	353					1999	894	132	2559	
v/s Ratio Prot								0.27		0.06	c0.37	
v/s Ratio Perm		0.05	c0.09						c0.40			
v/c Ratio		0.36	0.74					0.48	0.71	0.75	0.51	
Uniform Delay, d1		24.0	25.3					7.8	9.5	27.2	3.6	
Progression Factor		1.00	1.00					1.00	1.00	1.11	0.53	
Incremental Delay, d2		0.7	7.7					0.8	4.8	16.9	0.6	
Delay (s)		24.7	33.0					8.6	14.3	47.1	2.6	
Level of Service		C	C					A	B	D	A	
Approach Delay (s)		31.6			0.0			11.5			5.7	
Approach LOS		C			A			B			A	

Intersection Summary

HCM 2000 Control Delay	12.0	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.73		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	14.0
Intersection Capacity Utilization	75.1%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
42: 1st St & Mines Rd

BART to Livermore Extension Project
2040 Enhanced Bus AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	42	59	46	517	100	361	25	1382	339	173	1322	21
Future Volume (vph)	42	59	46	517	100	361	25	1382	339	173	1322	21
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		0.97	1.00	1.00	1.00	0.91		0.97	0.91	
Frt	1.00	0.93		1.00	1.00	0.85	1.00	0.97		1.00	1.00	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1740		3433	1863	1583	1770	4935		3433	5073	
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	1740		3433	1863	1583	1770	4935		3433	5073	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	46	64	50	562	109	392	27	1502	368	188	1437	23
RTOR Reduction (vph)	0	34	0	0	0	47	0	42	0	0	1	0
Lane Group Flow (vph)	46	80	0	562	109	345	27	1828	0	188	1459	0
Turn Type	Prot	NA		Prot	NA	pm+ov	Prot	NA		Prot	NA	
Protected Phases	7	4		3	8	1	5	2		1	6	
Permitted Phases						8						
Actuated Green, G (s)	3.4	8.5		15.7	20.8	26.9	1.9	38.5		6.1	42.7	
Effective Green, g (s)	3.4	8.5		15.7	20.8	26.9	1.9	38.5		6.1	42.7	
Actuated g/C Ratio	0.04	0.10		0.19	0.25	0.32	0.02	0.45		0.07	0.50	
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	70	174		635	456	576	39	2240		246	2554	
v/s Ratio Prot	0.03	0.05		c0.16	0.06	c0.04	0.02	c0.37		c0.05	0.29	
v/s Ratio Perm						0.17						
v/c Ratio	0.66	0.46		0.89	0.24	0.60	0.69	0.82		0.76	0.57	
Uniform Delay, d1	40.1	36.0		33.7	25.7	24.4	41.2	20.1		38.6	14.7	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	20.1	1.9		13.9	0.3	1.7	41.8	2.4		13.2	0.3	
Delay (s)	60.2	37.9		47.6	25.9	26.1	83.0	22.5		51.8	15.0	
Level of Service	E	D		D	C	C	F	C		D	B	
Approach Delay (s)		44.3			37.4			23.4			19.2	
Approach LOS		D			D			C			B	

Intersection Summary

HCM 2000 Control Delay	25.8	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.85		
Actuated Cycle Length (s)	84.8	Sum of lost time (s)	16.0
Intersection Capacity Utilization	70.6%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Unsignalized Intersection Capacity Analysis
 43: Vasco Rd & I-580 WB Ramps























BART to Livermore Extension Project
 2040 Enhanced Bus AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations			↗			↗		↑↑↑	↗		↑↑↑	↗
Traffic Volume (veh/h)	0	0	0	0	0	164	0	1039	0	0	1939	0
Future Volume (Veh/h)	0	0	0	0	0	164	0	1039	0	0	1939	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	0	0	0	178	0	1129	0	0	2108	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage (veh)												
Upstream signal (ft)											524	
pX, platoon unblocked												
vC, conflicting volume	2662	3237	703	1832	3237	376	2108			1129		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	2662	3237	703	1832	3237	376	2108			1129		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	100	100	71	100			100		
cM capacity (veh/h)	8	9	380	47	9	621	257			615		
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	NB 4	SB 1	SB 2	SB 3	SB 4		
Volume Total	0	178	376	376	376	0	703	703	703	0		
Volume Left	0	0	0	0	0	0	0	0	0	0		
Volume Right	0	178	0	0	0	0	0	0	0	0		
cSH	1700	621	1700	1700	1700	1700	1700	1700	1700	1700		
Volume to Capacity	0.00	0.29	0.22	0.22	0.22	0.00	0.41	0.41	0.41	0.00		
Queue Length 95th (ft)	0	29	0	0	0	0	0	0	0	0		
Control Delay (s)	0.0	13.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
Lane LOS	A	B										
Approach Delay (s)	0.0	13.1	0.0				0.0					
Approach LOS	A	B										
Intersection Summary												
Average Delay			0.7									
Intersection Capacity Utilization			40.8%		ICU Level of Service				A			
Analysis Period (min)			15									

HCM Unsignalized Intersection Capacity Analysis
44: Vasco Rd & I-580 EB Ramps

BART to Livermore Extension Project
2040 Enhanced Bus AM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations								  			  	
Traffic Volume (veh/h)	0	0	0	0	0	0	0	1082	0	73	2071	0
Future Volume (Veh/h)	0	0	0	0	0	0	0	1082	0	73	2071	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	0	0	0	0	0	1176	0	79	2251	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	2801	3585	750	2084	3585	392	2251			1176		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	2801	3585	750	2084	3585	392	2251			1176		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	100	100	100	100			87		
cM capacity (veh/h)	8	5	354	27	5	607	225			590		
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	NB 4	SB 1	SB 2	SB 3	SB 4		
Volume Total	0	0	392	392	392	0	79	750	750	750		
Volume Left	0	0	0	0	0	0	79	0	0	0		
Volume Right	0	0	0	0	0	0	0	0	0	0		
cSH	1700	1700	1700	1700	1700	1700	590	1700	1700	1700		
Volume to Capacity	0.00	0.00	0.23	0.23	0.23	0.00	0.13	0.44	0.44	0.44		
Queue Length 95th (ft)	0	0	0	0	0	0	12	0	0	0		
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	12.0	0.0	0.0	0.0		
Lane LOS	A	A					B					
Approach Delay (s)	0.0	0.0	0.0				0.4					
Approach LOS	A	A										
Intersection Summary												
Average Delay			0.3									
Intersection Capacity Utilization			43.3%		ICU Level of Service				A			
Analysis Period (min)			15									

HCM Signalized Intersection Capacity Analysis
45: Vasco Rd & East Ave

BART to Livermore Extension Project
2040 Enhanced Bus AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	296	367	53	10	26	19	66	255	197	259	294	302
Future Volume (vph)	296	367	53	10	26	19	66	255	197	259	294	302
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	0.95		0.97	1.00	1.00
Frt	1.00	0.98		1.00	0.94		1.00	0.93		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	3472		1770	3312		1770	3308		3433	1863	1583
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1770	3472		1770	3312		1770	3308		3433	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	322	399	58	11	28	21	72	277	214	282	320	328
RTOR Reduction (vph)	0	19	0	0	19	0	0	156	0	0	0	219
Lane Group Flow (vph)	322	438	0	11	30	0	72	335	0	282	320	109
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												6
Actuated Green, G (s)	11.6	16.2		0.6	5.2		2.0	14.0		5.3	17.3	17.3
Effective Green, g (s)	11.6	16.2		0.6	5.2		2.0	14.0		5.3	17.3	17.3
Actuated g/C Ratio	0.22	0.31		0.01	0.10		0.04	0.27		0.10	0.33	0.33
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	394	1079		20	330		67	888		349	618	525
v/s Ratio Prot	c0.18	c0.13		0.01	0.01		0.04	0.10		c0.08	c0.17	
v/s Ratio Perm												0.07
v/c Ratio	0.82	0.41		0.55	0.09		1.07	0.38		0.81	0.52	0.21
Uniform Delay, d1	19.2	14.2		25.6	21.3		25.1	15.5		22.9	14.0	12.5
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	12.4	0.3		28.9	0.1		132.0	0.3		12.9	0.7	0.2
Delay (s)	31.6	14.4		54.5	21.4		157.1	15.8		35.8	14.8	12.7
Level of Service	C	B		D	C		F	B		D	B	B
Approach Delay (s)		21.5			27.5			33.8			20.4	
Approach LOS		C			C			C			C	

Intersection Summary

HCM 2000 Control Delay	24.2	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.68		
Actuated Cycle Length (s)	52.1	Sum of lost time (s)	16.0
Intersection Capacity Utilization	53.8%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
46: Greenville Rd & I-580 WB Ramps

BART to Livermore Extension Project
2040 Enhanced Bus AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↖↗		↖		↕↕	↖		↕↕	
Traffic Volume (vph)	0	0	0	239	0	38	0	122	332	0	943	514
Future Volume (vph)	0	0	0	239	0	38	0	122	332	0	943	514
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0		4.0		4.0	4.0		4.0	
Lane Util. Factor				0.97		1.00		0.95	1.00		0.95	
Frt				1.00		0.85		1.00	0.85		0.95	
Flt Protected				0.95		1.00		1.00	1.00		1.00	
Satd. Flow (prot)				3433		1583		3539	1583		3352	
Flt Permitted				0.95		1.00		1.00	1.00		1.00	
Satd. Flow (perm)				3433		1583		3539	1583		3352	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	260	0	41	0	133	361	0	1025	559
RTOR Reduction (vph)	0	0	0	0	0	35	0	0	103	0	123	0
Lane Group Flow (vph)	0	0	0	260	0	6	0	133	258	0	1461	0
Turn Type				Prot		Prot		NA	Perm		NA	
Protected Phases				3		3		2			6	
Permitted Phases									2			
Actuated Green, G (s)				9.1		9.1		42.9	42.9		42.9	
Effective Green, g (s)				9.1		9.1		42.9	42.9		42.9	
Actuated g/C Ratio				0.15		0.15		0.71	0.71		0.71	
Clearance Time (s)				4.0		4.0		4.0	4.0		4.0	
Vehicle Extension (s)				3.0		3.0		3.0	3.0		3.0	
Lane Grp Cap (vph)				520		240		2530	1131		2396	
v/s Ratio Prot				c0.08		0.00		0.04			c0.44	
v/s Ratio Perm									0.16			
v/c Ratio				0.50		0.03		0.05	0.23		0.61	
Uniform Delay, d1				23.4		21.7		2.5	2.9		4.3	
Progression Factor				1.00		1.00		0.69	1.31		1.00	
Incremental Delay, d2				0.8		0.0		0.0	0.5		1.2	
Delay (s)				24.1		21.7		1.8	4.3		5.5	
Level of Service				C		C		A	A		A	
Approach Delay (s)		0.0			23.8			3.6			5.5	
Approach LOS		A			C			A			A	






















Intersection Summary

HCM 2000 Control Delay	7.4	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.59		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	56.0%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
47: Greenville Rd & I-580 EB Ramps

BART to Livermore Extension Project
2040 Enhanced Bus AM

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations	 							 			 		
Traffic Volume (vph)	35	0	141	0	0	0	0	428	73	0	892	30	
Future Volume (vph)	35	0	141	0	0	0	0	428	73	0	892	30	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)	4.0		4.0					4.0	4.0		4.0	4.0	
Lane Util. Factor	0.97		1.00					0.95	1.00		0.95	1.00	
Frt	1.00		0.85					1.00	0.85		1.00	0.85	
Flt Protected	0.95		1.00					1.00	1.00		1.00	1.00	
Satd. Flow (prot)	3433		1583					3539	1583		3539	1583	
Flt Permitted	0.95		1.00					1.00	1.00		1.00	1.00	
Satd. Flow (perm)	3433		1583					3539	1583		3539	1583	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	
Adj. Flow (vph)	38	0	153	0	0	0	0	465	79	0	970	33	
RTOR Reduction (vph)	0	0	123	0	0	0	0	0	19	0	0	8	
Lane Group Flow (vph)	38	0	30	0	0	0	0	465	60	0	970	25	
Turn Type	Prot		Prot					NA	Perm		NA	Perm	
Protected Phases	7		7					2			6		
Permitted Phases									2			6	
Actuated Green, G (s)	6.2		6.2					45.8	45.8		45.8	45.8	
Effective Green, g (s)	6.2		6.2					45.8	45.8		45.8	45.8	
Actuated g/C Ratio	0.10		0.10					0.76	0.76		0.76	0.76	
Clearance Time (s)	4.0		4.0					4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0		3.0					3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	354		163					2701	1208		2701	1208	
v/s Ratio Prot	0.01		c0.02					0.13			c0.27		
v/s Ratio Perm									0.04			0.02	
v/c Ratio	0.11		0.19					0.17	0.05		0.36	0.02	
Uniform Delay, d1	24.4		24.6					1.9	1.7		2.3	1.7	
Progression Factor	1.00		1.00					1.00	1.00		0.78	0.78	
Incremental Delay, d2	0.1		0.6					0.1	0.1		0.3	0.0	
Delay (s)	24.5		25.1					2.1	1.8		2.1	1.4	
Level of Service	C		C					A	A		A	A	
Approach Delay (s)		25.0			0.0			2.0			2.1		
Approach LOS		C			A			A			A		
Intersection Summary													
HCM 2000 Control Delay			4.6									HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio			0.34										
Actuated Cycle Length (s)			60.0									Sum of lost time (s)	8.0
Intersection Capacity Utilization			40.1%									ICU Level of Service	A
Analysis Period (min)			15										

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 48: Greenville Rd & Northfront Road/Altamont Pass Road

BART to Livermore Extension Project
 2040 Enhanced Bus AM



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↑	↑	↑	↑	↑
Traffic Volume (vph)	7	650	631	506	92	60
Future Volume (vph)	7	650	631	506	92	60
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	1863	1583	1770	1863	1770	1583
Flt Permitted	1.00	1.00	0.75	1.00	0.95	1.00
Satd. Flow (perm)	1863	1583	1402	1863	1770	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	8	707	686	550	100	65
RTOR Reduction (vph)	0	256	0	0	0	53
Lane Group Flow (vph)	8	451	686	550	100	12
Turn Type	NA	Perm	Perm	NA	Prot	Perm
Protected Phases	4			8	2	
Permitted Phases		4	8			2
Actuated Green, G (s)	28.7	28.7	28.7	28.7	8.3	8.3
Effective Green, g (s)	28.7	28.7	28.7	28.7	8.3	8.3
Actuated g/C Ratio	0.64	0.64	0.64	0.64	0.18	0.18
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	1188	1009	894	1188	326	291
v/s Ratio Prot	0.00			0.30	c0.06	
v/s Ratio Perm		0.28	c0.49			0.01
v/c Ratio	0.01	0.45	0.77	0.46	0.31	0.04
Uniform Delay, d1	3.0	4.1	5.8	4.2	15.9	15.1
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.0	0.3	4.0	0.3	0.5	0.1
Delay (s)	3.0	4.4	9.8	4.5	16.4	15.1
Level of Service	A	A	A	A	B	B
Approach Delay (s)	4.4			7.4	15.9	
Approach LOS	A			A	B	

Intersection Summary

HCM 2000 Control Delay	7.1	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.66		
Actuated Cycle Length (s)	45.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	81.9%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	120	170	127	407	751	222
Future Volume (vph)	120	170	127	407	751	222
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.2	5.2	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.88	0.97	0.95	0.95	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	3433	2787	3433	3539	3539	1583
Flt Permitted	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (perm)	3433	2787	3433	3539	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	130	185	138	442	816	241
RTOR Reduction (vph)	0	164	0	0	0	120
Lane Group Flow (vph)	130	21	138	442	816	121
Turn Type	Prot	Perm	Prot	NA	NA	Perm
Protected Phases	8		1	6	2	
Permitted Phases		8				2
Actuated Green, G (s)	5.5	5.5	3.2	27.1	19.9	19.9
Effective Green, g (s)	4.9	4.9	3.2	28.8	21.6	21.6
Actuated g/C Ratio	0.11	0.11	0.07	0.67	0.50	0.50
Clearance Time (s)	4.6	4.6	4.0	5.7	5.7	5.7
Vehicle Extension (s)	5.0	5.0	6.0	2.5	2.5	2.5
Lane Grp Cap (vph)	392	318	256	2375	1781	797
v/s Ratio Prot	c0.04		c0.04	0.12	c0.23	
v/s Ratio Perm		0.01				0.08
v/c Ratio	0.33	0.07	0.54	0.19	0.46	0.15
Uniform Delay, d1	17.5	17.0	19.1	2.6	6.9	5.7
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.0	0.2	5.1	0.0	0.1	0.1
Delay (s)	18.5	17.1	24.3	2.7	7.0	5.8
Level of Service	B	B	C	A	A	A
Approach Delay (s)	17.7			7.8	6.7	
Approach LOS	B			A	A	

Intersection Summary

HCM 2000 Control Delay	8.8	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.45		
Actuated Cycle Length (s)	42.9	Sum of lost time (s)	13.2
Intersection Capacity Utilization	38.8%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
50: Greenville Rd & Patterson Pass Rd

BART to Livermore Extension Project
2040 Enhanced Bus AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	40	6	71	251	409	320	17	144	1	6	339	48
Future Volume (vph)	40	6	71	251	409	320	17	144	1	6	339	48
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.86		1.00	0.93		1.00	1.00		1.00	0.98	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1607		1770	1740		1770	1861		1770	1828	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	1607		1770	1740		1770	1861		1770	1828	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	43	7	77	273	445	348	18	157	1	7	368	52
RTOR Reduction (vph)	0	60	0	0	32	0	0	0	0	0	6	0
Lane Group Flow (vph)	43	24	0	273	761	0	18	158	0	7	414	0
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												
Actuated Green, G (s)	2.1	18.6		21.6	38.1		1.4	26.0		0.7	25.3	
Effective Green, g (s)	2.1	18.6		21.6	38.1		1.4	26.0		0.7	25.3	
Actuated g/C Ratio	0.03	0.22		0.26	0.46		0.02	0.31		0.01	0.31	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	44	360		461	799		29	583		14	557	
v/s Ratio Prot	0.02	0.02		c0.15	c0.44		c0.01	0.08		0.00	c0.23	
v/s Ratio Perm												
v/c Ratio	0.98	0.07		0.59	0.95		0.62	0.27		0.50	0.74	
Uniform Delay, d1	40.4	25.3		26.8	21.5		40.5	21.3		40.9	25.9	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	125.9	0.1		2.0	21.0		34.8	1.1		25.4	8.7	
Delay (s)	166.2	25.4		28.8	42.5		75.3	22.5		66.3	34.6	
Level of Service	F	C		C	D		E	C		E	C	
Approach Delay (s)		73.1			39.0			27.9			35.1	
Approach LOS		E			D			C			D	

Intersection Summary

HCM 2000 Control Delay	39.4	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.87		
Actuated Cycle Length (s)	82.9	Sum of lost time (s)	16.0
Intersection Capacity Utilization	68.5%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 1: Dougherty Rd & Amador Valley Rd



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	393	467	821	2093	1129	317
Future Volume (vph)	393	467	821	2093	1129	317
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00	0.97	0.91	0.91	
Frt	1.00	0.85	1.00	1.00	0.97	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1770	1583	3433	5085	4918	
Flt Permitted	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	1770	1583	3433	5085	4918	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	427	508	892	2275	1227	345
RTOR Reduction (vph)	0	366	0	0	42	0
Lane Group Flow (vph)	427	142	892	2275	1530	0
Turn Type	Perm	Perm	Prot	NA	NA	
Protected Phases			5	2	6	
Permitted Phases	4	4				
Actuated Green, G (s)	30.9	30.9	32.6	77.1	40.5	
Effective Green, g (s)	30.9	30.9	32.6	77.1	40.5	
Actuated g/C Ratio	0.27	0.27	0.28	0.66	0.35	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	471	421	964	3379	1717	
v/s Ratio Prot			c0.26	0.45	c0.31	
v/s Ratio Perm	c0.24	0.09				
v/c Ratio	0.91	0.34	0.93	0.67	0.89	
Uniform Delay, d1	41.2	34.3	40.5	11.8	35.7	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	20.8	0.5	14.2	0.5	6.3	
Delay (s)	62.0	34.8	54.7	12.3	41.9	
Level of Service	E	C	D	B	D	
Approach Delay (s)	47.2			24.3	41.9	
Approach LOS	D			C	D	

Intersection Summary

HCM 2000 Control Delay	32.9	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.91		
Actuated Cycle Length (s)	116.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	84.1%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
2: Hopyard Road/Dougherty Rd & Dublin Blvd

BART to Livermore Extension Project
2040 Enhanced Bus PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↑↑↑	↖↗	↖↗↘	↑↑↑	↖	↖↗↘	↑↑↑	↖↗	↖↗	↑↑↑	↖↗
Traffic Volume (vph)	93	1153	895	634	1048	919	847	1997	326	703	1218	38
Future Volume (vph)	93	1153	895	634	1048	919	847	1997	326	703	1218	38
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	6.0	5.0	5.0	5.5	5.0	5.0	5.5	5.0	5.0	5.5	
Lane Util. Factor	0.97	0.91	0.88	0.94	0.91	1.00	0.94	0.91	0.88	0.97	0.86	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	3433	5085	2787	4990	5085	1583	4990	5085	2787	3433	6379	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	3433	5085	2787	4990	5085	1583	4990	5085	2787	3433	6379	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	101	1253	973	689	1139	999	921	2171	354	764	1324	41
RTOR Reduction (vph)	0	0	59	0	0	70	0	0	57	0	4	0
Lane Group Flow (vph)	101	1253	914	689	1139	929	921	2171	297	764	1361	0
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	
Protected Phases	5	2	3	1	6	7	3	8	1	7	4	
Permitted Phases			2			6			8			
Actuated Green, G (s)	17.3	35.5	55.8	19.0	37.7	51.7	20.3	45.0	64.0	14.0	38.7	
Effective Green, g (s)	17.3	35.5	55.8	19.0	37.7	51.7	20.3	45.0	64.0	14.0	38.7	
Actuated g/C Ratio	0.13	0.26	0.41	0.14	0.28	0.38	0.15	0.33	0.47	0.10	0.29	
Clearance Time (s)	5.0	6.0	5.0	5.0	5.5	5.0	5.0	5.5	5.0	5.0	5.5	
Vehicle Extension (s)	2.0	4.5	2.0	2.0	4.5	2.0	2.0	4.5	2.0	2.0	4.5	
Lane Grp Cap (vph)	439	1337	1151	702	1420	606	750	1695	1321	356	1828	
v/s Ratio Prot	0.03	c0.25	0.12	0.14	0.22	c0.16	0.18	c0.43	0.03	c0.22	0.21	
v/s Ratio Perm			0.21			0.43			0.07			
v/c Ratio	0.23	0.94	0.79	0.98	0.80	1.53	1.23	1.28	0.22	2.15	0.74	
Uniform Delay, d1	52.9	48.7	34.6	57.8	45.2	41.6	57.4	45.0	20.9	60.5	43.7	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.1	12.7	3.6	29.1	3.7	248.3	114.2	131.0	0.0	525.0	1.9	
Delay (s)	53.0	61.4	38.2	87.0	48.9	290.0	171.6	176.0	20.9	585.5	45.6	
Level of Service	D	E	D	F	D	F	F	F	C	F	D	
Approach Delay (s)		51.3			143.4			158.9			239.3	
Approach LOS		D			F			F			F	

Intersection Summary

HCM 2000 Control Delay	147.4	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.44		
Actuated Cycle Length (s)	135.0	Sum of lost time (s)	21.5
Intersection Capacity Utilization	120.9%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 3: Dougherty Rd/Hopyard Road & I-580 WB Ramps

BART to Livermore Extension Project
 2040 Enhanced Bus PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↔		↔		↑↑↑			↑↑↑	↔
Traffic Volume (vph)	0	0	0	325	0	664	0	2533	0	0	1652	0
Future Volume (vph)	0	0	0	325	0	664	0	2533	0	0	1652	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0		4.0		4.0			4.0	
Lane Util. Factor				0.97		0.88		0.91			0.86	
Frt				1.00		0.85		1.00			1.00	
Flt Protected				0.95		1.00		1.00			1.00	
Satd. Flow (prot)				3433		2787		5085			4806	
Flt Permitted				0.95		1.00		1.00			1.00	
Satd. Flow (perm)				3433		2787		5085			4806	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	353	0	722	0	2753	0	0	1796	0
RTOR Reduction (vph)	0	0	0	0	0	17	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	353	0	705	0	2753	0	0	1796	0
Turn Type				Prot		Prot		NA			NA	Perm
Protected Phases				4		4		2			6	
Permitted Phases												6
Actuated Green, G (s)				30.5		30.5		68.7			68.7	
Effective Green, g (s)				31.9		31.9		70.1			70.1	
Actuated g/C Ratio				0.29		0.29		0.64			0.64	
Clearance Time (s)				5.4		5.4		5.4			5.4	
Vehicle Extension (s)				3.0		3.0		3.0			3.0	
Lane Grp Cap (vph)				995		808		3240			3062	
v/s Ratio Prot				0.10		c0.25		c0.54			0.37	
v/s Ratio Perm												
v/c Ratio				0.35		0.87		0.85			0.59	
Uniform Delay, d1				30.9		37.1		15.8			11.6	
Progression Factor				1.00		1.00		1.09			1.00	
Incremental Delay, d2				0.2		10.2		0.3			0.8	
Delay (s)				31.1		47.4		17.4			12.4	
Level of Service				C		D		B			B	
Approach Delay (s)		0.0			42.0			17.4			12.4	
Approach LOS		A			D			B			B	

Intersection Summary			
HCM 2000 Control Delay	20.5	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.86		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	78.8%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 4: Hopyard Rd/Dougherty Rd & I-580 EB Ramps

BART to Livermore Extension Project
 2040 Enhanced Bus PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗		↖↗					↑↑↑	↖		↑↑↑	↖
Traffic Volume (vph)	1160	0	972	0	0	0	0	2643	0	0	1309	0
Future Volume (vph)	1160	0	972	0	0	0	0	2643	0	0	1309	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0					4.0			4.0	
Lane Util. Factor	0.97		0.88					0.91			0.86	
Frt	1.00		0.85					1.00			1.00	
Flt Protected	0.95		1.00					1.00			1.00	
Satd. Flow (prot)	3433		2787					5085			4806	
Flt Permitted	0.95		1.00					1.00			1.00	
Satd. Flow (perm)	3433		2787					5085			4806	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	1261	0	1057	0	0	0	0	2873	0	0	1423	0
RTOR Reduction (vph)	0	0	41	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	1261	0	1016	0	0	0	0	2873	0	0	1423	0
Turn Type	Prot		Prot					NA	Free		NA	Perm
Protected Phases	4		4					2			6	
Permitted Phases									Free			6
Actuated Green, G (s)	38.6		38.6					60.6			60.6	
Effective Green, g (s)	40.0		40.0					62.0			62.0	
Actuated g/C Ratio	0.36		0.36					0.56			0.56	
Clearance Time (s)	5.4		5.4					5.4			5.4	
Vehicle Extension (s)	3.0		3.0					3.0			3.0	
Lane Grp Cap (vph)	1248		1013					2866			2708	
v/s Ratio Prot	c0.37		0.36					c0.56			0.30	
v/s Ratio Perm												
v/c Ratio	1.01		1.00					1.00			0.53	
Uniform Delay, d1	35.0		35.0					24.0			14.9	
Progression Factor	1.00		1.00					1.00			0.71	
Incremental Delay, d2	28.1		29.1					17.4			0.6	
Delay (s)	63.1		64.1					41.4			11.2	
Level of Service	E		E					D			B	
Approach Delay (s)		63.5			0.0			41.4			11.2	
Approach LOS		E			A			D			B	
























Intersection Summary

HCM 2000 Control Delay	42.6	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	1.01		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	90.8%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
5: Hopyard Rd & Owens Rd

BART to Livermore Extension Project
2040 Enhanced Bus PM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	389	275	252	524	293	362	244	983	301	482	1581	266
Future Volume (vph)	389	275	252	524	293	362	244	983	301	482	1581	266
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	2.7	2.7		2.7	2.7	2.7	4.0	2.3	2.3	4.0	2.3	
Lane Util. Factor	0.91	0.91		1.00	0.95	0.95	1.00	0.91	1.00	0.97	0.91	
Frt	1.00	0.95		1.00	0.96	0.85	1.00	1.00	0.85	1.00	0.98	
Flt Protected	0.95	0.99		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1610	3168		1770	1696	1504	1770	5085	1583	3433	4975	
Flt Permitted	0.95	0.99		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1610	3168		1770	1696	1504	1770	5085	1583	3433	4975	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	423	299	274	570	318	393	265	1068	327	524	1718	289
RTOR Reduction (vph)	0	57	0	0	11	24	0	0	231	0	19	0
Lane Group Flow (vph)	233	706	0	570	429	247	265	1068	96	524	1988	0
Turn Type	Split	NA		Split	NA	pm+ov	Prot	NA	Perm	Prot	NA	
Protected Phases	8	8		4	4	1	5	2		1	6	
Permitted Phases						4			2			
Actuated Green, G (s)	18.0	18.0		28.0	28.0	52.3	15.0	33.7	33.7	24.3	43.0	
Effective Green, g (s)	19.3	19.3		29.3	29.3	54.9	15.0	35.4	35.4	24.3	44.7	
Actuated g/C Ratio	0.16	0.16		0.24	0.24	0.46	0.12	0.29	0.29	0.20	0.37	
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	258	509		432	414	721	221	1500	466	695	1853	
v/s Ratio Prot	0.14	c0.22		c0.32	0.25	0.07	c0.15	0.21		0.15	c0.40	
v/s Ratio Perm						0.09			0.06			
v/c Ratio	0.90	1.39		1.32	1.04	0.34	1.20	0.71	0.21	0.75	1.07	
Uniform Delay, d1	49.4	50.4		45.4	45.4	20.9	52.5	37.8	31.8	45.0	37.6	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	31.6	186.0		159.3	53.7	0.3	124.8	2.9	1.0	4.6	43.5	
Delay (s)	81.1	236.3		204.6	99.0	21.2	177.3	40.7	32.8	49.7	81.1	
Level of Service	F	F		F	F	C	F	D	C	D	F	
Approach Delay (s)		200.0			129.6			60.9			74.6	
Approach LOS		F			F			E			E	

























Intersection Summary

HCM 2000 Control Delay	101.3	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.21		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	11.7
Intersection Capacity Utilization	110.3%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
6: Hopyard Rd & Stoneridge Dr

BART to Livermore Extension Project
2040 Enhanced Bus PM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	275	1175	694	119	1365	197	620	865	89	264	905	206
Future Volume (vph)	275	1175	694	119	1365	197	620	865	89	264	905	206
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.91	1.00	0.97	0.91	1.00	0.94	0.95	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5085	1583	3433	5085	1583	4990	3539	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5085	1583	3433	5085	1583	4990	3539	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	299	1277	754	129	1484	214	674	940	97	287	984	224
RTOR Reduction (vph)	0	0	158	0	0	155	0	0	68	0	0	126
Lane Group Flow (vph)	299	1277	596	129	1484	59	674	940	29	287	984	98
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8			2			6
Actuated Green, G (s)	5.0	18.6	18.6	3.2	16.8	16.8	6.0	18.0	18.0	5.0	17.0	17.0
Effective Green, g (s)	5.0	18.6	18.6	3.2	16.8	16.8	6.0	18.0	18.0	5.0	17.0	17.0
Actuated g/C Ratio	0.08	0.31	0.31	0.05	0.28	0.28	0.10	0.30	0.30	0.08	0.28	0.28
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	282	1555	484	180	1405	437	492	1047	468	282	1421	442
v/s Ratio Prot	c0.09	0.25		0.04	0.29		c0.14	c0.27		0.08	0.19	
v/s Ratio Perm			c0.38			0.04			0.02			0.06
v/c Ratio	1.06	0.82	1.23	0.72	1.06	0.14	1.37	0.90	0.06	1.02	0.69	0.22
Uniform Delay, d1	27.9	19.6	21.1	28.4	22.0	16.5	27.4	20.5	15.3	27.9	19.6	16.8
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	70.4	3.6	120.9	12.7	40.4	0.1	179.1	10.2	0.1	58.2	1.5	0.3
Delay (s)	98.3	23.2	142.0	41.1	62.4	16.7	206.5	30.7	15.4	86.1	21.0	17.1
Level of Service	F	C	F	D	E	B	F	C	B	F	C	B
Approach Delay (s)		71.3			55.5			99.1			32.9	
Approach LOS		E			E			F			C	

Intersection Summary		
HCM 2000 Control Delay	66.0	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	1.17	E
Actuated Cycle Length (s)	60.8	Sum of lost time (s)
Intersection Capacity Utilization	79.0%	16.0
Analysis Period (min)	15	ICU Level of Service
		D

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
7: Hopyard Rd & Las Positas Blvd

BART to Livermore Extension Project
2040 Enhanced Bus PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↕	↗	↖↗	↕	↗	↖↗	↕↖↗	↗	↖↗	↕↖↗	↗
Traffic Volume (vph)	102	260	486	599	421	50	380	1002	264	72	1514	74
Future Volume (vph)	102	260	486	599	421	50	380	1002	264	72	1514	74
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.95	1.00	0.97	0.95	1.00	0.97	0.91	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	3433	3539	1583	3433	5085	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	3433	3539	1583	3433	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	111	283	528	651	458	54	413	1089	287	78	1646	80
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	52
Lane Group Flow (vph)	111	283	528	651	458	54	413	1089	287	78	1646	28
Turn Type	Prot	NA	Free	Prot	NA	Free	Prot	NA	Free	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1		6
Permitted Phases			Free			Free			Free			6
Actuated Green, G (s)	4.8	13.0	87.9	17.0	25.2	87.9	11.0	37.9	87.9	4.0	30.9	30.9
Effective Green, g (s)	4.8	13.0	87.9	17.0	25.2	87.9	11.0	37.9	87.9	4.0	30.9	30.9
Actuated g/C Ratio	0.05	0.15	1.00	0.19	0.29	1.00	0.13	0.43	1.00	0.05	0.35	0.35
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	187	523	1583	663	1014	1583	429	2192	1583	156	1787	556
v/s Ratio Prot	0.03	c0.08		c0.19	0.13		c0.12	0.21		0.02	c0.32	
v/s Ratio Perm			0.33			0.03			0.18			0.02
v/c Ratio	0.59	0.54	0.33	0.98	0.45	0.03	0.96	0.50	0.18	0.50	0.92	0.05
Uniform Delay, d1	40.6	34.7	0.0	35.3	25.7	0.0	38.2	18.1	0.0	41.0	27.3	18.8
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	5.0	1.1	0.6	30.2	0.3	0.0	33.7	0.2	0.3	2.5	8.3	0.0
Delay (s)	45.6	35.8	0.6	65.5	26.0	0.0	71.9	18.3	0.3	43.5	35.6	18.9
Level of Service	D	D	A	E	C	A	E	B	A	D	D	B
Approach Delay (s)		16.8			46.9			27.8			35.2	
Approach LOS		B			D			C			D	

































Intersection Summary

HCM 2000 Control Delay	32.3	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.87		
Actuated Cycle Length (s)	87.9	Sum of lost time (s)	16.0
Intersection Capacity Utilization	77.7%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
8: Willow Rd & Owens Rd

BART to Livermore Extension Project
2040 Enhanced Bus PM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 	  		 	  			 		 		 
Traffic Volume (vph)	79	831	188	131	677	78	187	77	0	185	63	107
Future Volume (vph)	79	831	188	131	677	78	187	77	0	185	63	107
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	5.3	4.0		5.3	4.0	4.0
Lane Util. Factor	0.97	0.91		0.97	0.91	1.00	1.00	0.95		1.00	1.00	1.00
Frt	1.00	0.97		1.00	1.00	0.85	1.00	1.00		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	4945		3433	5085	1583	1770	3539		1770	1863	1583
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.71	1.00		0.70	1.00	1.00
Satd. Flow (perm)	3433	4945		3433	5085	1583	1328	3539		1303	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	86	903	204	142	736	85	203	84	0	201	68	116
RTOR Reduction (vph)	0	23	0	0	0	33	0	0	0	0	0	91
Lane Group Flow (vph)	86	1084	0	142	736	52	203	84	0	201	68	25
Turn Type	Prot	NA		Prot	NA	Perm	Perm	NA	Perm	Perm	NA	Perm
Protected Phases	1	6		5	2			4			8	
Permitted Phases						2	4		4	8		8
Actuated Green, G (s)	6.9	61.5		10.7	65.3	65.3	22.8	22.8		22.8	22.8	22.8
Effective Green, g (s)	6.9	63.2		10.7	67.0	67.0	22.8	24.1		22.8	24.1	24.1
Actuated g/C Ratio	0.06	0.57		0.10	0.61	0.61	0.21	0.22		0.21	0.22	0.22
Clearance Time (s)	4.0	5.7		4.0	5.7	5.7	5.3	5.3		5.3	5.3	5.3
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	215	2841		333	3097	964	275	775		270	408	346
v/s Ratio Prot	0.03	c0.22		c0.04	0.14			0.02			0.04	
v/s Ratio Perm						0.03	0.15			c0.15		0.02
v/c Ratio	0.40	0.38		0.43	0.24	0.05	0.74	0.11		0.74	0.17	0.07
Uniform Delay, d1	49.6	12.7		46.8	9.8	8.7	40.8	34.4		40.9	34.8	34.1
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	1.2	0.4		0.9	0.2	0.1	9.9	0.1		10.6	0.2	0.1
Delay (s)	50.8	13.1		47.6	10.0	8.8	50.7	34.4		51.5	35.0	34.2
Level of Service	D	B		D	B	A	D	C		D	D	C
Approach Delay (s)		15.9			15.5			45.9			43.4	
Approach LOS		B			B			D			D	
Intersection Summary												
HCM 2000 Control Delay			22.5	HCM 2000 Level of Service				C				
HCM 2000 Volume to Capacity ratio			0.47									
Actuated Cycle Length (s)			110.0	Sum of lost time (s)				12.0				
Intersection Capacity Utilization			51.0%	ICU Level of Service				A				
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis
9: Hacienda Dr & Dublin Blvd

BART to Livermore Extension Project
2040 Enhanced Bus PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↑↑↑	↖↗	↖↗	↑↑↑		↖↗	↑↑	↖↗	↖↗	↑↑↑	↖↗
Traffic Volume (vph)	52	1103	170	239	608	28	384	654	550	39	695	217
Future Volume (vph)	52	1103	170	239	608	28	384	654	550	39	695	217
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	6.0	5.0	4.5	6.0		5.0	6.0	6.0	4.5	5.5	5.5
Lane Util. Factor	0.97	0.91	0.88	0.97	0.91		0.94	0.95	0.88	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5085	2787	3433	5052		4990	3539	2787	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5085	2787	3433	5052		4990	3539	2787	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	57	1199	185	260	661	30	417	711	598	42	755	236
RTOR Reduction (vph)	0	0	61	0	4	0	0	0	197	0	0	160
Lane Group Flow (vph)	57	1199	124	260	687	0	417	711	401	42	755	76
Turn Type	Prot	NA	pm+ov	Prot	NA		Prot	NA	Perm	Prot	NA	Perm
Protected Phases	5	2	3	1	6		3	8		7		4
Permitted Phases			2						8			4
Actuated Green, G (s)	4.1	34.4	46.6	10.0	40.3		12.2	34.5	34.5	2.2	24.5	24.5
Effective Green, g (s)	4.1	34.4	46.6	10.0	40.3		12.2	34.5	34.5	2.2	24.5	24.5
Actuated g/C Ratio	0.04	0.34	0.46	0.10	0.39		0.12	0.34	0.34	0.02	0.24	0.24
Clearance Time (s)	4.5	6.0	5.0	4.5	6.0		5.0	6.0	6.0	4.5	5.5	5.5
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	137	1713	1408	336	1994		596	1195	941	73	1220	379
v/s Ratio Prot	0.02	c0.24	0.01	c0.08	0.14		c0.08	0.20		0.01	c0.15	
v/s Ratio Perm			0.03						0.14			0.05
v/c Ratio	0.42	0.70	0.09	0.77	0.34		0.70	0.59	0.43	0.58	0.62	0.20
Uniform Delay, d1	47.8	29.4	15.7	44.9	21.6		43.2	28.0	26.1	49.5	34.6	31.0
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	2.0	1.3	0.0	10.6	0.1		3.6	0.8	0.3	10.5	0.9	0.3
Delay (s)	49.9	30.6	15.7	55.5	21.8		46.8	28.8	26.5	60.0	35.6	31.3
Level of Service	D	C	B	E	C		D	C	C	E	D	C
Approach Delay (s)		29.5			31.0			32.3			35.6	
Approach LOS		C			C			C			D	

Intersection Summary

HCM 2000 Control Delay	31.9	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.68		
Actuated Cycle Length (s)	102.1	Sum of lost time (s)	21.0
Intersection Capacity Utilization	67.0%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 10: Hacienda Dr & Martinelli Blvd/Hacienda Crossings

BART to Livermore Extension Project
 2040 Enhanced Bus PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗	↘	↙	↘		↖	↗	↘	↙	↘	↙
Traffic Volume (vph)	31	53	479	286	40	22	531	1566	467	57	1015	87
Future Volume (vph)	31	53	479	286	40	22	531	1566	467	57	1015	87
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	2.0	2.0	4.5	2.0		3.0	2.0	2.0	4.5	2.5	
Lane Util. Factor	1.00	0.91	0.91	0.97	1.00		0.94	0.91	1.00	0.97	0.86	
Frt	1.00	0.93	0.85	1.00	0.95		1.00	1.00	0.85	1.00	0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1770	1575	2882	3433	1763		4990	5085	1583	3433	6332	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1770	1575	2882	3433	1763		4990	5085	1583	3433	6332	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	34	58	521	311	43	24	577	1702	508	62	1103	95
RTOR Reduction (vph)	0	37	266	0	18	0	0	0	162	0	10	0
Lane Group Flow (vph)	34	73	203	311	49	0	577	1702	346	62	1188	0
Turn Type	Prot	NA	Perm	Prot	NA		Prot	NA	pm+ov	Prot	NA	
Protected Phases	5	2		1	6		3	8	1	7	4	
Permitted Phases			2						8			
Actuated Green, G (s)	3.6	16.7	16.7	13.8	26.9		13.5	57.2	71.0	6.3	50.0	
Effective Green, g (s)	3.1	18.7	18.7	13.3	28.9		14.5	59.2	75.0	5.8	51.5	
Actuated g/C Ratio	0.03	0.17	0.17	0.12	0.26		0.13	0.54	0.68	0.05	0.47	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	4.0	4.0	2.0	4.0		3.0	4.0	2.0	3.0	4.0	
Lane Grp Cap (vph)	49	267	489	415	463		657	2736	1108	181	2964	
v/s Ratio Prot	0.02	0.05		c0.09	0.03		c0.12	c0.33	0.04	0.02	c0.19	
v/s Ratio Perm			c0.07						0.17			
v/c Ratio	0.69	0.27	0.42	0.75	0.11		0.88	0.62	0.31	0.34	0.40	
Uniform Delay, d1	53.0	39.7	40.8	46.7	30.8		46.9	17.6	7.1	50.3	19.2	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.02	1.05	1.92	1.00	1.00	
Incremental Delay, d2	34.8	0.8	0.8	6.4	0.1		8.8	0.7	0.0	1.1	0.4	
Delay (s)	87.8	40.5	41.6	53.1	30.9		56.8	19.2	13.7	51.4	19.6	
Level of Service	F	D	D	D	C		E	B	B	D	B	
Approach Delay (s)		43.9			49.2			26.0			21.1	
Approach LOS		D			D			C			C	

Intersection Summary

HCM 2000 Control Delay	28.7	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.61		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	13.0
Intersection Capacity Utilization	67.6%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 11: Hacienda Dr & I-580 WB Ramps

BART to Livermore Extension Project
 2040 Enhanced Bus PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↔↔		↔↔		↑↑↑			↑↑↑	↔
Traffic Volume (vph)	0	0	0	419	0	528	0	1776	812	0	939	798
Future Volume (vph)	0	0	0	419	0	528	0	1776	812	0	939	798
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				2.6		2.6		2.1			2.1	2.1
Lane Util. Factor				0.97		0.88		0.91			0.86	0.86
Frt				1.00		0.85		0.95			0.96	0.85
Flt Protected				0.95		1.00		1.00			1.00	1.00
Satd. Flow (prot)				3433		2787		4846			4591	1362
Flt Permitted				0.95		1.00		1.00			1.00	1.00
Satd. Flow (perm)				3433		2787		4846			4591	1362
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	455	0	574	0	1930	883	0	1021	867
RTOR Reduction (vph)	0	0	0	0	0	25	0	147	0	0	137	148
Lane Group Flow (vph)	0	0	0	455	0	549	0	2666	0	0	1318	285
Turn Type				Prot		Prot		NA			NA	Perm
Protected Phases				4		4		2			6	
Permitted Phases												6
Actuated Green, G (s)				12.7		12.7		34.3			34.3	34.3
Effective Green, g (s)				14.1		14.1		36.2			36.2	36.2
Actuated g/C Ratio				0.26		0.26		0.66			0.66	0.66
Clearance Time (s)				4.0		4.0		4.0			4.0	4.0
Vehicle Extension (s)				3.0		3.0		3.0			3.0	3.0
Lane Grp Cap (vph)				880		714		3189			3021	896
v/s Ratio Prot				0.13		c0.20		c0.55			0.29	
v/s Ratio Perm												0.21
v/c Ratio				0.52		0.77		0.84			0.44	0.32
Uniform Delay, d1				17.5		18.9		7.1			4.5	4.1
Progression Factor				1.00		1.00		0.84			0.59	1.25
Incremental Delay, d2				0.5		5.0		1.7			0.4	0.9
Delay (s)				18.0		23.9		7.7			3.1	6.0
Level of Service				B		C		A			A	A
Approach Delay (s)		0.0			21.3			7.7			3.7	
Approach LOS		A			C			A			A	

Intersection Summary			
HCM 2000 Control Delay	8.8	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.81		
Actuated Cycle Length (s)	55.0	Sum of lost time (s)	4.7
Intersection Capacity Utilization	77.6%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 12: Hacienda Dr & I-580 EB Ramps

BART to Livermore Extension Project
 2040 Enhanced Bus PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	900	0	466	0	0	0	0	1846	582	0	949	313
Future Volume (vph)	900	0	466	0	0	0	0	1846	582	0	949	313
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0					4.0	4.0		4.0	
Lane Util. Factor	0.97		0.88					0.86	0.86		0.91	
Frt	1.00		0.85					0.99	0.85		0.96	
Flt Protected	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (prot)	3433		2787					4742	1362		4896	
Flt Permitted	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (perm)	3433		2787					4742	1362		4896	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	978	0	507	0	0	0	0	2007	633	0	1032	340
RTOR Reduction (vph)	0	0	107	0	0	0	0	9	180	0	50	0
Lane Group Flow (vph)	978	0	400	0	0	0	0	2194	257	0	1322	0
Turn Type	Prot		Prot					NA	Perm		NA	
Protected Phases	4		4					2			6	
Permitted Phases									2			
Actuated Green, G (s)	35.9		35.9					62.8	62.8		62.8	
Effective Green, g (s)	37.3		37.3					64.7	64.7		64.7	
Actuated g/C Ratio	0.34		0.34					0.59	0.59		0.59	
Clearance Time (s)	5.4		5.4					5.9	5.9		5.9	
Vehicle Extension (s)	2.0		2.0					2.0	2.0		2.0	
Lane Grp Cap (vph)	1164		945					2789	801		2879	
v/s Ratio Prot	c0.28		0.14					c0.46			0.27	
v/s Ratio Perm									0.19			
v/c Ratio	0.84		0.42					0.79	0.32		0.46	
Uniform Delay, d1	33.6		28.0					17.4	11.5		12.8	
Progression Factor	1.00		1.00					1.00	1.00		0.71	
Incremental Delay, d2	5.4		0.1					2.3	1.1		0.5	
Delay (s)	39.0		28.2					19.7	12.6		9.5	
Level of Service	D		C					B	B		A	
Approach Delay (s)		35.3			0.0			18.5			9.5	
Approach LOS		D			A			B			A	





































Intersection Summary

HCM 2000 Control Delay	20.8	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.81		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	72.3%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
13: Hacienda Dr & Owens Rd

BART to Livermore Extension Project
2040 Enhanced Bus PM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 	  		 	  		 	  		 	  	
Traffic Volume (vph)	676	960	55	147	364	876	27	733	269	609	513	277
Future Volume (vph)	676	960	55	147	364	876	27	733	269	609	513	277
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	2.3	4.0	4.0	2.3	4.0	4.0	2.7	4.0	4.0	2.7
Lane Util. Factor	0.97	0.91	1.00	0.97	0.91	1.00	0.97	0.91	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5085	1583	3433	5085	1583	3433	5085	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5085	1583	3433	5085	1583	3433	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	735	1043	60	160	396	952	29	797	292	662	558	301
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	735	1043	60	160	396	952	29	797	292	662	558	301
Turn Type	Prot	NA	Free	Prot	NA	Free	Prot	NA	Free	Prot	NA	Free
Protected Phases	1	6		5	2		7	4		3	8	
Permitted Phases			Free			Free			Free			Free
Actuated Green, G (s)	33.5	38.6	115.0	9.4	14.5	115.0	2.4	24.0	115.0	24.0	45.6	115.0
Effective Green, g (s)	33.5	40.3	115.0	9.4	16.2	115.0	2.4	25.3	115.0	24.0	46.9	115.0
Actuated g/C Ratio	0.29	0.35	1.00	0.08	0.14	1.00	0.02	0.22	1.00	0.21	0.41	1.00
Clearance Time (s)	4.0	5.7		4.0	5.7		4.0	5.3		4.0	5.3	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	1000	1781	1583	280	716	1583	71	1118	1583	716	2073	1583
v/s Ratio Prot	c0.21	0.21		0.05	0.08		0.01	c0.16		c0.19	0.11	
v/s Ratio Perm			0.04			c0.60			0.18			0.19
v/c Ratio	0.73	0.59	0.04	0.57	0.55	0.60	0.41	0.71	0.18	0.92	0.27	0.19
Uniform Delay, d1	36.7	30.5	0.0	50.9	46.0	0.0	55.6	41.5	0.0	44.6	22.6	0.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	2.8	0.5	0.0	2.8	0.9	1.7	3.8	3.9	0.3	17.7	0.3	0.3
Delay (s)	39.6	31.0	0.0	53.7	47.0	1.7	59.4	45.4	0.3	62.3	23.0	0.3
Level of Service	D	C	A	D	D	A	E	D	A	E	C	A
Approach Delay (s)		33.4			19.1			34.0			35.6	
Approach LOS		C			B			C			D	
Intersection Summary												
HCM 2000 Control Delay			30.5				HCM 2000 Level of Service				C	
HCM 2000 Volume to Capacity ratio			0.79									
Actuated Cycle Length (s)			115.0				Sum of lost time (s)				16.0	
Intersection Capacity Utilization			71.2%				ICU Level of Service				C	
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis
 14: Tassajara Rd & Dublin Blvd

BART to Livermore Extension Project
 2040 Enhanced Bus PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	278	1105	462	287	367	25	397	924	647	41	803	151
Future Volume (vph)	278	1105	462	287	367	25	397	924	647	41	803	151
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	6.0	6.0	5.0	6.0		5.0	6.0	6.0	5.0	5.7	5.7
Lane Util. Factor	0.97	0.86	0.88	0.94	0.91		0.94	0.86	1.00	0.97	0.86	0.88
Frt	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	6408	2787	4990	5037		4990	6408	1583	3433	6408	2787
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	6408	2787	4990	5037		4990	6408	1583	3433	6408	2787
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	302	1201	502	312	399	27	432	1004	703	45	873	164
RTOR Reduction (vph)	0	0	281	0	5	0	0	0	227	0	0	130
Lane Group Flow (vph)	302	1201	221	312	421	0	432	1004	476	45	873	34
Turn Type	Prot	NA	Perm	Prot	NA		Prot	NA	Perm	Prot	NA	Perm
Protected Phases	5	2		1	6		3	8		7		4
Permitted Phases			2						8			4
Actuated Green, G (s)	16.4	41.2	41.2	16.4	41.2		31.7	48.9	48.9	11.2	28.7	28.7
Effective Green, g (s)	16.4	41.2	41.2	16.4	41.2		31.7	48.9	48.9	11.2	28.7	28.7
Actuated g/C Ratio	0.12	0.29	0.29	0.12	0.29		0.23	0.35	0.35	0.08	0.21	0.21
Clearance Time (s)	5.0	6.0	6.0	5.0	6.0		5.0	6.0	6.0	5.0	5.7	5.7
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	403	1889	821	585	1485		1132	2243	554	275	1316	572
v/s Ratio Prot	c0.09	c0.19		0.06	0.08		c0.09	0.16		0.01	0.14	
v/s Ratio Perm			0.08						c0.30			0.01
v/c Ratio	0.75	0.64	0.27	0.53	0.28		0.38	0.45	0.86	0.16	0.66	0.06
Uniform Delay, d1	59.7	42.7	37.7	58.0	37.9		45.7	35.0	42.2	59.9	51.1	44.6
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	7.5	0.7	0.2	0.9	0.1		0.2	0.1	12.6	0.3	1.3	0.0
Delay (s)	67.1	43.4	37.9	59.0	38.0		45.9	35.1	54.8	60.2	52.3	44.7
Level of Service	E	D	D	E	D		D	D	D	E	D	D
Approach Delay (s)		45.6			46.9			43.8			51.5	
Approach LOS		D			D			D			D	

Intersection Summary

HCM 2000 Control Delay	46.2	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.73		
Actuated Cycle Length (s)	139.7	Sum of lost time (s)	22.0
Intersection Capacity Utilization	82.7%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 15: Tassajara Rd & I-580 WB Ramps

BART to Livermore Extension Project
 2040 Enhanced Bus PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↔↔		↔↔		↑↑	↔		↑↑↔	↔
Traffic Volume (vph)	0	0	0	574	0	226	0	1663	726	0	1321	635
Future Volume (vph)	0	0	0	574	0	226	0	1663	726	0	1321	635
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0		4.0		4.0	4.0		4.0	4.0
Lane Util. Factor				0.97		0.88		0.95	1.00		0.86	0.86
Frt				1.00		0.85		1.00	0.85		0.98	0.85
Flt Protected				0.95		1.00		1.00	1.00		1.00	1.00
Satd. Flow (prot)				3433		2787		3539	1583		4712	1362
Flt Permitted				0.95		1.00		1.00	1.00		1.00	1.00
Satd. Flow (perm)				3433		2787		3539	1583		4712	1362
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	624	0	246	0	1808	789	0	1436	690
RTOR Reduction (vph)	0	0	0	0	0	18	0	0	321	0	31	194
Lane Group Flow (vph)	0	0	0	624	0	228	0	1808	468	0	1619	282
Turn Type				Perm		Perm		NA	Perm		NA	Perm
Protected Phases								2			6	
Permitted Phases				8		8			2			6
Actuated Green, G (s)				14.4		14.4		32.6	32.6		32.6	32.6
Effective Green, g (s)				14.4		14.4		32.6	32.6		32.6	32.6
Actuated g/C Ratio				0.26		0.26		0.59	0.59		0.59	0.59
Clearance Time (s)				4.0		4.0		4.0	4.0		4.0	4.0
Vehicle Extension (s)				3.0		3.0		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)				898		729		2097	938		2792	807
v/s Ratio Prot								c0.51			0.34	
v/s Ratio Perm				c0.18		0.08			0.30			0.21
v/c Ratio				0.69		0.31		0.86	0.50		0.58	0.35
Uniform Delay, d1				18.3		16.3		9.3	6.5		7.0	5.8
Progression Factor				1.00		1.00		1.00	1.00		1.00	1.00
Incremental Delay, d2				2.4		0.2		5.0	1.9		0.9	1.2
Delay (s)				20.7		16.6		14.3	8.4		7.8	6.9
Level of Service				C		B		B	A		A	A
Approach Delay (s)		0.0			19.5			12.5			7.6	
Approach LOS		A			B			B			A	

Intersection Summary			
HCM 2000 Control Delay	11.7	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.81		
Actuated Cycle Length (s)	55.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	69.0%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 16: Santa Rita Rd & I-580 EB Ramps/Pimilco Dr

BART to Livermore Extension Project
 2040 Enhanced Bus PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	435	82	257	141	0	317	0	1583	194	314	1132	0
Future Volume (vph)	435	82	257	141	0	317	0	1583	194	314	1132	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0		4.0		4.0		4.0	4.0	
Lane Util. Factor	0.97	1.00	1.00	0.97		0.88		0.86		1.00	0.95	
Frt	1.00	1.00	0.85	1.00		0.85		0.98		1.00	1.00	
Flt Protected	0.95	1.00	1.00	0.95		1.00		1.00		0.95	1.00	
Satd. Flow (prot)	3433	1863	1583	3433		2787		6303		1770	3539	
Flt Permitted	0.95	1.00	1.00	0.95		1.00		1.00		0.95	1.00	
Satd. Flow (perm)	3433	1863	1583	3433		2787		6303		1770	3539	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	473	89	279	153	0	345	0	1721	211	341	1230	0
RTOR Reduction (vph)	0	0	73	0	0	35	0	19	0	0	0	0
Lane Group Flow (vph)	473	89	206	153	0	310	0	1913	0	341	1230	0
Turn Type	Perm	NA	Perm	Prot		pm+ov		NA		Prot	NA	Perm
Protected Phases		4		3		1		2		1	6	
Permitted Phases	4		4			3						6
Actuated Green, G (s)	19.9	19.9	19.9	7.6		32.2		41.9		24.6	70.5	
Effective Green, g (s)	19.9	19.9	19.9	7.6		32.2		41.9		24.6	70.5	
Actuated g/C Ratio	0.18	0.18	0.18	0.07		0.29		0.38		0.22	0.64	
Clearance Time (s)	4.0	4.0	4.0	4.0		4.0		4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0		3.0		3.0		3.0	3.0	
Lane Grp Cap (vph)	621	337	286	237		815		2400		395	2268	
v/s Ratio Prot		0.05		c0.04		0.08		c0.30		c0.19	0.35	
v/s Ratio Perm	c0.14		0.13			0.03						
v/c Ratio	0.76	0.26	0.72	0.65		0.38		0.80		0.86	0.54	
Uniform Delay, d1	42.8	38.8	42.4	49.9		31.0		30.3		41.1	10.9	
Progression Factor	1.00	1.00	1.00	1.00		1.00		1.00		1.00	1.00	
Incremental Delay, d2	5.5	0.4	8.6	5.9		0.3		2.9		17.4	0.9	
Delay (s)	48.3	39.2	51.1	55.8		31.3		33.1		58.5	11.8	
Level of Service	D	D	D	E		C		C		E	B	
Approach Delay (s)		48.2			38.8			33.1			21.9	
Approach LOS		D			D			C			C	































Intersection Summary

HCM 2000 Control Delay	32.7	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.79		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	66.0%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 17: Santa Rita Rd & Valley Ave

BART to Livermore Extension Project
 2040 Enhanced Bus PM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 	 			 		 	 		 	 	
Traffic Volume (vph)	366	715	121	135	373	793	144	630	157	1392	1071	271
Future Volume (vph)	366	715	121	135	373	793	144	630	157	1392	1071	271
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.97	0.95		0.97	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.97		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	3433	3433		3433	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	3433	3433		3433	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	398	777	132	147	405	862	157	685	171	1513	1164	295
RTOR Reduction (vph)	0	0	96	0	0	0	0	18	0	0	0	129
Lane Group Flow (vph)	398	777	36	147	405	862	157	838	0	1513	1164	166
Turn Type	Prot	NA	Perm	Prot	NA	Free	Prot	NA		Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			Free						6
Actuated Green, G (s)	14.0	22.0	22.0	8.0	16.0	120.0	9.5	30.0		44.0	64.5	64.5
Effective Green, g (s)	14.0	22.0	22.0	8.0	16.0	120.0	9.5	30.0		44.0	64.5	64.5
Actuated g/C Ratio	0.12	0.18	0.18	0.07	0.13	1.00	0.08	0.25		0.37	0.54	0.54
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	400	648	290	118	471	1583	271	858		1258	1902	850
v/s Ratio Prot	c0.12	c0.22		c0.08	0.11		0.05	c0.24		c0.44	0.33	
v/s Ratio Perm			0.02			0.54						0.11
v/c Ratio	0.99	1.20	0.12	1.25	0.86	0.54	0.58	0.98		1.20	0.61	0.20
Uniform Delay, d1	53.0	49.0	40.9	56.0	50.9	0.0	53.3	44.7		38.0	19.1	14.3
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	43.4	104.0	0.2	163.0	14.5	1.4	3.0	24.8		99.0	0.6	0.1
Delay (s)	96.4	153.0	41.1	219.0	65.4	1.4	56.3	69.5		137.0	19.7	14.5
Level of Service	F	F	D	F	E	A	E	E		F	B	B
Approach Delay (s)		124.5			42.3			67.5			78.9	
Approach LOS		F			D			E			E	
Intersection Summary												
HCM 2000 Control Delay			78.3			HCM 2000 Level of Service				E		
HCM 2000 Volume to Capacity ratio			1.14									
Actuated Cycle Length (s)			120.0			Sum of lost time (s)			16.0			
Intersection Capacity Utilization			102.7%			ICU Level of Service			G			
Analysis Period (min)			15									

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 18: Bernal Ave/Valley Ave & Stanley Blvd

BART to Livermore Extension Project
 2040 Enhanced Bus PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↑↑	↖	↖↗	↑↑	↖	↖	↑↑	↖	↖↗	↑↑	↖↗
Traffic Volume (vph)	228	837	59	93	235	350	95	364	302	823	551	132
Future Volume (vph)	228	837	59	93	235	350	95	364	302	823	551	132
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.95	1.00	0.97	0.91	0.91	1.00	0.95	1.00	0.97	0.95	0.95
Frt	1.00	1.00	0.85	1.00	0.94	0.85	1.00	1.00	0.85	1.00	0.97	0.97
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	3433	3178	1441	1770	3539	1583	3433	3437	3437
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	3433	3178	1441	1770	3539	1583	3433	3437	3437
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	248	910	64	101	255	380	103	396	328	895	599	143
RTOR Reduction (vph)	0	0	39	0	126	53	0	0	169	0	22	0
Lane Group Flow (vph)	248	910	25	101	311	145	103	396	159	895	720	0
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	NA
Protected Phases	7	4	5	3	8	1	5	2		1	6	
Permitted Phases			4			8			2			
Actuated Green, G (s)	10.2	25.6	33.3	3.0	18.4	43.7	7.7	15.5	15.5	25.3	33.1	
Effective Green, g (s)	10.2	25.6	33.3	3.0	18.4	43.7	7.7	15.5	15.5	25.3	33.1	
Actuated g/C Ratio	0.12	0.30	0.39	0.04	0.22	0.51	0.09	0.18	0.18	0.30	0.39	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	410	1060	691	120	684	804	159	642	287	1017	1332	
v/s Ratio Prot	c0.07	c0.26	0.00	0.03	0.10	0.05	0.06	0.11		c0.26	c0.21	
v/s Ratio Perm			0.01			0.05			0.10			
v/c Ratio	0.60	0.86	0.04	0.84	0.45	0.18	0.65	0.62	0.56	0.88	0.54	
Uniform Delay, d1	35.7	28.2	16.1	41.0	29.1	11.2	37.5	32.2	31.8	28.6	20.3	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	2.5	7.0	0.0	38.5	0.5	0.1	8.8	1.8	2.3	9.0	0.5	
Delay (s)	38.2	35.2	16.1	79.5	29.6	11.3	46.3	34.0	34.1	37.6	20.7	
Level of Service	D	D	B	E	C	B	D	C	C	D	C	
Approach Delay (s)		34.8			31.5			35.6			29.9	
Approach LOS		C			C			D			C	

Intersection Summary		
HCM 2000 Control Delay	32.6	HCM 2000 Level of Service C
HCM 2000 Volume to Capacity ratio	0.82	
Actuated Cycle Length (s)	85.4	Sum of lost time (s) 16.0
Intersection Capacity Utilization	75.3%	ICU Level of Service D
Analysis Period (min)	15	

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 19: Fallon Rd & Dublin Blvd/Croak Rd

BART to Livermore Extension Project
 2040 Enhanced Bus PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↑↑↑	↖↗	↖↗↘	↑↑↑	↖	↖↗↘	↑↑↑	↖↗	↖↗	↑↑↑	↖
Traffic Volume (vph)	219	947	431	83	30	95	245	809	334	187	652	29
Future Volume (vph)	219	947	431	83	30	95	245	809	334	187	652	29
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.91	0.88	0.94	0.91	1.00	0.94	0.91	0.88	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5085	2787	4990	5085	1583	4990	5085	2787	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5085	2787	4990	5085	1583	4990	5085	2787	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	238	1029	468	90	33	103	266	879	363	203	709	32
RTOR Reduction (vph)	0	0	68	0	0	91	0	0	169	0	0	22
Lane Group Flow (vph)	238	1029	400	90	33	12	266	879	194	203	709	10
Turn Type	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4	5	3	8		5	2		1	6	
Permitted Phases			4			8			2			6
Actuated Green, G (s)	19.3	25.7	35.8	3.2	9.6	9.6	10.1	28.7	28.7	6.4	25.0	25.0
Effective Green, g (s)	19.3	25.7	35.8	3.2	9.6	9.6	10.1	28.7	28.7	6.4	25.0	25.0
Actuated g/C Ratio	0.24	0.32	0.45	0.04	0.12	0.12	0.13	0.36	0.36	0.08	0.31	0.31
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	828	1633	1386	199	610	189	629	1824	999	274	1589	494
v/s Ratio Prot	0.07	c0.20	0.04	c0.02	0.01		0.05	c0.17		c0.06	0.14	
v/s Ratio Perm			0.11			0.01			0.07			0.01
v/c Ratio	0.29	0.63	0.29	0.45	0.05	0.07	0.42	0.48	0.19	0.74	0.45	0.02
Uniform Delay, d1	24.7	23.1	14.0	37.5	31.2	31.2	32.3	19.9	17.7	36.0	22.0	19.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.13	0.92	0.98	1.00	1.00	1.00
Incremental Delay, d2	0.2	0.8	0.1	1.6	0.0	0.1	0.4	0.8	0.4	10.3	0.9	0.1
Delay (s)	24.9	23.9	14.1	39.2	31.2	31.4	37.0	19.1	17.7	46.3	22.9	19.1
Level of Service	C	C	B	D	C	C	D	B	B	D	C	B
Approach Delay (s)		21.4			34.5			21.9			27.8	
Approach LOS		C			C			C			C	

Intersection Summary

HCM 2000 Control Delay	23.6	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.57		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	54.6%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
20: El Charro Rd/Fallon Rd & I-580 WB Ramps

BART to Livermore Extension Project
2040 Enhanced Bus PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↙	↖	↗		↑↑↑	↗		↑↑↑	↗
Traffic Volume (vph)	0	0	0	629	0	544	0	931	245	0	852	404
Future Volume (vph)	0	0	0	629	0	544	0	931	245	0	852	404
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0	4.0	4.0		4.0	4.0		4.0	4.0
Lane Util. Factor				0.95	0.95	0.88		0.91	1.00		0.91	1.00
Frt				1.00	1.00	0.85		1.00	0.85		1.00	0.85
Flt Protected				0.95	0.95	1.00		1.00	1.00		1.00	1.00
Satd. Flow (prot)				1681	1681	2787		5085	1583		5085	1583
Flt Permitted				0.95	0.95	1.00		1.00	1.00		1.00	1.00
Satd. Flow (perm)				1681	1681	2787		5085	1583		5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	684	0	591	0	1012	266	0	926	439
RTOR Reduction (vph)	0	0	0	0	0	33	0	0	144	0	0	237
Lane Group Flow (vph)	0	0	0	349	335	558	0	1012	122	0	926	202
Turn Type				Perm	NA	Perm		NA	Perm		NA	Perm
Protected Phases					8			2			6	
Permitted Phases				8		8			2			6
Actuated Green, G (s)				14.1	14.1	14.1		18.4	18.4		18.4	18.4
Effective Green, g (s)				13.6	13.6	13.6		18.4	18.4		18.4	18.4
Actuated g/C Ratio				0.34	0.34	0.34		0.46	0.46		0.46	0.46
Clearance Time (s)				3.5	3.5	3.5		4.0	4.0		4.0	4.0
Vehicle Extension (s)				2.0	2.0	2.0		2.0	2.0		2.0	2.0
Lane Grp Cap (vph)				571	571	947		2339	728		2339	728
v/s Ratio Prot								c0.20			0.18	
v/s Ratio Perm				c0.21	0.20	0.20			0.08			0.13
v/c Ratio				0.61	0.59	0.59		0.43	0.17		0.40	0.28
Uniform Delay, d1				11.0	10.9	10.9		7.3	6.3		7.1	6.7
Progression Factor				1.00	1.00	1.00		1.00	1.00		1.07	3.65
Incremental Delay, d2				1.4	1.0	0.6		0.6	0.5		0.5	0.9
Delay (s)				12.4	11.9	11.5		7.9	6.8		8.1	25.3
Level of Service				B	B	B		A	A		A	C
Approach Delay (s)		0.0			11.8			7.6			13.6	
Approach LOS		A			B			A			B	

Intersection Summary

HCM 2000 Control Delay	11.1	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.51		
Actuated Cycle Length (s)	40.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	49.1%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 21: El Charro Rd & I-580 EB Ramps

BART to Livermore Extension Project
 2040 Enhanced Bus PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	335	0	470	0	0	0	0	1547	281	0	1541	0
Future Volume (vph)	335	0	470	0	0	0	0	1547	281	0	1541	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0					4.0	4.0		4.0	
Lane Util. Factor	0.97		0.88					0.91	0.91		0.91	
Frt	1.00		0.85					1.00	0.85		1.00	
Flt Protected	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (prot)	3433		2787					3379	1441		3390	
Flt Permitted	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (perm)	3433		2787					3379	1441		3390	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	364	0	511	0	0	0	0	1682	305	0	1675	0
RTOR Reduction (vph)	0	0	44	0	0	0	0	2	95	0	0	0
Lane Group Flow (vph)	364	0	467	0	0	0	0	1717	173	0	1675	0
Turn Type	Prot		Perm					NA	Perm		NA	Perm
Protected Phases	4							2			6	
Permitted Phases			4						2			6
Actuated Green, G (s)	11.4		11.4					35.6	35.6		35.6	
Effective Green, g (s)	11.4		11.4					35.6	35.6		35.6	
Actuated g/C Ratio	0.21		0.21					0.65	0.65		0.65	
Clearance Time (s)	4.0		4.0					4.0	4.0		4.0	
Vehicle Extension (s)	2.0		2.0					3.0	3.0		3.0	
Lane Grp Cap (vph)	711		577					2187	932		2194	
v/s Ratio Prot	0.11							c0.51			0.49	
v/s Ratio Perm			c0.17						0.12			
v/c Ratio	0.51		0.81					0.78	0.19		0.76	
Uniform Delay, d1	19.3		20.8					7.0	3.9		6.8	
Progression Factor	1.00		1.00					1.00	1.00		1.00	
Incremental Delay, d2	0.3		8.0					2.9	0.4		2.6	
Delay (s)	19.6		28.8					9.9	4.3		9.3	
Level of Service	B		C					A	A		A	
Approach Delay (s)		25.0			0.0			9.1			9.3	
Approach LOS		C			A			A			A	

Intersection Summary

HCM 2000 Control Delay	12.3	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.79		
Actuated Cycle Length (s)	55.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	65.7%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 22: El Charro Rd & Stoneridge Dr/Jack London Blvd

BART to Livermore Extension Project
 2040 Enhanced Bus PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔↔↔	↑↑	↗	↖	↑↑	↗↗	↖	↑↑		↖↖↖	↑	↗↗
Traffic Volume (vph)	187	595	59	99	322	650	17	476	56	781	422	72
Future Volume (vph)	187	595	59	99	322	650	17	476	56	781	422	72
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	0.94	0.95	1.00	1.00	0.95	0.88	1.00	0.95		0.94	1.00	0.88
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.98		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	4491	3185	1425	1593	3185	2508	1593	3135		4491	1676	2508
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	4491	3185	1425	1593	3185	2508	1593	3135		4491	1676	2508
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	203	647	64	108	350	707	18	517	61	849	459	78
RTOR Reduction (vph)	0	0	49	0	0	84	0	14	0	0	0	44
Lane Group Flow (vph)	203	647	15	108	350	623	18	564	0	849	459	34
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Prot	NA		Prot	NA	Perm
Protected Phases	7	4		3	8	1	5	2		1	6	
Permitted Phases			4			8						6
Actuated Green, G (s)	6.0	15.4	15.4	5.0	14.4	29.7	0.8	14.9		15.3	29.4	29.4
Effective Green, g (s)	6.0	15.4	15.4	5.0	14.4	29.7	0.8	14.9		15.3	29.4	29.4
Actuated g/C Ratio	0.09	0.23	0.23	0.08	0.22	0.45	0.01	0.22		0.23	0.44	0.44
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	404	736	329	119	688	1118	19	701		1031	739	1107
v/s Ratio Prot	0.05	c0.20		c0.07	0.11	0.13	0.01	c0.18		c0.19	0.27	
v/s Ratio Perm			0.01			0.12						0.01
v/c Ratio	0.50	0.88	0.04	0.91	0.51	0.56	0.95	0.80		0.82	0.62	0.03
Uniform Delay, d1	28.9	24.7	19.9	30.6	23.0	13.6	32.9	24.5		24.4	14.3	10.5
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	1.0	11.6	0.1	54.2	0.6	0.6	179.6	6.7		5.4	1.6	0.0
Delay (s)	29.9	36.3	19.9	84.8	23.6	14.2	212.5	31.2		29.8	15.9	10.5
Level of Service	C	D	B	F	C	B	F	C		C	B	B
Approach Delay (s)		33.7			23.6			36.6			24.1	
Approach LOS		C			C			D			C	

Intersection Summary

HCM 2000 Control Delay	28.0	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.84		
Actuated Cycle Length (s)	66.6	Sum of lost time (s)	16.0
Intersection Capacity Utilization	70.8%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 23: Stanley Blvd & El Charro Rd



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	↙	↑↑	↑↑↑	↘	↙↘	↘↘
Traffic Volume (vph)	429	2673	780	12	175	398
Future Volume (vph)	429	2673	780	12	175	398
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95	0.91	1.00	0.97	0.88
Frt	1.00	1.00	1.00	0.85	1.00	0.85
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1770	3539	5085	1583	3433	2787
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1770	3539	5085	1583	3433	2787
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	466	2905	848	13	190	433
RTOR Reduction (vph)	0	0	0	7	0	388
Lane Group Flow (vph)	466	2905	848	6	190	45
Turn Type	Prot	NA	NA	Perm	Prot	Perm
Protected Phases	7	4	8		6	
Permitted Phases				8		6
Actuated Green, G (s)	35.5	96.1	56.6	56.6	12.0	12.0
Effective Green, g (s)	35.5	96.1	56.6	56.6	12.0	12.0
Actuated g/C Ratio	0.31	0.83	0.49	0.49	0.10	0.10
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	541	2929	2478	771	354	288
v/s Ratio Prot	0.26	c0.82	0.17		c0.06	
v/s Ratio Perm				0.00		0.02
v/c Ratio	0.86	0.99	0.34	0.01	0.54	0.16
Uniform Delay, d1	38.0	9.6	18.3	15.3	49.4	47.4
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	13.2	14.7	0.1	0.0	1.6	0.3
Delay (s)	51.2	24.3	18.4	15.3	51.0	47.7
Level of Service	D	C	B	B	D	D
Approach Delay (s)		28.0	18.3		48.7	
Approach LOS		C	B		D	

Intersection Summary

HCM 2000 Control Delay	29.0	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.98		
Actuated Cycle Length (s)	116.1	Sum of lost time (s)	12.0
Intersection Capacity Utilization	85.5%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
24: Airway Blvd/Driveway & N Canyons Pkwy

BART to Livermore Extension Project
2040 Enhanced Bus PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑	↑	↑↑	↑	↑		↑	↑↑		↑	
Traffic Volume (vph)	0	861	547	977	85	0	53	0	748	0	0	0
Future Volume (vph)	0	861	547	977	85	0	53	0	748	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		2.0	2.0	2.0	2.0			4.2	2.0			
Lane Util. Factor		0.95	1.00	0.97	1.00			1.00	0.88			
Frt		1.00	0.85	1.00	1.00			1.00	0.85			
Flt Protected		1.00	1.00	0.95	1.00			0.95	1.00			
Satd. Flow (prot)		3539	1583	3433	1863			1770	2787			
Flt Permitted		1.00	1.00	0.95	1.00			0.95	1.00			
Satd. Flow (perm)		3539	1583	3433	1863			1770	2787			
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	936	595	1062	92	0	58	0	813	0	0	0
RTOR Reduction (vph)	0	0	245	0	0	0	0	0	477	0	0	0
Lane Group Flow (vph)	0	936	350	1062	92	0	0	58	336	0	0	0
Turn Type		NA	Perm	Prot	NA	Perm	Split	NA	pm+ov			
Protected Phases		2		1	6		8	8	1	4	4	
Permitted Phases			2			6			8			
Actuated Green, G (s)		62.4	62.4	34.4	100.8			11.2	45.6			
Effective Green, g (s)		64.4	64.4	36.4	102.8			11.0	49.6			
Actuated g/C Ratio		0.54	0.54	0.30	0.86			0.09	0.41			
Clearance Time (s)		4.0	4.0	4.0	4.0			4.0	4.0			
Vehicle Extension (s)		3.0	3.0	3.0	3.0			3.0	3.0			
Lane Grp Cap (vph)		1899	849	1041	1595			162	1198			
v/s Ratio Prot		c0.26		c0.31	0.05			0.03	c0.09			
v/s Ratio Perm			0.22						0.04			
v/c Ratio		0.49	0.41	1.02	0.06			0.36	0.28			
Uniform Delay, d1		17.5	16.5	41.8	1.3			51.2	23.4			
Progression Factor		1.00	1.00	1.00	1.00			1.00	1.00			
Incremental Delay, d2		0.9	1.5	33.1	0.1			1.4	0.1			
Delay (s)		18.4	18.0	74.9	1.4			52.5	23.5			
Level of Service		B	B	E	A			D	C			
Approach Delay (s)		18.3			69.0			25.4			0.0	
Approach LOS		B			E			C			A	

Intersection Summary

HCM 2000 Control Delay	36.5	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.67		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	12.2
Intersection Capacity Utilization	68.4%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
25: Airway Blvd & I-580 WB Ramps

BART to Livermore Extension Project
2040 Enhanced Bus PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↙	↖	↗		↑↑	↗		↑↑↑	
Traffic Volume (vph)	0	0	0	129	35	178	0	689	384	0	913	712
Future Volume (vph)	0	0	0	129	35	178	0	689	384	0	913	712
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0	4.0	4.0		4.0	4.0		4.0	
Lane Util. Factor				0.95	0.95	0.88		0.95	1.00		0.91	
Frt				1.00	1.00	0.85		1.00	0.85		0.93	
Flt Protected				0.95	0.97	1.00		1.00	1.00		1.00	
Satd. Flow (prot)				1681	1715	2787		3539	1583		4751	
Flt Permitted				0.95	0.97	1.00		1.00	1.00		1.00	
Satd. Flow (perm)				1681	1715	2787		3539	1583		4751	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	140	38	193	0	749	417	0	992	774
RTOR Reduction (vph)	0	0	0	0	0	162	0	0	118	0	181	0
Lane Group Flow (vph)	0	0	0	74	104	31	0	749	299	0	1585	0
Turn Type				Split	NA	Perm		NA	Perm		NA	
Protected Phases				8	8			2			6	
Permitted Phases						8			2			
Actuated Green, G (s)				10.4	10.4	10.4		45.3	45.3		45.3	
Effective Green, g (s)				10.4	10.4	10.4		46.6	46.6		46.6	
Actuated g/C Ratio				0.16	0.16	0.16		0.72	0.72		0.72	
Clearance Time (s)				4.0	4.0	4.0		5.3	5.3		5.3	
Vehicle Extension (s)				2.0	2.0	2.0		4.0	4.0		4.0	
Lane Grp Cap (vph)				268	274	445		2537	1134		3406	
v/s Ratio Prot				0.04	c0.06			0.21			c0.33	
v/s Ratio Perm						0.01			0.19			
v/c Ratio				0.28	0.38	0.07		0.30	0.26		0.47	
Uniform Delay, d1				24.0	24.4	23.2		3.3	3.2		3.9	
Progression Factor				1.00	1.00	1.00		0.38	0.25		1.00	
Incremental Delay, d2				0.2	0.3	0.0		0.3	0.5		0.5	
Delay (s)				24.2	24.7	23.2		1.5	1.3		4.4	
Level of Service				C	C	C		A	A		A	
Approach Delay (s)		0.0			23.8			1.4			4.4	
Approach LOS		A			C			A			A	

Intersection Summary

HCM 2000 Control Delay	5.5	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.45		
Actuated Cycle Length (s)	65.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	48.6%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 26: Airway Blvd & I-580 EB Ramps/Kitty Hawk Rd

BART to Livermore Extension Project
 2040 Enhanced Bus PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔↔	↑	↔	↔	↑	↔	↔	↕↔		↔	↕↔	
Traffic Volume (vph)	569	186	348	64	94	124	53	454	156	125	390	478
Future Volume (vph)	569	186	348	64	94	124	53	454	156	125	390	478
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.4	4.4	4.4	4.5	2.7		4.0	2.7	
Lane Util. Factor	0.97	1.00	1.00	1.00	1.00	1.00	1.00	0.95		1.00	0.95	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.96		1.00	0.92	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	3433	1863	1583	1770	1863	1583	1770	3403		1770	3247	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	3433	1863	1583	1770	1863	1583	1770	3403		1770	3247	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	618	202	378	70	102	135	58	493	170	136	424	520
RTOR Reduction (vph)	0	0	291	0	0	80	0	22	0	0	153	0
Lane Group Flow (vph)	618	202	87	70	102	55	58	641	0	136	791	0
Turn Type	Split	NA	Perm	Split	NA	pm+ov	Prot	NA		Prot	NA	
Protected Phases	7	7		8	8	1	5	2		1	6	
Permitted Phases			7			8						
Actuated Green, G (s)	29.8	29.8	29.8	14.4	14.4	28.7	10.5	55.5		14.3	59.3	
Effective Green, g (s)	29.8	29.8	29.8	14.0	14.0	27.9	10.0	56.8		14.3	60.6	
Actuated g/C Ratio	0.23	0.23	0.23	0.11	0.11	0.21	0.08	0.44		0.11	0.47	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Vehicle Extension (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	3.5		2.0	4.0	
Lane Grp Cap (vph)	786	427	362	190	200	393	136	1486		194	1513	
v/s Ratio Prot	c0.18	0.11		0.04	c0.05	0.01	0.03	c0.19		c0.08	c0.24	
v/s Ratio Perm			0.05			0.02						
v/c Ratio	0.79	0.47	0.24	0.37	0.51	0.14	0.43	0.43		0.70	0.52	
Uniform Delay, d1	47.1	43.3	40.9	53.9	54.8	41.3	57.3	25.4		55.8	24.5	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		0.98	1.10	
Incremental Delay, d2	4.8	0.3	0.1	0.4	0.9	0.1	0.8	0.9		8.1	1.2	
Delay (s)	51.9	43.6	41.0	54.3	55.7	41.4	58.0	26.3		62.9	28.0	
Level of Service	D	D	D	D	E	D	E	C		E	C	
Approach Delay (s)		47.1			49.1			28.9			32.4	
Approach LOS		D			D			C			C	

Intersection Summary

HCM 2000 Control Delay	38.5	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.61		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	15.6
Intersection Capacity Utilization	71.5%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
27: Collier Canyon Rd & N Canyons Pkwy/Portola Ave

BART to Livermore Extension Project
2040 Enhanced Bus PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↖↖	↖↗	↖↗	↖↖	↖↗	↖↗	↖↖		↖↗	↖↖	↖↗
Traffic Volume (vph)	428	850	194	39	205	12	58	5	191	132	14	188
Future Volume (vph)	428	850	194	39	205	12	58	5	191	132	14	188
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	2.7	2.7	4.0	2.7	2.7	4.0	3.0		4.0	4.6	4.6
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.85		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	1770	1590		1770	1863	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	1770	1590		1770	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	465	924	211	42	223	13	63	5	208	143	15	204
RTOR Reduction (vph)	0	0	121	0	0	9	0	160	0	0	0	151
Lane Group Flow (vph)	465	924	90	42	223	4	63	53	0	143	15	53
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA		Prot	NA	Perm
Protected Phases	1	6		5	2		3	8		7		4
Permitted Phases			6			2						4
Actuated Green, G (s)	14.4	30.2	30.2	3.2	19.0	19.0	4.7	14.5		10.1	19.9	19.9
Effective Green, g (s)	14.4	31.5	31.5	3.2	20.3	20.3	4.7	15.5		10.1	19.3	19.3
Actuated g/C Ratio	0.19	0.43	0.43	0.04	0.27	0.27	0.06	0.21		0.14	0.26	0.26
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	668	1506	673	76	970	434	112	333		241	485	412
v/s Ratio Prot	c0.14	c0.26		0.02	0.06		0.04	c0.03		c0.08	0.01	
v/s Ratio Perm			0.06			0.00						0.03
v/c Ratio	0.70	0.61	0.13	0.55	0.23	0.01	0.56	0.16		0.59	0.03	0.13
Uniform Delay, d1	27.8	16.5	12.9	34.7	20.8	19.5	33.7	23.9		30.0	20.4	20.9
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	3.2	0.7	0.1	8.4	0.1	0.0	6.3	0.2		3.9	0.0	0.1
Delay (s)	30.9	17.3	13.0	43.1	20.9	19.5	40.0	24.2		33.9	20.4	21.1
Level of Service	C	B	B	D	C	B	D	C		C	C	C
Approach Delay (s)		20.7			24.2			27.8			26.1	
Approach LOS		C			C			C			C	

Intersection Summary

HCM 2000 Control Delay	22.6	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.55		
Actuated Cycle Length (s)	74.0	Sum of lost time (s)	15.3
Intersection Capacity Utilization	59.6%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
28: Isabel Ave/Campus Hill Dr & Portola Ave

BART to Livermore Extension Project
2040 Enhanced Bus PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↘	↗	↖	↘↗	↖↗		↘↗	↖↗	↘	↖	↗	↘↗
Traffic Volume (vph)	3	718	467	378	135	121	177	399	167	130	225	1
Future Volume (vph)	3	718	467	378	135	121	177	399	167	130	225	1
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	5.8	5.8
Lane Util. Factor	1.00	0.95	0.88	0.94	0.95		0.97	0.95	1.00	1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	0.93		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3539	2787	4990	3288		3433	3539	1583	1770	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	3539	2787	4990	3288		3433	3539	1583	1770	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	3	780	508	411	147	132	192	434	182	141	245	1
RTOR Reduction (vph)	0	0	319	0	71	0	0	0	144	0	0	1
Lane Group Flow (vph)	3	780	189	411	208	0	192	434	38	141	245	0
Turn Type	Prot	NA	Perm	Prot	NA		Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4						2			6
Actuated Green, G (s)	1.5	31.2	31.2	9.2	38.9		9.2	17.0	17.0	11.4	19.6	19.6
Effective Green, g (s)	1.5	32.5	32.5	9.2	40.2		9.2	18.3	18.3	11.4	18.7	18.7
Actuated g/C Ratio	0.02	0.37	0.37	0.11	0.46		0.11	0.21	0.21	0.13	0.21	0.21
Clearance Time (s)	4.0	5.3	5.3	4.0	5.3		4.0	5.3	5.3	4.0	4.9	4.9
Vehicle Extension (s)	2.0	3.0	3.0	2.0	3.0		2.0	3.0	3.0	2.0	3.0	3.0
Lane Grp Cap (vph)	30	1315	1036	525	1512		361	741	331	230	757	338
v/s Ratio Prot	0.00	c0.22		c0.08	0.06		0.06	c0.12		c0.08	0.07	
v/s Ratio Perm			0.07						0.02			0.00
v/c Ratio	0.10	0.59	0.18	0.78	0.14		0.53	0.59	0.12	0.61	0.32	0.00
Uniform Delay, d1	42.3	22.1	18.5	38.1	13.6		37.1	31.1	28.0	35.9	29.0	27.0
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.5	0.7	0.1	6.9	0.0		0.8	1.2	0.2	3.4	0.3	0.0
Delay (s)	42.8	22.8	18.6	45.1	13.6		37.8	32.3	28.1	39.3	29.3	27.0
Level of Service	D	C	B	D	B		D	C	C	D	C	C
Approach Delay (s)		21.2			32.4			32.7			32.9	
Approach LOS		C			C			C			C	

Intersection Summary		
HCM 2000 Control Delay	28.0	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.63	C
Actuated Cycle Length (s)	87.4	Sum of lost time (s)
Intersection Capacity Utilization	59.7%	17.8
Analysis Period (min)	15	ICU Level of Service
		B

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 29: Isabel Ave & I-580 WB Ramps

BART to Livermore Extension Project
 2040 Enhanced Bus PM





















Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↖↗		↖		↑↑↑	↖		↑↑↑	↖
Traffic Volume (vph)	0	0	0	681	0	439	0	450	0	0	670	490
Future Volume (vph)	0	0	0	681	0	439	0	450	0	0	670	490
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0		4.0		4.8			4.8	4.8
Lane Util. Factor				0.97		1.00		0.91			0.91	1.00
Frt				1.00		0.85		1.00			1.00	0.85
Flt Protected				0.95		1.00		1.00			1.00	1.00
Satd. Flow (prot)				3433		1583		5085			5085	1583
Flt Permitted				0.95		1.00		1.00			1.00	1.00
Satd. Flow (perm)				3433		1583		5085			5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	740	0	477	0	489	0	0	728	533
RTOR Reduction (vph)	0	0	0	0	0	196	0	0	0	0	0	227
Lane Group Flow (vph)	0	0	0	740	0	281	0	489	0	0	728	306
Turn Type				Prot		Prot		NA	Free		NA	Prot
Protected Phases				8		8		2			6	6
Permitted Phases									Free			
Actuated Green, G (s)				18.9		18.9		38.1			38.1	38.1
Effective Green, g (s)				18.9		18.9		37.3			37.3	37.3
Actuated g/C Ratio				0.29		0.29		0.57			0.57	0.57
Clearance Time (s)				4.0		4.0		4.0			4.0	4.0
Vehicle Extension (s)				2.0		2.0		4.0			4.0	4.0
Lane Grp Cap (vph)				998		460		2918			2918	908
v/s Ratio Prot				c0.22		0.18		0.10			0.14	c0.19
v/s Ratio Perm												
v/c Ratio				0.74		0.61		0.17			0.25	0.34
Uniform Delay, d1				20.8		19.9		6.5			6.9	7.3
Progression Factor				1.00		1.00		0.76			1.00	1.00
Incremental Delay, d2				2.6		1.6		0.1			0.2	1.0
Delay (s)				23.5		21.4		5.1			7.1	8.3
Level of Service				C		C		A			A	A
Approach Delay (s)		0.0			22.7			5.1			7.6	
Approach LOS		A			C			A			A	

Intersection Summary			
HCM 2000 Control Delay	13.4	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.47		
Actuated Cycle Length (s)	65.0	Sum of lost time (s)	8.8
Intersection Capacity Utilization	43.2%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 30: Isabel Ave & I-580 EB Ramps

BART to Livermore Extension Project
 2040 Enhanced Bus PM

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations													
Traffic Volume (vph)	192	0	389	0	0	0	0	713	690	0	919	662	
Future Volume (vph)	192	0	389	0	0	0	0	713	690	0	919	662	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)	4.0		4.0					4.0	4.0		4.0	4.0	
Lane Util. Factor	0.97		0.88					0.91	1.00		0.91	1.00	
Frt	1.00		0.85					1.00	0.85		1.00	0.85	
Flt Protected	0.95		1.00					1.00	1.00		1.00	1.00	
Satd. Flow (prot)	3433		2787					5085	1583		5085	1583	
Flt Permitted	0.95		1.00					1.00	1.00		1.00	1.00	
Satd. Flow (perm)	3433		2787					5085	1583		5085	1583	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	
Adj. Flow (vph)	209	0	423	0	0	0	0	775	750	0	999	720	
RTOR Reduction (vph)	0	0	169	0	0	0	0	0	0	0	0	0	
Lane Group Flow (vph)	209	0	254	0	0	0	0	775	750	0	999	720	
Turn Type	Prot		Perm					NA	Free		NA	Free	
Protected Phases	4							2			6		
Permitted Phases			4						Free			Free	
Actuated Green, G (s)	10.2		10.2					45.8	65.0		45.8	65.0	
Effective Green, g (s)	10.2		10.2					46.8	65.0		46.8	65.0	
Actuated g/C Ratio	0.16		0.16					0.72	1.00		0.72	1.00	
Clearance Time (s)	4.0		4.0					5.0			5.0		
Vehicle Extension (s)	2.0		2.0					4.0			4.0		
Lane Grp Cap (vph)	538		437					3661	1583		3661	1583	
v/s Ratio Prot	0.06							0.15			0.20		
v/s Ratio Perm			0.09						c0.47			0.45	
v/c Ratio	0.39		0.58					0.21	0.47		0.27	0.45	
Uniform Delay, d1	24.6		25.4					3.0	0.0		3.2	0.0	
Progression Factor	1.00		1.00					1.00	1.00		0.93	1.00	
Incremental Delay, d2	0.2		1.3					0.1	1.0		0.2	0.9	
Delay (s)	24.8		26.7					3.1	1.0		3.1	0.9	
Level of Service	C		C					A	A		A	A	
Approach Delay (s)		26.1			0.0			2.1			2.2		
Approach LOS		C			A			A			A		
Intersection Summary													
HCM 2000 Control Delay			6.0									HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio			0.54										
Actuated Cycle Length (s)			65.0									Sum of lost time (s)	8.0
Intersection Capacity Utilization			38.0%									ICU Level of Service	A
Analysis Period (min)			15										
c Critical Lane Group													

HCM Signalized Intersection Capacity Analysis
 31: Isabel Ave & Airway Blvd

BART to Livermore Extension Project
 2040 Enhanced Bus PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↑	↗	↖	↑	↗	↖	↑↑↑	↗	↖↗	↑↑↑	↗
Traffic Volume (vph)	0	165	360	144	143	59	415	1215	67	372	1294	10
Future Volume (vph)	0	165	360	144	143	59	415	1215	67	372	1294	10
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.2	5.6	5.2	5.2	5.6	4.0	4.0	4.0	4.0	4.0	5.0
Lane Util. Factor		1.00	1.00	1.00	1.00	1.00	1.00	0.91	1.00	0.97	0.91	1.00
Frt		1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1863	1583	1770	1863	1583	1770	5085	1583	3433	5085	1583
Flt Permitted		1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)		1863	1583	1770	1863	1583	1770	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	179	391	157	155	64	451	1321	73	404	1407	11
RTOR Reduction (vph)	0	0	66	0	0	36	0	0	43	0	0	7
Lane Group Flow (vph)	0	179	325	157	155	28	451	1321	30	404	1407	4
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4	5	3	8	1	5	2		1	NA	6
Permitted Phases			4			8			2			6
Actuated Green, G (s)		14.1	35.2	8.4	27.1	41.1	21.1	36.5	36.5	14.0	29.4	29.4
Effective Green, g (s)		13.5	34.0	7.8	26.5	39.9	22.1	37.5	37.5	15.0	30.4	29.4
Actuated g/C Ratio		0.15	0.37	0.08	0.29	0.43	0.24	0.41	0.41	0.16	0.33	0.32
Clearance Time (s)		4.6	5.0	4.6	4.6	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Extension (s)		3.0	3.0	3.0	3.0	3.0	3.0	5.0	5.0	3.0	5.0	5.0
Lane Grp Cap (vph)		272	583	149	535	685	424	2068	643	558	1676	504
v/s Ratio Prot		c0.10	0.12	c0.09	0.08	0.01	c0.25	0.26		0.12	c0.28	
v/s Ratio Perm			0.08			0.01			0.02			0.00
v/c Ratio		0.66	0.56	1.05	0.29	0.04	1.06	0.64	0.05	0.72	0.84	0.01
Uniform Delay, d1		37.2	23.1	42.2	25.5	15.1	35.0	21.9	16.5	36.6	28.6	21.4
Progression Factor		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2		5.7	1.2	88.7	0.3	0.0	61.6	0.9	0.1	4.6	4.3	0.0
Delay (s)		42.8	24.3	130.9	25.8	15.1	96.7	22.8	16.6	41.3	33.0	21.4
Level of Service		D	C	F	C	B	F	C	B	D	C	C
Approach Delay (s)		30.1			67.9			40.6			34.7	
Approach LOS		C			E			D			C	

Intersection Summary		
HCM 2000 Control Delay	39.2	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.91	D
Actuated Cycle Length (s)	92.2	Sum of lost time (s)
Intersection Capacity Utilization	80.0%	20.0
Analysis Period (min)	15	ICU Level of Service
		D

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
32: Isabel Ave & Jack London Blvd

BART to Livermore Extension Project
2040 Enhanced Bus PM



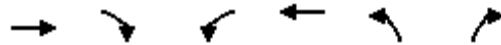
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↕	↖	↖↗	↕	↖	↖↗	↕↕↕	↖	↖↗	↕↕↕	↖
Traffic Volume (vph)	115	899	330	286	181	294	142	1399	612	479	1286	55
Future Volume (vph)	115	899	330	286	181	294	142	1399	612	479	1286	55
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3
Lane Util. Factor	0.97	0.95	1.00	0.97	1.00	1.00	0.97	0.91	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	3433	1863	1583	3433	5085	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	3433	1863	1583	3433	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	125	977	359	311	197	320	154	1521	665	521	1398	60
RTOR Reduction (vph)	0	0	141	0	0	38	0	0	126	0	0	37
Lane Group Flow (vph)	125	977	218	311	197	282	154	1521	539	521	1398	23
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8	1	5	2		1	NA	6
Permitted Phases			4			8			2			6
Actuated Green, G (s)	8.3	33.0	33.0	10.9	35.6	53.1	9.5	37.4	37.4	17.5	45.4	45.4
Effective Green, g (s)	8.3	33.0	33.0	10.9	35.6	53.1	9.5	37.4	37.4	17.5	45.4	45.4
Actuated g/C Ratio	0.07	0.28	0.28	0.09	0.30	0.44	0.08	0.31	0.31	0.15	0.38	0.38
Clearance Time (s)	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	237	973	435	311	552	770	271	1584	493	500	1923	598
v/s Ratio Prot	0.04	c0.28		c0.09	0.11	c0.05	0.04	0.30		c0.15	0.27	
v/s Ratio Perm			0.14			0.12			c0.34			0.01
v/c Ratio	0.53	1.00	0.50	1.00	0.36	0.37	0.57	0.96	1.09	1.04	0.73	0.04
Uniform Delay, d1	54.0	43.5	36.6	54.5	33.2	22.2	53.3	40.6	41.3	51.2	32.0	23.5
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	2.1	29.9	0.9	51.0	0.4	0.3	2.7	14.3	68.3	51.6	1.4	0.0
Delay (s)	56.1	73.4	37.5	105.6	33.6	22.5	56.0	54.9	109.6	102.9	33.4	23.6
Level of Service	E	E	D	F	C	C	E	D	F	F	C	C
Approach Delay (s)		63.1			56.4			70.5			51.4	
Approach LOS		E			E			E			D	

Intersection Summary

HCM 2000 Control Delay	61.4	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.04		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	21.2
Intersection Capacity Utilization	91.4%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 33: Isabel Ave Connector & Stanley Blvd



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑	↑	↑↑	↑↑	↑↑	↑↑
Traffic Volume (vph)	2141	783	811	558	149	935
Future Volume (vph)	2141	783	811	558	149	935
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	2.3	2.3	4.0	2.3	2.5	2.5
Lane Util. Factor	0.95	1.00	0.97	0.95	0.97	0.88
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	3539	1583	3433	3539	3433	2787
Flt Permitted	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (perm)	3539	1583	3433	3539	3433	2787
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	2327	851	882	607	162	1016
RTOR Reduction (vph)	0	0	0	0	0	2
Lane Group Flow (vph)	2327	851	882	607	162	1014
Turn Type	NA	pm+ov	Prot	NA	Prot	pm+ov
Protected Phases	2	8	1	6	8	1
Permitted Phases		2				8
Actuated Green, G (s)	58.0	67.9	20.0	82.0	9.9	29.9
Effective Green, g (s)	59.7	71.3	20.0	83.7	11.4	32.9
Actuated g/C Ratio	0.60	0.71	0.20	0.84	0.11	0.33
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Grp Cap (vph)	2114	1166	687	2965	391	987
v/s Ratio Prot	c0.66	0.08	c0.26	0.17	0.05	c0.22
v/s Ratio Perm		0.45				0.14
v/c Ratio	1.10	0.73	1.28	0.20	0.41	1.03
Uniform Delay, d1	20.1	8.5	40.0	1.6	41.1	33.5
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	53.3	2.0	138.6	0.0	0.3	35.8
Delay (s)	73.4	10.5	178.6	1.6	41.4	69.3
Level of Service	E	B	F	A	D	E
Approach Delay (s)	56.5			106.4	65.5	
Approach LOS	E			F	E	

Intersection Summary

HCM 2000 Control Delay	71.1	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.13		
Actuated Cycle Length (s)	99.9	Sum of lost time (s)	8.8
Intersection Capacity Utilization	99.0%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 34: Murrieta Blvd/Driveway & Portola Ave

BART to Livermore Extension Project
 2040 Enhanced Bus PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗		↖	↗		↖	↗	↗		↗	
Traffic Volume (vph)	0	1158	169	249	645	1	180	5	413	4	7	0
Future Volume (vph)	0	1158	169	249	645	1	180	5	413	4	7	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.8		4.0	5.8		5.2	5.2	5.2		4.0	
Lane Util. Factor		0.95		1.00	0.95		0.95	0.95	1.00		1.00	
Frt		0.98		1.00	1.00		1.00	1.00	0.85		1.00	
Flt Protected		1.00		0.95	1.00		0.95	0.95	1.00		0.98	
Satd. Flow (prot)		3472		1770	3538		1681	1689	1583		1832	
Flt Permitted		1.00		0.95	1.00		0.95	0.95	1.00		0.98	
Satd. Flow (perm)		3472		1770	3538		1681	1689	1583		1832	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	1259	184	271	701	1	196	5	449	4	8	0
RTOR Reduction (vph)	0	10	0	0	0	0	0	0	238	0	0	0
Lane Group Flow (vph)	0	1433	0	271	702	0	102	99	211	0	12	0
Turn Type	Prot	NA		Prot	NA		Split	NA	Perm		Split	NA
Protected Phases	5	2		1	6		8	8			4	4
Permitted Phases									8			
Actuated Green, G (s)		40.0		14.2	58.2		14.9	14.9	14.9		0.7	
Effective Green, g (s)		39.1		14.2	57.3		14.3	14.3	14.3		0.7	
Actuated g/C Ratio		0.45		0.16	0.66		0.16	0.16	0.16		0.01	
Clearance Time (s)		4.9		4.0	4.9		4.6	4.6	4.6		4.0	
Vehicle Extension (s)		2.0		2.0	2.0		2.0	2.0	2.0		2.0	
Lane Grp Cap (vph)		1555		287	2322		275	276	259		14	
v/s Ratio Prot		c0.41		c0.15	0.20		0.06	0.06			c0.01	
v/s Ratio Perm									c0.13			
v/c Ratio		0.92		0.94	0.30		0.37	0.36	0.81		0.86	
Uniform Delay, d1		22.7		36.2	6.4		32.5	32.4	35.2		43.3	
Progression Factor		1.00		1.00	1.00		1.00	1.00	1.00		1.00	
Incremental Delay, d2		9.2		37.8	0.0		0.3	0.3	16.6		160.8	
Delay (s)		31.9		74.0	6.5		32.8	32.7	51.9		204.1	
Level of Service		C		E	A		C	C	D		F	
Approach Delay (s)		31.9			25.3			46.0			204.1	
Approach LOS		C			C			D			F	

Intersection Summary

HCM 2000 Control Delay	33.4	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.90		
Actuated Cycle Length (s)	87.3	Sum of lost time (s)	19.0
Intersection Capacity Utilization	78.8%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
35: Murrieta Blvd & Jack London Blvd



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	357	1123	498	286	381	160
Future Volume (vph)	357	1123	498	286	381	160
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00	1.00	0.95	0.91	
Frt	1.00	0.85	1.00	1.00	0.96	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1770	1583	1770	3539	4860	
Flt Permitted	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	1770	1583	1770	3539	4860	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	388	1221	541	311	414	174
RTOR Reduction (vph)	0	393	0	0	64	0
Lane Group Flow (vph)	388	828	541	311	524	0
Turn Type	Prot	Perm	Prot	NA	NA	
Protected Phases	4		5	2	6	
Permitted Phases		4				
Actuated Green, G (s)	56.0	56.0	35.0	55.3	16.3	
Effective Green, g (s)	56.0	56.0	35.0	55.3	16.3	
Actuated g/C Ratio	0.47	0.47	0.29	0.46	0.14	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	830	743	519	1640	664	
v/s Ratio Prot	0.22		c0.31	0.09	c0.11	
v/s Ratio Perm		c0.52				
v/c Ratio	0.47	1.11	1.04	0.19	0.79	
Uniform Delay, d1	21.5	31.6	42.1	18.8	49.8	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.4	69.0	51.0	0.1	6.2	
Delay (s)	21.9	100.6	93.1	18.9	56.1	
Level of Service	C	F	F	B	E	
Approach Delay (s)	81.7			66.0	56.1	
Approach LOS	F			E	E	

Intersection Summary

HCM 2000 Control Delay	72.4	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.04		
Actuated Cycle Length (s)	119.3	Sum of lost time (s)	12.0
Intersection Capacity Utilization	87.1%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 36: Murrieta Blvd & Stanley Blvd

BART to Livermore Extension Project
 2040 Enhanced Bus PM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	323	1507	829	81	1035	218	287	340	19	241	378	204
Future Volume (vph)	323	1507	829	81	1035	218	287	340	19	241	378	204
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	5.8	5.8	4.0	5.8	4.9	4.9	5.8		4.9	5.8	4.9
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.97	0.95		1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	3433	3511		1770	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	3433	3511		1770	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	351	1638	901	88	1125	237	312	370	21	262	411	222
RTOR Reduction (vph)	0	0	211	0	0	53	0	3	0	0	0	120
Lane Group Flow (vph)	351	1638	690	88	1125	184	312	388	0	262	411	102
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Prot	NA		Prot	NA	Perm
Protected Phases	1	6		5	2	3	7	4		3	8	
Permitted Phases			6			2						8
Actuated Green, G (s)	12.0	52.3	52.3	4.0	44.3	60.3	13.4	17.4		16.0	20.0	20.0
Effective Green, g (s)	12.0	51.4	51.4	4.0	43.4	58.5	12.5	16.5		15.1	19.1	20.0
Actuated g/C Ratio	0.11	0.48	0.48	0.04	0.40	0.54	0.12	0.15		0.14	0.18	0.19
Clearance Time (s)	4.0	4.9	4.9	4.0	4.9	4.0	4.0	4.9		4.0	4.9	4.9
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	383	1692	756	65	1428	861	399	538		248	628	294
v/s Ratio Prot	c0.10	c0.46		c0.05	0.32	0.03	0.09	0.11		c0.15	c0.12	
v/s Ratio Perm			0.44			0.09						0.06
v/c Ratio	0.92	0.97	0.91	1.35	0.79	0.21	0.78	0.72		1.06	0.65	0.35
Uniform Delay, d1	47.3	27.3	26.0	51.8	28.0	12.6	46.2	43.3		46.2	41.1	38.1
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	26.1	14.8	15.3	232.0	3.0	0.1	9.6	4.7		72.8	2.5	0.7
Delay (s)	73.3	42.1	41.2	283.7	31.0	12.8	55.8	48.0		119.0	43.6	38.8
Level of Service	E	D	D	F	C	B	E	D		F	D	D
Approach Delay (s)		45.6			43.3			51.5			64.5	
Approach LOS		D			D			D			E	

Intersection Summary		
HCM 2000 Control Delay	48.6	HCM 2000 Level of Service D
HCM 2000 Volume to Capacity ratio	0.96	
Actuated Cycle Length (s)	107.5	Sum of lost time (s) 20.5
Intersection Capacity Utilization	86.6%	ICU Level of Service E
Analysis Period (min)	15	

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
37: Livermore Ave & I-580 WB Ramps

BART to Livermore Extension Project
2040 Enhanced Bus PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↖	↔		↗	↑			↕	
Traffic Volume (vph)	0	0	0	687	23	32	580	452	0	0	111	0
Future Volume (vph)	0	0	0	687	23	32	580	452	0	0	111	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)					4.0		4.0	4.0			4.0	
Lane Util. Factor					0.95		0.97	1.00			0.95	
Frt					0.99		1.00	1.00			1.00	
Flt Protected					0.96		0.95	1.00			1.00	
Satd. Flow (prot)					1680		3433	1863			3539	
Flt Permitted					0.96		0.95	1.00			1.00	
Satd. Flow (perm)					1680		3433	1863			3539	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	747	25	35	630	491	0	0	121	0
RTOR Reduction (vph)	0	0	0	0	1	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	0	806	0	630	491	0	0	121	0
Turn Type				Split	NA		Prot	NA			NA	
Protected Phases				8	8		5	2			6	
Permitted Phases												
Actuated Green, G (s)					69.8		27.5	50.5			19.5	
Effective Green, g (s)					69.8		27.0	52.2			21.2	
Actuated g/C Ratio					0.54		0.21	0.40			0.16	
Clearance Time (s)					4.0		3.5	5.7			5.7	
Vehicle Extension (s)					2.0		2.0	2.5			2.5	
Lane Grp Cap (vph)					902		713	748			577	
v/s Ratio Prot					c0.48		c0.18	c0.26			0.03	
v/s Ratio Perm												
v/c Ratio					0.89		0.88	0.66			0.21	
Uniform Delay, d1					26.8		50.0	31.6			47.1	
Progression Factor					1.00		0.39	0.26			1.00	
Incremental Delay, d2					10.9		1.3	0.4			0.8	
Delay (s)					37.7		20.8	8.6			48.0	
Level of Service					D		C	A			D	
Approach Delay (s)		0.0			37.7			15.5			48.0	
Approach LOS		A			D			B			D	

Intersection Summary

HCM 2000 Control Delay	26.1	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.86		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	111.3%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 38: Livermore Ave & I-580 EB Ramps

BART to Livermore Extension Project
 2040 Enhanced Bus PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔	↗					↕		↘	↕	
Traffic Volume (vph)	232	11	1367	0	0	0	0	816	227	112	682	0
Future Volume (vph)	232	11	1367	0	0	0	0	816	227	112	682	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0					3.0		5.0	3.0	
Lane Util. Factor		0.95	0.95					0.95		1.00	0.95	
Frt		0.89	0.85					0.97		1.00	1.00	
Flt Protected		0.99	1.00					1.00		0.95	1.00	
Satd. Flow (prot)		1555	1504					3424		1770	3539	
Flt Permitted		0.99	1.00					1.00		0.95	1.00	
Satd. Flow (perm)		1555	1504					3424		1770	3539	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	252	12	1486	0	0	0	0	887	247	122	741	0
RTOR Reduction (vph)	0	70	70	0	0	0	0	20	0	0	0	0
Lane Group Flow (vph)	0	922	688	0	0	0	0	1114	0	122	741	0
Turn Type	Prot	NA	Perm					NA		Prot	NA	
Protected Phases	7	4						2		1	6	
Permitted Phases			4									
Actuated Green, G (s)		62.9	62.9					44.3		10.8	59.1	
Effective Green, g (s)		62.9	62.9					45.3		9.8	60.1	
Actuated g/C Ratio		0.48	0.48					0.35		0.08	0.46	
Clearance Time (s)		4.0	4.0					4.0		4.0	4.0	
Vehicle Extension (s)		2.0	2.0					2.5		2.0	2.5	
Lane Grp Cap (vph)		752	727					1193		133	1636	
v/s Ratio Prot								c0.33		c0.07	0.21	
v/s Ratio Perm		0.59	0.46									
v/c Ratio		1.23	0.95					0.93		0.92	0.45	
Uniform Delay, d1		33.5	31.9					40.9		59.7	23.8	
Progression Factor		1.00	1.00					1.00		0.79	1.16	
Incremental Delay, d2		113.3	20.8					14.4		39.0	0.6	
Delay (s)		146.8	52.8					55.3		86.3	28.1	
Level of Service		F	D					E		F	C	
Approach Delay (s)		106.1			0.0			55.3			36.3	
Approach LOS		F			A			E			D	

Intersection Summary		
HCM 2000 Control Delay	74.6	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	1.09	E
Actuated Cycle Length (s)	130.0	Sum of lost time (s)
Intersection Capacity Utilization	111.3%	12.0
Analysis Period (min)	15	ICU Level of Service
		H

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 39: Livermore Ave & Portola Ave

BART to Livermore Extension Project
 2040 Enhanced Bus PM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	735	643	180	17	313	67	195	645	91	251	1036	484
Future Volume (vph)	735	643	180	17	313	67	195	645	91	251	1036	484
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	2.7	4.0	4.0	2.7	4.0	4.0	4.9		4.0	4.9	4.9
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	1.00	0.95		1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.98		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	1770	3474		1770	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	1770	3474		1770	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	799	699	196	18	340	73	212	701	99	273	1126	526
RTOR Reduction (vph)	0	0	125	0	0	61	0	8	0	0	0	66
Lane Group Flow (vph)	799	699	71	18	340	12	212	792	0	273	1126	460
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA		Prot	NA	pm+ov
Protected Phases	3	8		7	4		1	6		5	2	3
Permitted Phases			8			4						2
Actuated Green, G (s)	31.0	45.8	45.8	5.1	19.9	19.9	16.1	33.5		25.6	43.0	74.0
Effective Green, g (s)	31.0	47.1	45.8	5.1	21.2	19.9	16.1	32.6		25.6	42.1	72.2
Actuated g/C Ratio	0.25	0.37	0.36	0.04	0.17	0.16	0.13	0.26		0.20	0.33	0.57
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	844	1322	575	71	595	250	226	898		359	1182	907
v/s Ratio Prot	c0.23	c0.20		0.01	c0.10		c0.12	0.23		0.15	c0.32	0.12
v/s Ratio Perm			0.04			0.01						0.17
v/c Ratio	0.95	0.53	0.12	0.25	0.57	0.05	0.94	0.88		0.76	0.95	0.51
Uniform Delay, d1	46.7	30.8	26.7	58.6	48.2	45.0	54.5	44.8		47.3	41.0	16.2
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	19.1	0.4	0.1	1.9	1.3	0.1	42.5	10.1		9.2	16.1	0.4
Delay (s)	65.8	31.2	26.8	60.5	49.5	45.1	96.9	55.0		56.5	57.0	16.6
Level of Service	E	C	C	E	D	D	F	D		E	E	B
Approach Delay (s)		47.0			49.2			63.8			45.9	
Approach LOS		D			D			E			D	

Intersection Summary		
HCM 2000 Control Delay	50.1	HCM 2000 Level of Service D
HCM 2000 Volume to Capacity ratio	0.89	
Actuated Cycle Length (s)	126.0	Sum of lost time (s) 16.5
Intersection Capacity Utilization	83.1%	ICU Level of Service E
Analysis Period (min)	15	

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
40: First St/Springtown Blvd & I-580 WB Ramps

BART to Livermore Extension Project
2040 Enhanced Bus PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations			↗↘			↗	↗↘	↑			↗↘	↗
Traffic Volume (vph)	0	0	262	0	0	0	386	1439	0	0	421	184
Future Volume (vph)	0	0	262	0	0	0	386	1439	0	0	421	184
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)			4.5				4.5	4.0			4.5	4.5
Lane Util. Factor			0.88				0.97	1.00			0.95	1.00
Frt			0.85				1.00	1.00			1.00	0.85
Flt Protected			1.00				0.95	1.00			1.00	1.00
Satd. Flow (prot)			2787				3433	1863			3539	1583
Flt Permitted			1.00				0.95	1.00			1.00	1.00
Satd. Flow (perm)			2787				3433	1863			3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	285	0	0	0	420	1564	0	0	458	200
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	10
Lane Group Flow (vph)	0	0	285	0	0	0	420	1564	0	0	458	190
Turn Type			Over			Free	Prot	NA			NA	Perm
Protected Phases			5				5	2			6	
Permitted Phases						Free						6
Actuated Green, G (s)			19.9				19.9	130.0			102.1	102.1
Effective Green, g (s)			19.4				19.4	130.0			101.6	101.6
Actuated g/C Ratio			0.15				0.15	1.00			0.78	0.78
Clearance Time (s)			4.0				4.0	4.0			4.0	4.0
Vehicle Extension (s)			2.0				2.0	0.2			4.0	4.0
Lane Grp Cap (vph)			415				512	1863			2765	1237
v/s Ratio Prot			0.10				0.12	c0.84			0.13	
v/s Ratio Perm												0.12
v/c Ratio			0.69				0.82	0.84			0.17	0.15
Uniform Delay, d1			52.4				53.6	0.0			3.6	3.5
Progression Factor			1.00				0.81	1.00			1.00	1.00
Incremental Delay, d2			3.7				1.0	0.5			0.1	0.3
Delay (s)			56.2				44.1	0.5			3.7	3.8
Level of Service			E				D	A			A	A
Approach Delay (s)		56.2			0.0			9.7			3.7	
Approach LOS		E			A			A			A	



















Intersection Summary

HCM 2000 Control Delay	12.9	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.90		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	79.1%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
41: First St & I-580 EB Ramps

BART to Livermore Extension Project
2040 Enhanced Bus PM

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations													
Traffic Volume (vph)	536	3	684	0	0	0	0	1703	447	97	1182	0	
Future Volume (vph)	536	3	684	0	0	0	0	1703	447	97	1182	0	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)		4.0	4.0					5.0	5.0	5.0	5.0		
Lane Util. Factor		1.00	0.88					0.95	1.00	1.00	0.95		
Frt		1.00	0.85					1.00	0.85	1.00	1.00		
Flt Protected		0.95	1.00					1.00	1.00	0.95	1.00		
Satd. Flow (prot)		1774	2787					3539	1583	1770	3539		
Flt Permitted		0.95	1.00					1.00	1.00	0.95	1.00		
Satd. Flow (perm)		1774	2787					3539	1583	1770	3539		
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	
Adj. Flow (vph)	583	3	743	0	0	0	0	1851	486	105	1285	0	
RTOR Reduction (vph)	0	0	81	0	0	0	0	0	152	0	0	0	
Lane Group Flow (vph)	0	586	662	0	0	0	0	1851	334	105	1285	0	
Turn Type	Perm	NA	Perm					NA	Perm	Prot	NA		
Protected Phases		4						2		1	6		
Permitted Phases	4		4						2				
Actuated Green, G (s)		41.5	41.5					67.5	67.5	9.0	80.5		
Effective Green, g (s)		41.0	41.0					67.0	67.0	8.0	80.0		
Actuated g/C Ratio		0.32	0.32					0.52	0.52	0.06	0.62		
Clearance Time (s)		3.5	3.5					4.5	4.5	4.0	4.5		
Vehicle Extension (s)		2.5	2.5					4.0	4.0	2.0	4.0		
Lane Grp Cap (vph)		559	878					1823	815	108	2177		
v/s Ratio Prot								c0.52		c0.06	0.36		
v/s Ratio Perm		0.33	0.24						0.21				
v/c Ratio		1.05	0.75					1.02	0.41	0.97	0.59		
Uniform Delay, d1		44.5	40.0					31.5	19.4	60.9	15.1		
Progression Factor		1.00	1.00					1.00	1.00	0.93	0.98		
Incremental Delay, d2		51.3	3.5					25.0	1.5	76.8	1.2		
Delay (s)		95.8	43.5					56.5	20.9	133.6	16.0		
Level of Service		F	D					E	C	F	B		
Approach Delay (s)		66.6			0.0			49.1			24.9		
Approach LOS		E			A			D			C		
Intersection Summary													
HCM 2000 Control Delay			47.0									HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio			1.02										
Actuated Cycle Length (s)			130.0									Sum of lost time (s)	14.0
Intersection Capacity Utilization			94.0%									ICU Level of Service	F
Analysis Period (min)			15										
c Critical Lane Group													

HCM Signalized Intersection Capacity Analysis
42: 1st St & Mines Rd

BART to Livermore Extension Project
2040 Enhanced Bus PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↗	↘		↖	↗	↘	↖	↑↑↑		↖	↗	↘
Traffic Volume (vph)	76	251	80	436	228	323	72	1537	868	375	1170	50
Future Volume (vph)	76	251	80	436	228	323	72	1537	868	375	1170	50
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		0.97	1.00	1.00	1.00	0.91		0.97	0.91	
Frt	1.00	0.96		1.00	1.00	0.85	1.00	0.95		1.00	0.99	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1795		3433	1863	1583	1770	4810		3433	5054	
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	1795		3433	1863	1583	1770	4810		3433	5054	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	83	273	87	474	248	351	78	1671	943	408	1272	54
RTOR Reduction (vph)	0	9	0	0	0	31	0	84	0	0	3	0
Lane Group Flow (vph)	83	351	0	474	248	320	78	2530	0	408	1323	0
Turn Type	Prot	NA		Prot	NA	pm+ov	Prot	NA		Prot	NA	
Protected Phases	7	4		3	8	1	5	2		1	6	
Permitted Phases						8						
Actuated Green, G (s)	7.8	20.0		14.0	26.2	37.2	8.3	59.8		11.0	62.5	
Effective Green, g (s)	7.8	20.0		14.0	26.2	37.2	8.3	59.8		11.0	62.5	
Actuated g/C Ratio	0.06	0.17		0.12	0.22	0.31	0.07	0.50		0.09	0.52	
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	114	297		397	404	539	121	2381		312	2614	
v/s Ratio Prot	0.05	c0.20		c0.14	0.13	0.05	0.04	c0.53		c0.12	c0.26	
v/s Ratio Perm						0.15						
v/c Ratio	0.73	1.18		1.19	0.61	0.59	0.64	1.09dr		1.31	0.51	
Uniform Delay, d1	55.5	50.4		53.4	42.7	35.4	54.8	30.5		54.9	19.1	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	20.6	110.7		109.5	2.8	1.8	11.2	37.7		159.7	0.2	
Delay (s)	76.0	161.1		162.9	45.5	37.2	66.0	68.2		214.6	19.2	
Level of Service	E	F		F	D	D	E	E		F	B	
Approach Delay (s)		145.1			94.6			68.1			65.2	
Approach LOS		F			F			E			E	

Intersection Summary























HCM 2000 Control Delay	77.8	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.11		
Actuated Cycle Length (s)	120.8	Sum of lost time (s)	16.0
Intersection Capacity Utilization	103.7%	ICU Level of Service	G
Analysis Period (min)	15		

dr Defacto Right Lane. Recode with 1 though lane as a right lane.

c Critical Lane Group























HCM Unsignalized Intersection Capacity Analysis
43: Vasco Rd & I-580 WB Ramps

BART to Livermore Extension Project
2040 Enhanced Bus PM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations								  			  	
Traffic Volume (veh/h)	0	0	0	0	0	154	0	2465	0	0	585	0
Future Volume (Veh/h)	0	0	0	0	0	154	0	2465	0	0	585	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	0	0	0	167	0	2679	0	0	636	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage (veh)												
Upstream signal (ft)											524	
pX, platoon unblocked												
vC, conflicting volume	1696	3315	212	2891	3315	893	636			2679		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1696	3315	212	2891	3315	893	636			2679		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	100	100	41	100			100		
cM capacity (veh/h)	25	8	793	7	8	285	943			152		
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	NB 4	SB 1	SB 2	SB 3	SB 4		
Volume Total	0	167	893	893	893	0	212	212	212	0		
Volume Left	0	0	0	0	0	0	0	0	0	0		
Volume Right	0	167	0	0	0	0	0	0	0	0		
cSH	1700	285	1700	1700	1700	1700	1700	1700	1700	1700		
Volume to Capacity	0.00	0.59	0.53	0.53	0.53	0.00	0.12	0.12	0.12	0.00		
Queue Length 95th (ft)	0	86	0	0	0	0	0	0	0	0		
Control Delay (s)	0.0	34.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
Lane LOS	A	D										
Approach Delay (s)	0.0	34.2	0.0				0.0					
Approach LOS	A	D										
Intersection Summary												
Average Delay			1.6									
Intersection Capacity Utilization			63.8%		ICU Level of Service					B		
Analysis Period (min)			15									

HCM Unsignalized Intersection Capacity Analysis
44: Vasco Rd & I-580 EB Ramps

BART to Livermore Extension Project
2040 Enhanced Bus PM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations								  			  	
Traffic Volume (veh/h)	0	0	0	0	0	0	0	2857	0	64	726	0
Future Volume (Veh/h)	0	0	0	0	0	0	0	2857	0	64	726	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	0	0	0	0	0	3105	0	70	789	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1964	4034	263	3508	4034	1035	789			3105		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1964	4034	263	3508	4034	1035	789			3105		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	100	100	100	100			32		
cM capacity (veh/h)	17	1	735	1	1	229	827			102		
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	NB 4	SB 1	SB 2	SB 3	SB 4		
Volume Total	0	0	1035	1035	1035	0	70	263	263	263		
Volume Left	0	0	0	0	0	0	70	0	0	0		
Volume Right	0	0	0	0	0	0	0	0	0	0		
cSH	1700	1700	1700	1700	1700	1700	102	1700	1700	1700		
Volume to Capacity	0.00	0.00	0.61	0.61	0.61	0.00	0.68	0.15	0.15	0.15		
Queue Length 95th (ft)	0	0	0	0	0	0	87	0	0	0		
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	94.9	0.0	0.0	0.0		
Lane LOS	A	A					F					
Approach Delay (s)	0.0	0.0	0.0				7.7					
Approach LOS	A	A										
Intersection Summary												
Average Delay			1.7									
Intersection Capacity Utilization			58.5%		ICU Level of Service					B		
Analysis Period (min)			15									

HCM Signalized Intersection Capacity Analysis
45: Vasco Rd & East Ave

BART to Livermore Extension Project
2040 Enhanced Bus PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	725	39	115	134	397	285	112	413	14	16	383	458
Future Volume (vph)	725	39	115	134	397	285	112	413	14	16	383	458
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	0.95		0.97	1.00	1.00
Frt	1.00	0.89		1.00	0.94		1.00	1.00		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	3142		1770	3317		1770	3522		3433	1863	1583
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1770	3142		1770	3317		1770	3522		3433	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	788	42	125	146	432	310	122	449	15	17	416	498
RTOR Reduction (vph)	0	70	0	0	118	0	0	2	0	0	0	381
Lane Group Flow (vph)	788	97	0	146	624	0	122	462	0	17	416	117
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												6
Actuated Green, G (s)	45.0	49.5		13.5	18.0		7.0	31.8		1.6	26.4	26.4
Effective Green, g (s)	45.0	49.5		13.5	18.0		7.0	31.8		1.6	26.4	26.4
Actuated g/C Ratio	0.40	0.44		0.12	0.16		0.06	0.28		0.01	0.23	0.23
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	708	1383		212	531		110	996		48	437	371
v/s Ratio Prot	c0.45	0.03		0.08	c0.19		c0.07	0.13		0.00	c0.22	
v/s Ratio Perm												0.07
v/c Ratio	1.11	0.07		0.69	1.17		1.11	0.46		0.35	0.95	0.32
Uniform Delay, d1	33.7	18.2		47.4	47.2		52.7	33.3		54.9	42.4	35.5
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	69.2	0.0		9.0	96.9		118.2	0.3		4.5	30.9	0.5
Delay (s)	102.9	18.2		56.4	144.1		170.9	33.6		59.3	73.3	36.0
Level of Service	F	B		E	F		F	C		E	E	D
Approach Delay (s)		88.1			129.7			62.2			53.1	
Approach LOS		F			F			E			D	

Intersection Summary

HCM 2000 Control Delay	84.9	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.08		
Actuated Cycle Length (s)	112.4	Sum of lost time (s)	16.0
Intersection Capacity Utilization	100.0%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

46: Greenville Rd & I-580 WB Ramps

BART to Livermore Extension Project
2040 Enhanced Bus PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↖↗		↖		↕↕	↖		↕↗	
Traffic Volume (vph)	0	0	0	105	0	32	0	1315	573	0	168	26
Future Volume (vph)	0	0	0	105	0	32	0	1315	573	0	168	26
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0		4.0		4.0	4.0		4.0	
Lane Util. Factor				0.97		1.00		0.95	1.00		0.95	
Frt				1.00		0.85		1.00	0.85		0.98	
Flt Protected				0.95		1.00		1.00	1.00		1.00	
Satd. Flow (prot)				3433		1583		3539	1583		3469	
Flt Permitted				0.95		1.00		1.00	1.00		1.00	
Satd. Flow (perm)				3433		1583		3539	1583		3469	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	114	0	35	0	1429	623	0	183	28
RTOR Reduction (vph)	0	0	0	0	0	32	0	0	85	0	4	0
Lane Group Flow (vph)	0	0	0	114	0	3	0	1429	538	0	207	0
Turn Type				Prot		Prot		NA	Perm		NA	
Protected Phases				3		3		2			6	
Permitted Phases									2			
Actuated Green, G (s)				9.7		9.7		112.3	112.3		112.3	
Effective Green, g (s)				9.7		9.7		112.3	112.3		112.3	
Actuated g/C Ratio				0.07		0.07		0.86	0.86		0.86	
Clearance Time (s)				4.0		4.0		4.0	4.0		4.0	
Vehicle Extension (s)				3.0		3.0		3.0	3.0		3.0	
Lane Grp Cap (vph)				256		118		3057	1367		2996	
v/s Ratio Prot				c0.03		0.00		c0.40			0.06	
v/s Ratio Perm									0.34			
v/c Ratio				0.45		0.02		0.47	0.39		0.07	
Uniform Delay, d1				57.6		55.8		2.0	1.8		1.3	
Progression Factor				1.00		1.00		0.65	0.83		1.00	
Incremental Delay, d2				1.2		0.1		0.5	0.8		0.0	
Delay (s)				58.8		55.8		1.8	2.3		1.3	
Level of Service				E		E		A	A		A	
Approach Delay (s)		0.0			58.1			2.0			1.3	
Approach LOS		A			E			A			A	

Intersection Summary

HCM 2000 Control Delay	5.4	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.47		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	46.4%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
47: Greenville Rd & I-580 EB Ramps

BART to Livermore Extension Project
2040 Enhanced Bus PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↗↗		↖					↕↕	↗		↕↕	↖
Traffic Volume (vph)	181	0	85	0	0	0	0	1377	359	0	200	66
Future Volume (vph)	181	0	85	0	0	0	0	1377	359	0	200	66
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0					4.0	4.0		4.0	4.0
Lane Util. Factor	0.97		1.00					0.95	1.00		0.95	1.00
Frt	1.00		0.85					1.00	0.85		1.00	0.85
Flt Protected	0.95		1.00					1.00	1.00		1.00	1.00
Satd. Flow (prot)	3433		1583					3539	1583		3539	1583
Flt Permitted	0.95		1.00					1.00	1.00		1.00	1.00
Satd. Flow (perm)	3433		1583					3539	1583		3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	197	0	92	0	0	0	0	1497	390	0	217	72
RTOR Reduction (vph)	0	0	83	0	0	0	0	0	62	0	0	12
Lane Group Flow (vph)	197	0	9	0	0	0	0	1497	328	0	217	60
Turn Type	Prot		Prot					NA	Perm		NA	Perm
Protected Phases	7		7					2			6	
Permitted Phases									2			6
Actuated Green, G (s)	12.8		12.8					109.2	109.2		109.2	109.2
Effective Green, g (s)	12.8		12.8					109.2	109.2		109.2	109.2
Actuated g/C Ratio	0.10		0.10					0.84	0.84		0.84	0.84
Clearance Time (s)	4.0		4.0					4.0	4.0		4.0	4.0
Vehicle Extension (s)	3.0		3.0					3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	338		155					2972	1329		2972	1329
v/s Ratio Prot	c0.06		0.01					c0.42			0.06	
v/s Ratio Perm									0.21			0.04
v/c Ratio	0.58		0.06					0.50	0.25		0.07	0.05
Uniform Delay, d1	56.0		53.1					2.9	2.1		1.8	1.7
Progression Factor	1.00		1.00					0.85	2.08		0.60	0.10
Incremental Delay, d2	2.6		0.2					0.6	0.4		0.0	0.1
Delay (s)	58.6		53.3					3.0	4.8		1.1	0.2
Level of Service	E		D					A	A		A	A
Approach Delay (s)		56.9			0.0			3.4			0.9	
Approach LOS		E			A			A			A	

Intersection Summary

HCM 2000 Control Delay	9.4	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.51		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	49.9%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 48: Greenville Rd & Northfront Road/Altamont Pass Road



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↑	↑	↑	↑	↑
Traffic Volume (vph)	555	182	2	73	267	1136
Future Volume (vph)	555	182	2	73	267	1136
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	1863	1583	1770	1863	1770	1583
Flt Permitted	1.00	1.00	0.11	1.00	0.95	1.00
Satd. Flow (perm)	1863	1583	213	1863	1770	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	603	198	2	79	290	1235
RTOR Reduction (vph)	0	89	0	0	0	25
Lane Group Flow (vph)	603	109	2	79	290	1210
Turn Type	NA	Perm	Perm	NA	Prot	Perm
Protected Phases	4			8	2	
Permitted Phases		4	8			2
Actuated Green, G (s)	35.0	35.0	35.0	35.0	77.0	77.0
Effective Green, g (s)	35.0	35.0	35.0	35.0	77.0	77.0
Actuated g/C Ratio	0.29	0.29	0.29	0.29	0.64	0.64
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	543	461	62	543	1135	1015
v/s Ratio Prot	c0.32			0.04	0.16	
v/s Ratio Perm		0.07	0.01			c0.76
v/c Ratio	1.11	0.24	0.03	0.15	0.26	1.19
Uniform Delay, d1	42.5	32.3	30.4	31.4	9.2	21.5
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	72.6	0.3	0.2	0.1	0.1	96.4
Delay (s)	115.1	32.6	30.6	31.6	9.3	117.9
Level of Service	F	C	C	C	A	F
Approach Delay (s)	94.7			31.5	97.3	
Approach LOS	F			C	F	

Intersection Summary

HCM 2000 Control Delay	94.2	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.17		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	106.2%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
49: Greenville Rd & Southfront Rd



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	398	115	224	1163	150	134
Future Volume (vph)	398	115	224	1163	150	134
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.2	5.2	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.88	0.97	0.95	0.95	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	3433	2787	3433	3539	3539	1583
Flt Permitted	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (perm)	3433	2787	3433	3539	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	433	125	243	1264	163	146
RTOR Reduction (vph)	0	91	0	0	0	86
Lane Group Flow (vph)	433	34	243	1264	163	60
Turn Type	Prot	Perm	Prot	NA	NA	Perm
Protected Phases	8		1	6	2	
Permitted Phases		8				2
Actuated Green, G (s)	18.3	18.3	7.6	36.4	24.8	24.8
Effective Green, g (s)	17.7	17.7	7.6	38.1	26.5	26.5
Actuated g/C Ratio	0.27	0.27	0.12	0.59	0.41	0.41
Clearance Time (s)	4.6	4.6	4.0	5.7	5.7	5.7
Vehicle Extension (s)	5.0	5.0	6.0	2.5	2.5	2.5
Lane Grp Cap (vph)	934	758	401	2074	1442	645
v/s Ratio Prot	c0.13		0.07	c0.36	0.05	
v/s Ratio Perm		0.01				0.04
v/c Ratio	0.46	0.04	0.61	0.61	0.11	0.09
Uniform Delay, d1	19.7	17.4	27.3	8.7	12.0	11.8
Progression Factor	1.00	1.00	1.00	1.00	1.16	3.67
Incremental Delay, d2	0.8	0.1	4.6	1.3	0.2	0.3
Delay (s)	20.5	17.5	31.9	10.0	14.1	43.7
Level of Service	C	B	C	B	B	D
Approach Delay (s)	19.8			13.5	28.1	
Approach LOS	B			B	C	

Intersection Summary

HCM 2000 Control Delay	16.9	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.61		
Actuated Cycle Length (s)	65.0	Sum of lost time (s)	13.2
Intersection Capacity Utilization	51.2%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
50: Greenville Rd & Patterson Pass Rd

BART to Livermore Extension Project
2040 Enhanced Bus PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	41	538	65	6	12	8	66	478	333	411	216	40
Future Volume (vph)	41	538	65	6	12	8	66	478	333	411	216	40
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.98		1.00	0.94		1.00	0.94		1.00	0.98	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1833		1770	1748		1770	1748		1770	1820	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	1833		1770	1748		1770	1748		1770	1820	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	45	585	71	7	13	9	72	520	362	447	235	43
RTOR Reduction (vph)	0	4	0	0	7	0	0	20	0	0	5	0
Lane Group Flow (vph)	45	652	0	7	15	0	72	862	0	447	273	0
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												
Actuated Green, G (s)	9.6	32.0		0.8	23.2		7.6	46.8		22.0	61.2	
Effective Green, g (s)	9.6	32.0		0.8	23.2		7.6	46.8		22.0	61.2	
Actuated g/C Ratio	0.08	0.27		0.01	0.20		0.06	0.40		0.19	0.52	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	144	498		12	344		114	695		331	947	
v/s Ratio Prot	c0.03	c0.36		0.00	0.01		0.04	c0.49		c0.25	0.15	
v/s Ratio Perm												
v/c Ratio	0.31	1.31		0.58	0.04		0.63	1.24		1.35	0.29	
Uniform Delay, d1	50.9	42.8		58.2	38.2		53.6	35.4		47.8	15.9	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	1.2	153.4		56.2	0.1		10.9	119.9		176.4	0.8	
Delay (s)	52.1	196.2		114.5	38.3		64.5	155.3		224.2	16.7	
Level of Service	D	F		F	D		E	F		F	B	
Approach Delay (s)		186.9			56.7			148.4			144.6	
Approach LOS		F			E			F			F	

Intersection Summary

HCM 2000 Control Delay	157.4	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.28		
Actuated Cycle Length (s)	117.6	Sum of lost time (s)	16.0
Intersection Capacity Utilization	110.5%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
1: Dougherty Rd & Amador Valley Rd

BART to Livermore Extension Project
2040 BART + INP + Garage AM



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	105	915	485	850	2299	129
Future Volume (vph)	105	915	485	850	2299	129
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00	0.97	0.91	0.91	
Frt	1.00	0.85	1.00	1.00	0.99	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1770	1583	3433	5085	5045	
Flt Permitted	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	1770	1583	3433	5085	5045	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	114	995	527	924	2499	140
RTOR Reduction (vph)	0	125	0	0	5	0
Lane Group Flow (vph)	114	870	527	924	2634	0
Turn Type	Perm	Perm	Prot	NA	NA	
Protected Phases			5	2	6	
Permitted Phases	4	4				
Actuated Green, G (s)	42.0	42.0	11.0	65.0	50.0	
Effective Green, g (s)	42.0	42.0	11.0	65.0	50.0	
Actuated g/C Ratio	0.37	0.37	0.10	0.57	0.43	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	646	578	328	2874	2193	
v/s Ratio Prot			c0.15	0.18	c0.52	
v/s Ratio Perm	0.06	c0.55				
v/c Ratio	0.18	1.51	1.61	0.32	1.20	
Uniform Delay, d1	24.8	36.5	52.0	13.3	32.5	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.1	236.2	286.9	0.1	95.1	
Delay (s)	24.9	272.7	338.9	13.3	127.6	
Level of Service	C	F	F	B	F	
Approach Delay (s)	247.2			131.6	127.6	
Approach LOS	F			F	F	

Intersection Summary

HCM 2000 Control Delay	154.2	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.37		
Actuated Cycle Length (s)	115.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	110.6%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

2: Hopyard Road/Dougherty Rd & Dublin Blvd

BART to Livermore Extension Project
2040 BART + INP + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	56	568	518	328	828	491	694	1107	149	1123	2286	109
Future Volume (vph)	56	568	518	328	828	491	694	1107	149	1123	2286	109
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	6.0	5.0	5.0	5.5	5.0	5.0	5.5	5.0	5.0	5.5	
Lane Util. Factor	0.97	0.91	0.88	0.94	0.91	1.00	0.94	0.91	0.88	0.97	0.86	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	3433	5085	2787	4990	5085	1583	4990	5085	2787	3433	6364	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	3433	5085	2787	4990	5085	1583	4990	5085	2787	3433	6364	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	61	617	563	357	900	534	754	1203	162	1221	2485	118
RTOR Reduction (vph)	0	0	64	0	0	79	0	0	60	0	4	0
Lane Group Flow (vph)	61	617	499	357	900	455	754	1203	102	1221	2599	0
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	
Protected Phases	5	2	3	1	6	7	3	8	1	7	4	
Permitted Phases			2			6			8			
Actuated Green, G (s)	12.0	31.3	47.3	15.0	34.8	62.0	16.0	45.0	60.0	27.2	56.2	
Effective Green, g (s)	12.0	31.3	47.3	15.0	34.8	62.0	16.0	45.0	60.0	27.2	56.2	
Actuated g/C Ratio	0.09	0.22	0.34	0.11	0.25	0.44	0.11	0.32	0.43	0.19	0.40	
Clearance Time (s)	5.0	6.0	5.0	5.0	5.5	5.0	5.0	5.5	5.0	5.0	5.5	
Vehicle Extension (s)	2.0	4.5	2.0	2.0	4.5	2.0	2.0	4.5	2.0	2.0	4.5	
Lane Grp Cap (vph)	294	1136	941	534	1263	701	570	1634	1194	666	2554	
v/s Ratio Prot	0.02	c0.12	0.06	0.07	c0.18	0.13	c0.15	0.24	0.01	c0.36	c0.41	
v/s Ratio Perm			0.12			0.16			0.03			
v/c Ratio	0.21	0.54	0.53	0.67	0.71	0.65	1.32	0.74	0.09	1.83	1.02	
Uniform Delay, d1	59.6	48.0	37.4	60.1	48.0	30.5	62.0	42.2	23.7	56.4	41.9	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	0.84	0.76	0.87	1.00	1.00	
Incremental Delay, d2	0.1	1.9	0.3	2.5	3.4	1.6	155.0	1.6	0.0	380.9	22.3	
Delay (s)	59.7	49.9	37.7	62.6	51.5	32.1	207.1	33.7	20.7	437.3	64.2	
Level of Service	E	D	D	E	D	C	F	C	C	F	E	
Approach Delay (s)		44.8			47.9			94.4			183.3	
Approach LOS		D			D			F			F	

Intersection Summary

HCM 2000 Control Delay	116.2	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.10		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	21.5
Intersection Capacity Utilization	99.4%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

3: Dougherty Rd/Hopyard Road & I-580 WB Ramps

BART to Livermore Extension Project
2040 BART + INP + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↔↔		↔↔		↑↑↑			↑↑↑	↔
Traffic Volume (vph)	0	0	0	396	0	637	0	1659	0	0	2258	0
Future Volume (vph)	0	0	0	396	0	637	0	1659	0	0	2258	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0		4.0		4.0			4.0	
Lane Util. Factor				0.97		0.88		0.91			0.86	
Frt				1.00		0.85		1.00			1.00	
Flt Protected				0.95		1.00		1.00			1.00	
Satd. Flow (prot)				3433		2787		5085			4806	
Flt Permitted				0.95		1.00		1.00			1.00	
Satd. Flow (perm)				3433		2787		5085			4806	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	430	0	692	0	1803	0	0	2454	0
RTOR Reduction (vph)	0	0	0	0	0	28	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	430	0	664	0	1803	0	0	2454	0
Turn Type				Prot		Prot		NA			NA	Perm
Protected Phases				4		4		2			6	
Permitted Phases												6
Actuated Green, G (s)				38.5		38.5		90.7			90.7	
Effective Green, g (s)				39.9		39.9		92.1			92.1	
Actuated g/C Ratio				0.28		0.28		0.66			0.66	
Clearance Time (s)				5.4		5.4		5.4			5.4	
Vehicle Extension (s)				3.0		3.0		3.0			3.0	
Lane Grp Cap (vph)				978		794		3345			3161	
v/s Ratio Prot				0.13		c0.24		0.35			c0.51	
v/s Ratio Perm												
v/c Ratio				0.44		0.84		0.54			0.78	
Uniform Delay, d1				40.9		47.0		12.7			16.7	
Progression Factor				1.00		1.00		0.96			0.44	
Incremental Delay, d2				0.3		7.6		0.6			0.8	
Delay (s)				41.2		54.6		12.8			8.1	
Level of Service				D		D		B			A	
Approach Delay (s)		0.0			49.5			12.8			8.1	
Approach LOS		A			D			B			A	

Intersection Summary

HCM 2000 Control Delay	18.3	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.79		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	61.6%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

4: Hopyard Rd/Dougherty Rd & I-580 EB Ramps

BART to Livermore Extension Project
2040 BART + INP + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗		↖↗					↑↑↑	↖		↑↑↑	↖
Traffic Volume (vph)	896	0	1451	0	0	0	0	853	0	0	1799	0
Future Volume (vph)	896	0	1451	0	0	0	0	853	0	0	1799	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0					4.0			4.0	
Lane Util. Factor	0.97		0.88					0.91			0.86	
Frt	1.00		0.85					1.00			1.00	
Flt Protected	0.95		1.00					1.00			1.00	
Satd. Flow (prot)	3433		2787					5085			4806	
Flt Permitted	0.95		1.00					1.00			1.00	
Satd. Flow (perm)	3433		2787					5085			4806	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	974	0	1577	0	0	0	0	927	0	0	1955	0
RTOR Reduction (vph)	0	0	9	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	974	0	1568	0	0	0	0	927	0	0	1955	0
Turn Type	Prot		Prot					NA	Free		NA	Perm
Protected Phases	4		4					2			6	
Permitted Phases									Free			6
Actuated Green, G (s)	73.2		73.2					56.0			56.0	
Effective Green, g (s)	74.6		74.6					57.4			57.4	
Actuated g/C Ratio	0.53		0.53					0.41			0.41	
Clearance Time (s)	5.4		5.4					5.4			5.4	
Vehicle Extension (s)	3.0		3.0					3.0			3.0	
Lane Grp Cap (vph)	1829		1485					2084			1970	
v/s Ratio Prot	0.28		c0.56					0.18			c0.41	
v/s Ratio Perm												
v/c Ratio	0.53		1.06					0.44			0.99	
Uniform Delay, d1	21.3		32.7					29.8			41.1	
Progression Factor	1.00		1.00					1.00			1.01	
Incremental Delay, d2	0.3		39.7					0.7			15.0	
Delay (s)	21.6		72.4					30.5			56.6	
Level of Service	C		E					C			E	
Approach Delay (s)		53.0			0.0			30.5			56.6	
Approach LOS		D			A			C			E	





























Intersection Summary

HCM 2000 Control Delay	50.5	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	1.03		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	92.2%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
5: Hopyard Rd & Owens Rd

BART to Livermore Extension Project
2040 BART + INP + Garage AM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		 						  		 	 	
Traffic Volume (vph)	189	107	54	132	131	207	162	833	204	988	1780	533
Future Volume (vph)	189	107	54	132	131	207	162	833	204	988	1780	533
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	2.7	2.7		2.7	2.7	2.7	4.0	2.3	2.3	4.0	2.3	
Lane Util. Factor	0.91	0.91		1.00	0.95	0.95	1.00	0.91	1.00	0.97	0.91	
Frt	1.00	0.97		1.00	0.95	0.85	1.00	1.00	0.85	1.00	0.97	
Flt Protected	0.95	0.98		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1610	3222		1770	1682	1504	1770	5085	1583	3433	4910	
Flt Permitted	0.95	0.98		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1610	3222		1770	1682	1504	1770	5085	1583	3433	4910	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	205	116	59	143	142	225	176	905	222	1074	1935	579
RTOR Reduction (vph)	0	27	0	0	19	30	0	0	156	0	60	0
Lane Group Flow (vph)	113	240	0	143	193	125	176	905	66	1074	2454	0
Turn Type	Split	NA		Split	NA	pm+ov	Prot	NA	Perm	Prot	NA	
Protected Phases	8	8		4	4	1	5	2		1	6	
Permitted Phases						4			2			
Actuated Green, G (s)	6.0	6.0		9.2	9.2	42.9	10.8	25.1	25.1	33.7	48.0	
Effective Green, g (s)	7.3	7.3		10.5	10.5	45.5	10.8	26.8	26.8	33.7	49.7	
Actuated g/C Ratio	0.08	0.08		0.12	0.12	0.51	0.12	0.30	0.30	0.37	0.55	
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	130	261		206	196	805	212	1514	471	1285	2711	
v/s Ratio Prot	0.07	c0.07		0.08	c0.11	0.06	0.10	0.18		c0.31	c0.50	
v/s Ratio Perm						0.02			0.04			
v/c Ratio	0.87	0.92		0.69	0.98	0.16	0.83	0.60	0.14	0.84	0.91	
Uniform Delay, d1	40.9	41.1		38.2	39.7	11.9	38.7	27.0	23.2	25.6	18.0	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	41.8	35.2		9.7	58.9	0.1	23.2	1.7	0.6	4.9	5.6	
Delay (s)	82.6	76.3		47.9	98.5	12.0	61.9	28.7	23.8	30.5	23.6	
Level of Service	F	E		D	F	B	E	C	C	C	C	
Approach Delay (s)		78.2			58.0			32.4			25.7	
Approach LOS		E			E			C			C	


































Intersection Summary

HCM 2000 Control Delay	33.5	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.93		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	11.7
Intersection Capacity Utilization	86.5%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
6: Hopyard Rd & Stoneridge Dr

BART to Livermore Extension Project
2040 BART + INP + Garage AM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 	  		 	  		  	 		  		
Traffic Volume (vph)	232	791	474	66	960	134	627	848	69	294	1023	296
Future Volume (vph)	232	791	474	66	960	134	627	848	69	294	1023	296
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.91	1.00	0.97	0.91	1.00	0.94	0.95	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5085	1583	3433	5085	1583	4990	3539	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5085	1583	3433	5085	1583	4990	3539	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	252	860	515	72	1043	146	682	922	75	320	1112	322
RTOR Reduction (vph)	0	0	203	0	0	104	0	0	53	0	0	127
Lane Group Flow (vph)	252	860	312	72	1043	42	682	922	22	320	1112	195
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8			2			6
Actuated Green, G (s)	4.0	19.1	19.1	2.4	17.5	17.5	8.0	18.0	18.0	6.0	16.0	16.0
Effective Green, g (s)	4.0	19.1	19.1	2.4	17.5	17.5	8.0	18.0	18.0	6.0	16.0	16.0
Actuated g/C Ratio	0.07	0.31	0.31	0.04	0.28	0.28	0.13	0.29	0.29	0.10	0.26	0.26
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	223	1579	491	133	1446	450	649	1035	463	334	1322	411
v/s Ratio Prot	c0.07	0.17		0.02	c0.21		c0.14	c0.26		0.09	0.22	
v/s Ratio Perm			0.20			0.03			0.01			0.12
v/c Ratio	1.13	0.54	0.63	0.54	0.72	0.09	1.05	0.89	0.05	0.96	0.84	0.48
Uniform Delay, d1	28.8	17.6	18.2	29.0	19.8	16.2	26.8	20.8	15.6	27.6	21.5	19.2
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	99.7	0.4	2.7	4.4	1.8	0.1	49.4	9.8	0.0	37.8	5.0	0.9
Delay (s)	128.4	18.0	20.9	33.5	21.6	16.3	76.2	30.6	15.6	65.4	26.6	20.1
Level of Service	F	B	C	C	C	B	E	C	B	E	C	C
Approach Delay (s)		36.0			21.7			48.4			32.5	
Approach LOS		D			C			D			C	

Intersection Summary

HCM 2000 Control Delay	35.5	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.90		
Actuated Cycle Length (s)	61.5	Sum of lost time (s)	16.0
Intersection Capacity Utilization	70.3%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
7: Hopyard Rd & Las Positas Blvd

BART to Livermore Extension Project
2040 BART + INP + Garage AM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	158	489	410	356	454	55	463	1229	395	114	1076	95
Future Volume (vph)	158	489	410	356	454	55	463	1229	395	114	1076	95
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.95	1.00	0.97	0.95	1.00	0.97	0.91	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	3433	3539	1583	3433	5085	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	3433	3539	1583	3433	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	172	532	446	387	493	60	503	1336	429	124	1170	103
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	73
Lane Group Flow (vph)	172	532	446	387	493	60	503	1336	429	124	1170	30
Turn Type	Prot	NA	Free	Prot	NA	Free	Prot	NA	Free	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1		6
Permitted Phases			Free			Free			Free			6
Actuated Green, G (s)	6.9	14.5	69.4	8.0	15.6	69.4	11.0	27.7	69.4	3.2	19.9	19.9
Effective Green, g (s)	6.9	14.5	69.4	8.0	15.6	69.4	11.0	27.7	69.4	3.2	19.9	19.9
Actuated g/C Ratio	0.10	0.21	1.00	0.12	0.22	1.00	0.16	0.40	1.00	0.05	0.29	0.29
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	341	739	1583	395	795	1583	544	2029	1583	158	1458	453
v/s Ratio Prot	0.05	c0.15		c0.11	0.14		c0.15	0.26		0.04	c0.23	
v/s Ratio Perm			c0.28			0.04			0.27			0.02
v/c Ratio	0.50	0.72	0.28	0.98	0.62	0.04	0.92	0.66	0.27	0.78	0.80	0.07
Uniform Delay, d1	29.6	25.6	0.0	30.6	24.2	0.0	28.8	17.0	0.0	32.8	22.9	18.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.2	3.4	0.4	39.4	1.5	0.0	21.6	0.8	0.4	22.1	3.3	0.1
Delay (s)	30.8	28.9	0.4	70.0	25.7	0.0	50.4	17.8	0.4	54.8	26.2	18.1
Level of Service	C	C	A	E	C	A	D	B	A	D	C	B
Approach Delay (s)		18.2			42.3			21.7			28.2	
Approach LOS		B			D			C			C	

































Intersection Summary

HCM 2000 Control Delay	25.9	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.84		
Actuated Cycle Length (s)	69.4	Sum of lost time (s)	16.0
Intersection Capacity Utilization	71.0%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
8: Willow Rd & Owens Rd

BART to Livermore Extension Project
2040 BART + INP + Garage AM

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations	 	  		 	  			 		 	 		
Traffic Volume (vph)	209	462	248	104	359	125	100	124	0	107	86	97	
Future Volume (vph)	209	462	248	104	359	125	100	124	0	107	86	97	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	5.3	4.0		5.3	4.0	4.0	
Lane Util. Factor	0.97	0.91		0.97	0.91	1.00	1.00	0.95		1.00	1.00	1.00	
Frt	1.00	0.95		1.00	1.00	0.85	1.00	1.00		1.00	1.00	0.85	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	
Satd. Flow (prot)	3433	4819		3433	5085	1583	1770	3539		1770	1863	1583	
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.70	1.00		0.67	1.00	1.00	
Satd. Flow (perm)	3433	4819		3433	5085	1583	1298	3539		1241	1863	1583	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	
Adj. Flow (vph)	227	502	270	113	390	136	109	135	0	116	93	105	
RTOR Reduction (vph)	0	136	0	0	0	87	0	0	0	0	0	83	
Lane Group Flow (vph)	227	636	0	113	390	49	109	135	0	116	93	22	
Turn Type	Prot	NA		Prot	NA	Perm	Perm	NA	Perm	Perm	NA	Perm	
Protected Phases	1	6		5	2			4			8		
Permitted Phases						2	4		4	8		8	
Actuated Green, G (s)	5.6	15.3		3.7	13.4	13.4	7.5	7.5		7.5	7.5	7.5	
Effective Green, g (s)	5.6	17.0		3.7	15.1	15.1	7.5	8.8		7.5	8.8	8.8	
Actuated g/C Ratio	0.13	0.41		0.09	0.36	0.36	0.18	0.21		0.18	0.21	0.21	
Clearance Time (s)	4.0	5.7		4.0	5.7	5.7	5.3	5.3		5.3	5.3	5.3	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	
Lane Grp Cap (vph)	463	1974		306	1850	575	234	750		224	395	335	
v/s Ratio Prot	c0.07	c0.13		c0.03	0.08			0.04			0.05		
v/s Ratio Perm						0.03	0.08			c0.09		0.01	
v/c Ratio	0.49	0.32		0.37	0.21	0.09	0.47	0.18		0.52	0.24	0.07	
Uniform Delay, d1	16.6	8.3		17.8	9.1	8.7	15.2	13.4		15.4	13.6	13.1	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	
Incremental Delay, d2	0.8	0.1		0.8	0.1	0.1	1.5	0.1		2.0	0.3	0.1	
Delay (s)	17.4	8.4		18.6	9.2	8.7	16.7	13.5		17.4	13.9	13.2	
Level of Service	B	A		B	A	A	B	B		B	B	B	
Approach Delay (s)		10.5			10.7			14.9			14.9		
Approach LOS		B			B			B			B		
Intersection Summary													
HCM 2000 Control Delay			11.7									HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio			0.38										
Actuated Cycle Length (s)			41.5									Sum of lost time (s)	12.0
Intersection Capacity Utilization			42.6%									ICU Level of Service	A
Analysis Period (min)			15										
c Critical Lane Group													

HCM Signalized Intersection Capacity Analysis
9: Hacienda Dr & Dublin Blvd

BART to Livermore Extension Project
2040 BART + INP + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↑↑↑	↖↗	↖↗	↑↑↑		↖↗	↑↑	↖↗	↖↗	↑↑↑	↖↗
Traffic Volume (vph)	89	394	120	282	765	80	182	709	124	11	399	133
Future Volume (vph)	89	394	120	282	765	80	182	709	124	11	399	133
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	6.0	5.0	4.5	6.0		5.0	6.0	6.0	4.5	5.5	5.5
Lane Util. Factor	0.97	0.91	0.88	0.97	0.91		0.94	0.95	0.88	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5085	2787	3433	5013		4990	3539	2787	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5085	2787	3433	5013		4990	3539	2787	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	97	428	130	307	832	87	198	771	135	12	434	145
RTOR Reduction (vph)	0	0	53	0	8	0	0	0	97	0	0	126
Lane Group Flow (vph)	97	428	77	307	911	0	198	771	38	12	434	19
Turn Type	Prot	NA	pm+ov	Prot	NA		Prot	NA	Perm	Prot	NA	Perm
Protected Phases	5	2	3	1	6		3	8		7	NA	4
Permitted Phases			2						8			4
Actuated Green, G (s)	9.3	59.8	82.7	17.7	68.2		22.9	38.9	38.9	2.6	18.6	18.6
Effective Green, g (s)	9.3	59.8	82.7	17.7	68.2		22.9	38.9	38.9	2.6	18.6	18.6
Actuated g/C Ratio	0.07	0.43	0.59	0.13	0.49		0.16	0.28	0.28	0.02	0.13	0.13
Clearance Time (s)	4.5	6.0	5.0	4.5	6.0		5.0	6.0	6.0	4.5	5.5	5.5
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	228	2172	1646	434	2442		816	983	774	63	675	210
v/s Ratio Prot	0.03	0.08	0.01	c0.09	c0.18		0.04	c0.22		0.00	c0.09	
v/s Ratio Perm			0.02						0.01			0.01
v/c Ratio	0.43	0.20	0.05	0.71	0.37		0.24	0.78	0.05	0.19	0.64	0.09
Uniform Delay, d1	62.8	25.1	12.1	58.7	22.5		51.0	46.7	37.0	67.7	57.6	53.3
Progression Factor	1.00	1.00	1.00	1.00	1.00		0.79	0.78	0.45	1.00	1.00	1.00
Incremental Delay, d2	1.3	0.2	0.0	5.2	0.4		0.2	4.1	0.0	1.5	2.1	0.2
Delay (s)	64.1	25.3	12.1	63.9	22.9		40.6	40.5	16.5	69.1	59.7	53.5
Level of Service	E	C	B	E	C		D	D	B	E	E	D
Approach Delay (s)		28.4			33.2			37.6			58.3	
Approach LOS		C			C			D			E	

Intersection Summary

HCM 2000 Control Delay	37.8	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.58		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	21.0
Intersection Capacity Utilization	60.3%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 10: Hacienda Dr & Martinelli Blvd/Hacienda Crossings

BART to Livermore Extension Project
 2040 BART + INP + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗	↖↗	↖↗	↗		↖↗↘	↖↗↘	↗	↖↗	↖↗↘	
Traffic Volume (vph)	16	11	227	107	13	9	255	970	109	17	736	55
Future Volume (vph)	16	11	227	107	13	9	255	970	109	17	736	55
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	2.0	2.0	4.5	2.0		3.0	2.0	2.0	4.5	2.5	
Lane Util. Factor	1.00	0.91	0.91	0.97	1.00		0.94	0.91	1.00	0.97	0.86	
Frt	1.00	0.90	0.85	1.00	0.94		1.00	1.00	0.85	1.00	0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1770	1523	2882	3433	1746		4990	5085	1583	3433	6341	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1770	1523	2882	3433	1746		4990	5085	1583	3433	6341	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	17	12	247	116	14	10	277	1054	118	18	800	60
RTOR Reduction (vph)	0	23	200	0	9	0	0	0	25	0	4	0
Lane Group Flow (vph)	17	15	22	116	15	0	277	1054	93	18	856	0
Turn Type	Prot	NA	Perm	Prot	NA		Prot	NA	pm+ov	Prot	NA	
Protected Phases	5	2		1	6		3	8	1	7	4	
Permitted Phases			2						8			
Actuated Green, G (s)	4.8	12.0	12.0	11.5	18.7		13.1	95.2	106.7	5.3	87.4	
Effective Green, g (s)	4.3	14.0	14.0	11.0	20.7		14.1	97.2	110.7	4.8	88.9	
Actuated g/C Ratio	0.03	0.10	0.10	0.08	0.15		0.10	0.69	0.79	0.03	0.64	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	4.0	4.0	2.0	4.0		3.0	4.0	2.0	3.0	4.0	
Lane Grp Cap (vph)	54	152	288	269	258		502	3530	1274	117	4026	
v/s Ratio Prot	0.01	c0.01		c0.03	0.01		c0.06	c0.21	0.01	0.01	c0.13	
v/s Ratio Perm			0.01						0.05			
v/c Ratio	0.31	0.10	0.08	0.43	0.06		0.55	0.30	0.07	0.15	0.21	
Uniform Delay, d1	66.4	57.2	57.1	61.5	51.3		59.9	8.3	3.3	65.6	10.8	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.02	1.05	2.03	0.77	0.15	
Incremental Delay, d2	3.3	0.4	0.2	0.4	0.1		1.2	0.2	0.0	0.6	0.1	
Delay (s)	69.7	57.6	57.3	61.9	51.4		62.2	8.9	6.6	51.0	1.7	
Level of Service	E	E	E	E	D		E	A	A	D	A	
Approach Delay (s)		58.1			60.1			18.9			2.7	
Approach LOS		E			E			B			A	

Intersection Summary		
HCM 2000 Control Delay	19.8	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.32	B
Actuated Cycle Length (s)	140.0	Sum of lost time (s)
Intersection Capacity Utilization	44.2%	13.0
Analysis Period (min)	15	ICU Level of Service
		A

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 11: Hacienda Dr & I-580 WB Ramps

BART to Livermore Extension Project
 2040 BART + INP + Garage AM


























Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↔↔		↔↔		↑↑↑			↑↑↑	↔
Traffic Volume (vph)	0	0	0	239	0	449	0	1253	274	0	739	416
Future Volume (vph)	0	0	0	239	0	449	0	1253	274	0	739	416
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				2.6		2.6		2.1			2.1	2.1
Lane Util. Factor				0.97		0.88		0.91			0.86	0.86
Frt				1.00		0.85		0.97			0.97	0.85
Flt Protected				0.95		1.00		1.00			1.00	1.00
Satd. Flow (prot)				3433		2787		4948			4648	1362
Flt Permitted				0.95		1.00		1.00			1.00	1.00
Satd. Flow (perm)				3433		2787		4948			4648	1362
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	260	0	488	0	1362	298	0	803	452
RTOR Reduction (vph)	0	0	0	0	0	68	0	39	0	0	53	72
Lane Group Flow (vph)	0	0	0	260	0	420	0	1621	0	0	976	154
Turn Type				Prot		Prot		NA			NA	Perm
Protected Phases				4		4		2			6	
Permitted Phases												6
Actuated Green, G (s)				16.1		16.1		45.9			45.9	45.9
Effective Green, g (s)				17.5		17.5		47.8			47.8	47.8
Actuated g/C Ratio				0.25		0.25		0.68			0.68	0.68
Clearance Time (s)				4.0		4.0		4.0			4.0	4.0
Vehicle Extension (s)				3.0		3.0		3.0			3.0	3.0
Lane Grp Cap (vph)				858		696		3378			3173	930
v/s Ratio Prot				0.08		c0.15		c0.33			0.21	
v/s Ratio Perm												0.11
v/c Ratio				0.30		0.60		0.48			0.31	0.17
Uniform Delay, d1				21.3		23.2		5.2			4.5	4.0
Progression Factor				1.00		1.00		0.69			0.43	0.67
Incremental Delay, d2				0.2		1.5		0.4			0.2	0.4
Delay (s)				21.5		24.7		4.1			2.2	3.0
Level of Service				C		C		A			A	A
Approach Delay (s)		0.0			23.6			4.1			2.3	
Approach LOS		A			C			A			A	

Intersection Summary			
HCM 2000 Control Delay	7.4	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.51		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	4.7
Intersection Capacity Utilization	52.7%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group







































HCM Signalized Intersection Capacity Analysis
 12: Hacienda Dr & I-580 EB Ramps

BART to Livermore Extension Project
 2040 BART + INP + Garage AM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 		 					  			  	
Traffic Volume (vph)	818	0	1161	0	0	0	0	671	166	0	1027	205
Future Volume (vph)	818	0	1161	0	0	0	0	671	166	0	1027	205
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0					4.0	4.0		4.0	
Lane Util. Factor	0.97		0.88					0.86	0.86		0.91	
Frt	1.00		0.85					0.99	0.85		0.98	
Flt Protected	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (prot)	3433		2787					4754	1362		4958	
Flt Permitted	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (perm)	3433		2787					4754	1362		4958	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	889	0	1262	0	0	0	0	729	180	0	1116	223
RTOR Reduction (vph)	0	0	26	0	0	0	0	12	74	0	44	0
Lane Group Flow (vph)	889	0	1236	0	0	0	0	773	50	0	1295	0
Turn Type	Prot		Prot					NA	Perm		NA	
Protected Phases	4		4					2			6	
Permitted Phases									2			
Actuated Green, G (s)	32.4		32.4					26.3	26.3		26.3	
Effective Green, g (s)	33.8		33.8					28.2	28.2		28.2	
Actuated g/C Ratio	0.48		0.48					0.40	0.40		0.40	
Clearance Time (s)	5.4		5.4					5.9	5.9		5.9	
Vehicle Extension (s)	2.0		2.0					2.0	2.0		2.0	
Lane Grp Cap (vph)	1657		1345					1915	548		1997	
v/s Ratio Prot	0.26		c0.44					0.16			c0.26	
v/s Ratio Perm									0.04			
v/c Ratio	0.54		0.92					0.40	0.09		0.65	
Uniform Delay, d1	12.6		16.8					14.9	13.0		16.9	
Progression Factor	1.00		1.00					1.00	1.00		0.88	
Incremental Delay, d2	0.2		10.0					0.6	0.3		1.6	
Delay (s)	12.8		26.8					15.5	13.3		16.4	
Level of Service	B		C					B	B		B	
Approach Delay (s)		21.0			0.0			15.2			16.4	
Approach LOS		C			A			B			B	
Intersection Summary												
HCM 2000 Control Delay			18.4					HCM 2000 Level of Service			B	
HCM 2000 Volume to Capacity ratio			0.80									
Actuated Cycle Length (s)			70.0					Sum of lost time (s)			8.0	
Intersection Capacity Utilization			71.7%					ICU Level of Service			C	
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis
13: Hacienda Dr & Owens Rd

BART to Livermore Extension Project
2040 BART + INP + Garage AM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 	  		  	  		 	  		  	  	
Traffic Volume (vph)	154	282	26	149	463	430	29	303	143	668	902	610
Future Volume (vph)	154	282	26	149	463	430	29	303	143	668	902	610
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	2.3	4.0	4.0	2.3	4.0	4.0	2.7	4.0	4.0	2.7
Lane Util. Factor	0.97	0.91	1.00	0.97	0.91	1.00	0.97	0.91	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5085	1583	3433	5085	1583	3433	5085	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5085	1583	3433	5085	1583	3433	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	167	307	28	162	503	467	32	329	155	726	980	663
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	167	307	28	162	503	467	32	329	155	726	980	663
Turn Type	Prot	NA	Free	Prot	NA	Free	Prot	NA	Free	Prot	NA	Free
Protected Phases	1	6		5	2		7	4		3	8	
Permitted Phases			Free			Free			Free			Free
Actuated Green, G (s)	11.9	17.7	115.0	11.6	17.4	115.0	4.3	33.1	115.0	33.6	62.4	115.0
Effective Green, g (s)	11.9	19.4	115.0	11.6	19.1	115.0	4.3	34.4	115.0	33.6	63.7	115.0
Actuated g/C Ratio	0.10	0.17	1.00	0.10	0.17	1.00	0.04	0.30	1.00	0.29	0.55	1.00
Clearance Time (s)	4.0	5.7		4.0	5.7		4.0	5.3		4.0	5.3	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	355	857	1583	346	844	1583	128	1521	1583	1003	2816	1583
v/s Ratio Prot	0.05	0.06		0.05	c0.10		0.01	0.06		c0.21	0.19	
v/s Ratio Perm			0.02			0.29			0.10			c0.42
v/c Ratio	0.47	0.36	0.02	0.47	0.60	0.30	0.25	0.22	0.10	0.72	0.35	0.42
Uniform Delay, d1	48.6	42.3	0.0	48.8	44.4	0.0	53.8	30.2	0.0	36.5	14.2	0.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.0	0.3	0.0	1.0	1.1	0.5	1.0	0.3	0.1	2.6	0.3	0.8
Delay (s)	49.6	42.5	0.0	49.8	45.5	0.5	54.8	30.5	0.1	39.2	14.5	0.8
Level of Service	D	D	A	D	D	A	D	C	A	D	B	A
Approach Delay (s)		42.5			27.5			22.9			18.2	
Approach LOS		D			C			C			B	
Intersection Summary												
HCM 2000 Control Delay			23.8				HCM 2000 Level of Service			C		
HCM 2000 Volume to Capacity ratio			0.59									
Actuated Cycle Length (s)			115.0				Sum of lost time (s)			16.0		
Intersection Capacity Utilization			51.6%				ICU Level of Service			A		
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis
14: Tassajara Rd & Dublin Blvd

BART to Livermore Extension Project
2040 BART + INP + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔↔	↑↑↑	↔↔	↔↔↔	↑↑↑		↔↔↔	↑↑↑	↔	↔↔	↑↑↑	↔↔
Traffic Volume (vph)	101	202	149	588	980	57	249	500	177	34	1187	290
Future Volume (vph)	101	202	149	588	980	57	249	500	177	34	1187	290
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	6.0	6.0	5.0	6.0		5.0	6.0	6.0	5.0	5.7	5.7
Lane Util. Factor	0.97	0.86	0.88	0.94	0.91		0.94	0.86	1.00	0.97	0.86	0.88
Frt	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	6408	2787	4990	5043		4990	6408	1583	3433	6408	2787
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	6408	2787	4990	5043		4990	6408	1583	3433	6408	2787
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	110	220	162	639	1065	62	271	543	192	37	1290	315
RTOR Reduction (vph)	0	0	122	0	4	0	0	0	140	0	0	220
Lane Group Flow (vph)	110	220	40	639	1123	0	271	543	52	37	1290	95
Turn Type	Prot	NA	Perm	Prot	NA		Prot	NA	Perm	Prot	NA	Perm
Protected Phases	5	2		1	6		3	8		7	NA	4
Permitted Phases			2						8			4
Actuated Green, G (s)	16.2	33.7	33.7	22.1	39.6		18.3	37.0	37.0	22.3	41.3	41.3
Effective Green, g (s)	16.2	33.7	33.7	22.1	39.6		18.3	37.0	37.0	22.3	41.3	41.3
Actuated g/C Ratio	0.12	0.25	0.25	0.16	0.29		0.13	0.27	0.27	0.16	0.30	0.30
Clearance Time (s)	5.0	6.0	6.0	5.0	6.0		5.0	6.0	6.0	5.0	5.7	5.7
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	405	1575	685	804	1456		666	1729	427	558	1930	839
v/s Ratio Prot	0.03	0.03		c0.13	c0.22		c0.05	0.08		c0.01	c0.20	
v/s Ratio Perm			0.01						0.03			0.03
v/c Ratio	0.27	0.14	0.06	0.79	0.77		0.41	0.31	0.12	0.07	0.67	0.11
Uniform Delay, d1	55.1	40.4	39.6	55.3	44.6		54.4	39.9	37.8	48.6	41.9	34.7
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.4	0.0	0.0	5.5	2.6		0.4	0.1	0.1	0.1	0.9	0.1
Delay (s)	55.4	40.4	39.6	60.8	47.2		54.8	40.0	37.9	48.6	42.8	34.7
Level of Service	E	D	D	E	D		D	D	D	D	D	C
Approach Delay (s)		43.5			52.1			43.6			41.4	
Approach LOS		D			D			D			D	

Intersection Summary

HCM 2000 Control Delay	45.9	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.70		
Actuated Cycle Length (s)	137.1	Sum of lost time (s)	22.0
Intersection Capacity Utilization	82.2%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 15: Tassajara Rd & I-580 WB Ramps

BART to Livermore Extension Project
 2040 BART + INP + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↔		↔		↑↑	↔		↑↑↑	↔
Traffic Volume (vph)	0	0	0	604	0	296	0	1192	475	0	1041	935
Future Volume (vph)	0	0	0	604	0	296	0	1192	475	0	1041	935
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0		4.0		4.0	4.0		4.0	4.0
Lane Util. Factor				0.97		0.88		0.95	1.00		0.86	0.86
Frt				1.00		0.85		1.00	0.85		0.95	0.85
Flt Protected				0.95		1.00		1.00	1.00		1.00	1.00
Satd. Flow (prot)				3433		2787		3539	1583		4583	1362
Flt Permitted				0.95		1.00		1.00	1.00		1.00	1.00
Satd. Flow (perm)				3433		2787		3539	1583		4583	1362
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	657	0	322	0	1296	516	0	1132	1016
RTOR Reduction (vph)	0	0	0	0	0	67	0	0	198	0	103	194
Lane Group Flow (vph)	0	0	0	657	0	255	0	1296	318	0	1537	314
Turn Type				Perm		Perm		NA	Perm		NA	Perm
Protected Phases								2			6	
Permitted Phases				8		8			2			6
Actuated Green, G (s)				18.8		18.8		43.2	43.2		43.2	43.2
Effective Green, g (s)				18.8		18.8		43.2	43.2		43.2	43.2
Actuated g/C Ratio				0.27		0.27		0.62	0.62		0.62	0.62
Clearance Time (s)				4.0		4.0		4.0	4.0		4.0	4.0
Vehicle Extension (s)				3.0		3.0		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)				922		748		2184	976		2828	840
v/s Ratio Prot								c0.37			0.34	
v/s Ratio Perm				c0.19		0.09			0.20			0.23
v/c Ratio				0.71		0.34		0.59	0.33		0.54	0.37
Uniform Delay, d1				23.2		20.6		8.1	6.4		7.7	6.7
Progression Factor				1.00		1.00		1.00	1.00		1.00	1.00
Incremental Delay, d2				2.6		0.3		1.2	0.9		0.8	1.3
Delay (s)				25.8		20.9		9.3	7.3		8.5	7.9
Level of Service				C		C		A	A		A	A
Approach Delay (s)		0.0			24.2			8.7			8.3	
Approach LOS		A			C			A			A	

Intersection Summary		
HCM 2000 Control Delay	11.6	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.63	B
Actuated Cycle Length (s)	70.0	Sum of lost time (s)
Intersection Capacity Utilization	56.8%	8.0
Analysis Period (min)	15	ICU Level of Service
		B

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 16: Santa Rita Rd & I-580 EB Ramps/Pimilco Dr

BART to Livermore Extension Project
 2040 BART + INP + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	549	124	750	190	0	184	0	905	134	194	1347	0
Future Volume (vph)	549	124	750	190	0	184	0	905	134	194	1347	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0		4.0		4.0		4.0	4.0	
Lane Util. Factor	0.97	1.00	1.00	0.97		0.88		0.86		1.00	0.95	
Frt	1.00	1.00	0.85	1.00		0.85		0.98		1.00	1.00	
Flt Protected	0.95	1.00	1.00	0.95		1.00		1.00		0.95	1.00	
Satd. Flow (prot)	3433	1863	1583	3433		2787		6284		1770	3539	
Flt Permitted	0.95	1.00	1.00	0.95		1.00		1.00		0.95	1.00	
Satd. Flow (perm)	3433	1863	1583	3433		2787		6284		1770	3539	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	597	135	815	207	0	200	0	984	146	211	1464	0
RTOR Reduction (vph)	0	0	0	0	0	71	0	44	0	0	0	0
Lane Group Flow (vph)	597	135	815	207	0	129	0	1086	0	211	1464	0
Turn Type	Perm	NA	Free	Prot		pm+ov		NA		Prot	NA	Perm
Protected Phases		4		3		1		2		1	6	
Permitted Phases	4		Free			3						6
Actuated Green, G (s)	14.8	14.8	60.0	4.3		12.9		16.3		8.6	28.9	
Effective Green, g (s)	14.8	14.8	60.0	4.3		12.9		16.3		8.6	28.9	
Actuated g/C Ratio	0.25	0.25	1.00	0.07		0.22		0.27		0.14	0.48	
Clearance Time (s)	4.0	4.0		4.0		4.0		4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0		3.0		3.0		3.0	3.0	
Lane Grp Cap (vph)	846	459	1583	246		599		1707		253	1704	
v/s Ratio Prot		0.07		0.06		0.03		0.17		0.12	c0.41	
v/s Ratio Perm	c0.17		c0.51			0.02						
v/c Ratio	0.71	0.29	0.51	0.84		0.21		0.64		0.83	0.86	
Uniform Delay, d1	20.6	18.4	0.0	27.5		19.4		19.2		25.0	13.8	
Progression Factor	1.00	1.00	1.00	1.00		1.00		1.00		1.00	1.00	
Incremental Delay, d2	2.7	0.4	1.2	22.1		0.2		1.8		20.4	5.9	
Delay (s)	23.3	18.7	1.2	49.6		19.6		21.1		45.4	19.6	
Level of Service	C	B	A	D		B		C		D	B	
Approach Delay (s)		11.3			34.8			21.1			22.9	
Approach LOS		B			C			C			C	

Intersection Summary

HCM 2000 Control Delay	19.7	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.90		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	59.6%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 17: Santa Rita Rd & Valley Ave

BART to Livermore Extension Project
 2040 BART + INP + Garage AM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	221	251	82	193	425	1005	122	591	86	601	897	181
Future Volume (vph)	221	251	82	193	425	1005	122	591	86	601	897	181
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.97	0.95		0.97	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.98		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	3433	3472		3433	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	3433	3472		3433	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	240	273	89	210	462	1092	133	642	93	653	975	197
RTOR Reduction (vph)	0	0	73	0	0	0	0	15	0	0	0	116
Lane Group Flow (vph)	240	273	16	210	462	1092	133	720	0	653	975	81
Turn Type	Prot	NA	Perm	Prot	NA	Free	Prot	NA		Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1		6
Permitted Phases			4			Free						6
Actuated Green, G (s)	8.7	12.9	12.9	10.0	14.2	72.4	3.9	18.5		15.0	29.6	29.6
Effective Green, g (s)	8.7	12.9	12.9	10.0	14.2	72.4	3.9	18.5		15.0	29.6	29.6
Actuated g/C Ratio	0.12	0.18	0.18	0.14	0.20	1.00	0.05	0.26		0.21	0.41	0.41
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	412	630	282	244	694	1583	184	887		711	1446	647
v/s Ratio Prot	0.07	0.08		0.12	0.13		0.04	0.21		c0.19	0.28	
v/s Ratio Perm			0.01			c0.69						0.05
v/c Ratio	0.58	0.43	0.06	0.86	0.67	0.69	0.72	0.81		0.92	0.67	0.12
Uniform Delay, d1	30.1	26.5	24.7	30.5	26.9	0.0	33.7	25.3		28.1	17.5	13.3
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	2.1	0.5	0.1	25.2	2.4	2.5	13.1	5.7		16.8	1.3	0.1
Delay (s)	32.2	27.0	24.8	55.7	29.3	2.5	46.8	31.0		44.9	18.7	13.4
Level of Service	C	C	C	E	C	A	D	C		D	B	B
Approach Delay (s)		28.7			15.9			33.4			27.5	
Approach LOS		C			B			C			C	
Intersection Summary												
HCM 2000 Control Delay			24.6			HCM 2000 Level of Service				C		
HCM 2000 Volume to Capacity ratio			0.91									
Actuated Cycle Length (s)			72.4			Sum of lost time (s)			16.0			
Intersection Capacity Utilization			67.6%			ICU Level of Service				C		
Analysis Period (min)			15									

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
18: Bernal Ave/Valley Ave & Stanley Blvd

BART to Livermore Extension Project
2040 BART + INP + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	216	203	55	250	895	954	174	480	101	143	370	125
Future Volume (vph)	216	203	55	250	895	954	174	480	101	143	370	125
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.95	1.00	0.97	0.91	0.91	1.00	0.95	1.00	0.97	0.95	0.95
Frt	1.00	1.00	0.85	1.00	0.96	0.85	1.00	1.00	0.85	1.00	0.96	0.96
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	3433	3238	1441	1770	3539	1583	3433	3405	3405
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	3433	3238	1441	1770	3539	1583	3433	3405	3405
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	235	221	60	272	973	1037	189	522	110	155	402	136
RTOR Reduction (vph)	0	0	30	0	47	28	0	0	87	0	37	0
Lane Group Flow (vph)	235	221	30	272	1341	594	189	522	23	155	501	0
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	NA
Protected Phases	7	4	5	3	8	1	5	2		1	6	
Permitted Phases			4			8			2			
Actuated Green, G (s)	7.0	33.0	44.6	11.1	37.1	47.0	11.6	18.2	18.2	9.9	16.5	
Effective Green, g (s)	7.0	33.0	44.6	11.1	37.1	47.0	11.6	18.2	18.2	9.9	16.5	
Actuated g/C Ratio	0.08	0.37	0.51	0.13	0.42	0.53	0.13	0.21	0.21	0.11	0.19	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	272	1324	872	432	1362	833	232	730	326	385	636	
v/s Ratio Prot	c0.07	0.06	0.00	c0.08	c0.41	0.08	c0.11	c0.15		0.05	0.15	
v/s Ratio Perm			0.01			0.33			0.01			
v/c Ratio	0.86	0.17	0.03	0.63	0.98	0.71	0.81	0.72	0.07	0.40	0.79	
Uniform Delay, d1	40.1	18.4	11.0	36.6	25.3	15.5	37.3	32.6	28.2	36.4	34.2	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	23.6	0.1	0.0	2.9	20.6	2.9	19.3	3.3	0.1	0.7	6.4	
Delay (s)	63.7	18.5	11.0	39.5	45.9	18.4	56.5	35.9	28.3	37.1	40.6	
Level of Service	E	B	B	D	D	B	E	D	C	D	D	
Approach Delay (s)		38.2			37.6			39.6			39.8	
Approach LOS		D			D			D			D	

Intersection Summary

HCM 2000 Control Delay	38.4	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.90		
Actuated Cycle Length (s)	88.2	Sum of lost time (s)	16.0
Intersection Capacity Utilization	78.3%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
19: Fallon Rd & Dublin Blvd/Croak Rd

BART to Livermore Extension Project
2040 BART + INP + Garage AM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	50	82	96	330	1076	386	795	294	46	84	752	305
Future Volume (vph)	50	82	96	330	1076	386	795	294	46	84	752	305
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.91	0.88	0.94	0.91	1.00	0.94	0.91	0.88	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5085	2787	4990	5085	1583	4990	5085	2787	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5085	2787	4990	5085	1583	4990	5085	2787	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	54	89	104	359	1170	420	864	320	50	91	817	332
RTOR Reduction (vph)	0	0	53	0	0	230	0	0	33	0	0	88
Lane Group Flow (vph)	54	89	51	359	1170	190	864	320	17	91	817	244
Turn Type	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4	5	3	8		5	2		1	6	
Permitted Phases			4			8			2			6
Actuated Green, G (s)	2.2	24.8	40.1	10.0	32.6	32.6	15.3	27.6	27.6	3.8	16.1	16.1
Effective Green, g (s)	2.2	24.8	40.1	10.0	32.6	32.6	15.3	27.6	27.6	3.8	16.1	16.1
Actuated g/C Ratio	0.03	0.30	0.49	0.12	0.40	0.40	0.19	0.34	0.34	0.05	0.20	0.20
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	91	1534	1359	607	2016	627	928	1707	935	158	995	310
v/s Ratio Prot	0.02	0.02	0.01	c0.07	c0.23		c0.17	0.06		0.03	c0.16	
v/s Ratio Perm			0.01			0.12			0.01			0.15
v/c Ratio	0.59	0.06	0.04	0.59	0.58	0.30	0.93	0.19	0.02	0.58	0.82	0.79
Uniform Delay, d1	39.6	20.4	11.0	34.2	19.4	17.0	32.9	19.4	18.2	38.4	31.7	31.4
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	10.0	0.0	0.0	1.5	0.4	0.3	15.5	0.1	0.0	5.0	5.5	12.5
Delay (s)	49.5	20.4	11.0	35.7	19.9	17.3	48.4	19.4	18.3	43.4	37.2	43.9
Level of Service	D	C	B	D	B	B	D	B	B	D	D	D
Approach Delay (s)		22.8			22.2			39.7			39.4	
Approach LOS		C			C			D			D	

Intersection Summary

HCM 2000 Control Delay	31.4	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.74		
Actuated Cycle Length (s)	82.2	Sum of lost time (s)	16.0
Intersection Capacity Utilization	64.8%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
20: El Charro Rd/Fallon Rd & I-580 WB Ramps

BART to Livermore Extension Project
2040 BART + INP + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↙	↖	↗		↑↑↑	↗		↑↑↑	↗
Traffic Volume (vph)	0	0	0	257	0	618	0	890	478	0	671	399
Future Volume (vph)	0	0	0	257	0	618	0	890	478	0	671	399
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0	4.0	4.0		4.0	4.0		4.0	4.0
Lane Util. Factor				0.95	0.95	0.88		0.91	1.00		0.91	1.00
Frt				1.00	1.00	0.85		1.00	0.85		1.00	0.85
Flt Protected				0.95	0.95	1.00		1.00	1.00		1.00	1.00
Satd. Flow (prot)				1681	1681	2787		5085	1583		5085	1583
Flt Permitted				0.95	0.95	1.00		1.00	1.00		1.00	1.00
Satd. Flow (perm)				1681	1681	2787		5085	1583		5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	279	0	672	0	967	520	0	729	434
RTOR Reduction (vph)	0	0	0	0	0	62	0	0	269	0	0	225
Lane Group Flow (vph)	0	0	0	142	137	610	0	967	251	0	729	209
Turn Type				Perm	NA	Perm		NA	Perm		NA	Perm
Protected Phases					8			2			6	
Permitted Phases				8		8			2			6
Actuated Green, G (s)				13.2	13.2	13.2		19.3	19.3		19.3	19.3
Effective Green, g (s)				12.7	12.7	12.7		19.3	19.3		19.3	19.3
Actuated g/C Ratio				0.32	0.32	0.32		0.48	0.48		0.48	0.48
Clearance Time (s)				3.5	3.5	3.5		4.0	4.0		4.0	4.0
Vehicle Extension (s)				2.0	2.0	2.0		2.0	2.0		2.0	2.0
Lane Grp Cap (vph)				533	533	884		2453	763		2453	763
v/s Ratio Prot								c0.19			0.14	
v/s Ratio Perm				0.08	0.08	c0.22			0.16			0.13
v/c Ratio				0.27	0.26	0.69		0.39	0.33		0.30	0.27
Uniform Delay, d1				10.2	10.1	11.9		6.6	6.4		6.3	6.2
Progression Factor				1.00	1.00	1.00		1.00	1.00		1.00	1.00
Incremental Delay, d2				0.1	0.1	1.8		0.5	1.2		0.3	0.9
Delay (s)				10.3	10.2	13.7		7.1	7.5		6.6	7.1
Level of Service				B	B	B		A	A		A	A
Approach Delay (s)		0.0			12.7			7.2			6.7	
Approach LOS		A			B			A			A	























Intersection Summary

HCM 2000 Control Delay	8.5	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.51		
Actuated Cycle Length (s)	40.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	45.5%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
21: El Charro Rd & I-580 EB Ramps

BART to Livermore Extension Project
2040 BART + INP + Garage AM

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations	 		 					 			 		
Traffic Volume (vph)	278	0	627	0	0	0	0	1440	486	0	567	0	
Future Volume (vph)	278	0	627	0	0	0	0	1440	486	0	567	0	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)	4.0		4.0					4.0	4.0		4.0		
Lane Util. Factor	0.97		0.88					0.91	0.91		0.91		
Frt	1.00		0.85					0.99	0.85		1.00		
Flt Protected	0.95		1.00					1.00	1.00		1.00		
Satd. Flow (prot)	3433		2787					3371	1441		3390		
Flt Permitted	0.95		1.00					1.00	1.00		1.00		
Satd. Flow (perm)	3433		2787					3371	1441		3390		
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	
Adj. Flow (vph)	302	0	682	0	0	0	0	1565	528	0	616	0	
RTOR Reduction (vph)	0	0	453	0	0	0	0	3	126	0	0	0	
Lane Group Flow (vph)	302	0	229	0	0	0	0	1625	339	0	616	0	
Turn Type	Prot		Perm					NA	Perm		NA	Perm	
Protected Phases	4							2			6		
Permitted Phases			4						2			6	
Actuated Green, G (s)	11.0		11.0					51.0	51.0		51.0		
Effective Green, g (s)	11.0		11.0					51.0	51.0		51.0		
Actuated g/C Ratio	0.16		0.16					0.73	0.73		0.73		
Clearance Time (s)	4.0		4.0					4.0	4.0		4.0		
Vehicle Extension (s)	2.0		2.0					3.0	3.0		3.0		
Lane Grp Cap (vph)	539		437					2456	1049		2469		
v/s Ratio Prot	c0.09							c0.48			0.18		
v/s Ratio Perm			0.08						0.24				
v/c Ratio	0.56		0.52					0.66	0.32		0.25		
Uniform Delay, d1	27.3		27.1					5.0	3.4		3.2		
Progression Factor	1.00		1.00					1.00	1.00		1.00		
Incremental Delay, d2	0.8		0.5					1.4	0.8		0.2		
Delay (s)	28.1		27.6					6.4	4.2		3.4		
Level of Service	C		C					A	A		A		
Approach Delay (s)		27.8			0.0			5.9			3.4		
Approach LOS		C			A			A			A		
Intersection Summary													
HCM 2000 Control Delay			11.3									HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio			0.64										
Actuated Cycle Length (s)			70.0									Sum of lost time (s)	8.0
Intersection Capacity Utilization			59.6%									ICU Level of Service	B
Analysis Period (min)			15										

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 22: El Charro Rd & Stoneridge Dr/Jack London Blvd

BART to Livermore Extension Project
 2040 BART + INP + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔↔↔	↑↑	↗	↖	↑↑	↗↗	↖	↑↑		↖↖↖	↑	↗↗
Traffic Volume (vph)	98	127	15	65	625	870	31	592	28	338	222	113
Future Volume (vph)	98	127	15	65	625	870	31	592	28	338	222	113
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	0.94	0.95	1.00	1.00	0.95	0.88	1.00	0.95		0.94	1.00	0.88
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	4491	3185	1425	1593	3185	2508	1593	3164		4491	1676	2508
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	4491	3185	1425	1593	3185	2508	1593	3164		4491	1676	2508
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	107	138	16	71	679	946	34	643	30	367	241	123
RTOR Reduction (vph)	0	0	12	0	0	100	0	6	0	0	0	75
Lane Group Flow (vph)	107	138	4	71	679	846	34	667	0	367	241	48
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Prot	NA		Prot	NA	Perm
Protected Phases	7	4		3	8	1	5	2		1	6	
Permitted Phases			4			8						6
Actuated Green, G (s)	3.0	15.1	15.1	3.0	15.1	23.3	2.3	17.5		8.2	23.4	23.4
Effective Green, g (s)	3.0	15.1	15.1	3.0	15.1	23.3	2.3	17.5		8.2	23.4	23.4
Actuated g/C Ratio	0.05	0.25	0.25	0.05	0.25	0.39	0.04	0.29		0.14	0.39	0.39
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	225	804	359	79	804	977	61	925		615	655	981
v/s Ratio Prot	c0.02	0.04		0.04	0.21	c0.12	0.02	c0.21		0.08	0.14	
v/s Ratio Perm			0.00			0.22						0.02
v/c Ratio	0.48	0.17	0.01	0.90	0.84	0.87	0.56	0.72		0.60	0.37	0.05
Uniform Delay, d1	27.6	17.5	16.8	28.2	21.2	16.8	28.2	19.0		24.2	12.9	11.3
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	1.6	0.1	0.0	67.3	8.1	8.1	10.6	2.8		1.6	0.4	0.0
Delay (s)	29.2	17.6	16.8	95.5	29.3	24.9	38.8	21.8		25.8	13.3	11.3
Level of Service	C	B	B	F	C	C	D	C		C	B	B
Approach Delay (s)		22.3			29.7			22.6			19.2	
Approach LOS		C			C			C			B	

Intersection Summary		
HCM 2000 Control Delay	25.4	HCM 2000 Level of Service C
HCM 2000 Volume to Capacity ratio	0.78	
Actuated Cycle Length (s)	59.8	Sum of lost time (s) 16.0
Intersection Capacity Utilization	66.3%	ICU Level of Service C
Analysis Period (min)	15	

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
23: Stanley Blvd & El Charro Rd



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	439	464	2766	130	28	122
Future Volume (vph)	439	464	2766	130	28	122
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95	0.91	1.00	0.97	0.88
Frt	1.00	1.00	1.00	0.85	1.00	0.85
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1770	3539	5085	1583	3433	2787
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1770	3539	5085	1583	3433	2787
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	477	504	3007	141	30	133
RTOR Reduction (vph)	0	0	0	31	0	125
Lane Group Flow (vph)	477	504	3007	110	30	8
Turn Type	Prot	NA	NA	Perm	Prot	Perm
Protected Phases	7	4	8		6	
Permitted Phases				8		6
Actuated Green, G (s)	28.0	95.0	63.0	63.0	6.7	6.7
Effective Green, g (s)	28.0	95.0	63.0	63.0	6.7	6.7
Actuated g/C Ratio	0.26	0.87	0.57	0.57	0.06	0.06
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	451	3064	2920	909	209	170
v/s Ratio Prot	c0.27	0.14	c0.59		c0.01	
v/s Ratio Perm				0.07		0.00
v/c Ratio	1.06	0.16	1.03	0.12	0.14	0.05
Uniform Delay, d1	40.9	1.1	23.4	10.7	48.8	48.5
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	58.4	0.0	24.9	0.1	0.3	0.1
Delay (s)	99.3	1.2	48.2	10.7	49.1	48.6
Level of Service	F	A	D	B	D	D
Approach Delay (s)		48.9	46.6		48.7	
Approach LOS		D	D		D	

Intersection Summary

HCM 2000 Control Delay	47.2	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.98		
Actuated Cycle Length (s)	109.7	Sum of lost time (s)	12.0
Intersection Capacity Utilization	91.1%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
24: Airway Blvd/Driveway & N Canyons Pkwy

BART to Livermore Extension Project
2040 BART + INP + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑	↑	↑↑	↑	↑		↑	↑↑		↑	
Traffic Volume (vph)	0	111	54	720	871	0	849	0	1137	0	0	0
Future Volume (vph)	0	111	54	720	871	0	849	0	1137	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		2.0	2.0	2.0	2.0			4.2	2.0			
Lane Util. Factor		0.95	1.00	0.97	1.00			1.00	0.88			
Frt		1.00	0.85	1.00	1.00			1.00	0.85			
Flt Protected		1.00	1.00	0.95	1.00			0.95	1.00			
Satd. Flow (prot)		3539	1583	3433	1863			1770	2787			
Flt Permitted		1.00	1.00	0.95	1.00			0.95	1.00			
Satd. Flow (perm)		3539	1583	3433	1863			1770	2787			
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	121	59	783	947	0	923	0	1236	0	0	0
RTOR Reduction (vph)	0	0	52	0	0	0	0	0	117	0	0	0
Lane Group Flow (vph)	0	121	7	783	947	0	0	923	1119	0	0	0
Turn Type		NA	Perm	Prot	NA	Perm	Split	NA	pm+ov			
Protected Phases		2		1	6		8	8	1	4	4	
Permitted Phases			2			6			8			
Actuated Green, G (s)		10.2	10.2	40.8	55.0			40.0	80.8			
Effective Green, g (s)		12.2	12.2	42.8	57.0			39.8	84.8			
Actuated g/C Ratio		0.12	0.12	0.42	0.55			0.39	0.82			
Clearance Time (s)		4.0	4.0	4.0	4.0			4.0	4.0			
Vehicle Extension (s)		3.0	3.0	3.0	3.0			3.0	3.0			
Lane Grp Cap (vph)		419	187	1426	1030			683	2348			
v/s Ratio Prot		0.03		0.23	c0.51			c0.52	0.20			
v/s Ratio Perm			0.00						0.20			
v/c Ratio		0.29	0.04	0.55	0.92			1.35	0.48			
Uniform Delay, d1		41.4	40.2	22.8	20.9			31.6	2.6			
Progression Factor		1.00	1.00	1.00	1.00			1.00	1.00			
Incremental Delay, d2		0.4	0.1	0.4	12.7			167.7	0.2			
Delay (s)		41.8	40.3	23.2	33.6			199.3	2.8			
Level of Service		D	D	C	C			F	A			
Approach Delay (s)		41.3			28.9			86.8			0.0	
Approach LOS		D			C			F			A	

Intersection Summary

HCM 2000 Control Delay	60.2	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.16		
Actuated Cycle Length (s)	103.0	Sum of lost time (s)	12.2
Intersection Capacity Utilization	99.7%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
25: Airway Blvd & I-580 WB Ramps

BART to Livermore Extension Project
2040 BART + INP + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↙	↖	↗↘		↕	↗		↕↖↗	
Traffic Volume (vph)	0	0	0	94	50	739	0	1344	343	0	352	546
Future Volume (vph)	0	0	0	94	50	739	0	1344	343	0	352	546
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0	4.0	4.0		4.0	4.0		4.0	
Lane Util. Factor				0.95	0.95	0.88		0.95	1.00		0.91	
Frt				1.00	1.00	0.85		1.00	0.85		0.91	
Flt Protected				0.95	0.98	1.00		1.00	1.00		1.00	
Satd. Flow (prot)				1681	1729	2787		3539	1583		4622	
Flt Permitted				0.95	0.98	1.00		1.00	1.00		1.00	
Satd. Flow (perm)				1681	1729	2787		3539	1583		4622	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	102	54	803	0	1461	373	0	383	593
RTOR Reduction (vph)	0	0	0	0	0	32	0	0	173	0	275	0
Lane Group Flow (vph)	0	0	0	54	102	771	0	1461	200	0	701	0
Turn Type				Split	NA	Perm		NA	Perm		NA	
Protected Phases				8	8			2			6	
Permitted Phases						8			2			
Actuated Green, G (s)				18.4	18.4	18.4		29.3	29.3		29.3	
Effective Green, g (s)				18.4	18.4	18.4		30.6	30.6		30.6	
Actuated g/C Ratio				0.32	0.32	0.32		0.54	0.54		0.54	
Clearance Time (s)				4.0	4.0	4.0		5.3	5.3		5.3	
Vehicle Extension (s)				2.0	2.0	2.0		4.0	4.0		4.0	
Lane Grp Cap (vph)				542	558	899		1899	849		2481	
v/s Ratio Prot				0.03	0.06			c0.41			0.15	
v/s Ratio Perm						c0.28			0.13			
v/c Ratio				0.10	0.18	0.86		0.77	0.24		0.28	
Uniform Delay, d1				13.5	13.9	18.1		10.4	7.0		7.2	
Progression Factor				1.00	1.00	1.00		1.00	1.00		1.00	
Incremental Delay, d2				0.0	0.1	7.9		2.1	0.2		0.1	
Delay (s)				13.5	13.9	25.9		12.5	7.2		7.3	
Level of Service				B	B	C		B	A		A	
Approach Delay (s)		0.0			24.0			11.4			7.3	
Approach LOS		A			C			B			A	


























Intersection Summary

HCM 2000 Control Delay	13.5	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.80		
Actuated Cycle Length (s)	57.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	69.7%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 26: Airway Blvd & I-580 EB Ramps/Kitty Hawk Rd

BART to Livermore Extension Project
 2040 BART + INP + Garage AM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 							 			 	
Traffic Volume (vph)	721	216	535	42	48	67	59	532	167	49	205	196
Future Volume (vph)	721	216	535	42	48	67	59	532	167	49	205	196
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.4	4.4	4.4	4.5	2.7		4.0	2.7	
Lane Util. Factor	0.97	1.00	1.00	1.00	1.00	1.00	1.00	0.95		1.00	0.95	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.96		1.00	0.93	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	3433	1863	1583	1770	1863	1583	1770	3412		1770	3280	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	3433	1863	1583	1770	1863	1583	1770	3412		1770	3280	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	784	235	582	46	52	73	64	578	182	53	223	213
RTOR Reduction (vph)	0	0	411	0	0	61	0	37	0	0	159	0
Lane Group Flow (vph)	784	235	171	46	52	12	64	723	0	53	277	0
Turn Type	Split	NA	Perm	Split	NA	pm+ov	Prot	NA		Prot	NA	
Protected Phases	7	7		8	8	1	5	2		1	6	
Permitted Phases			7			8						
Actuated Green, G (s)	21.5	21.5	21.5	10.0	10.0	12.9	8.3	22.7		2.9	17.3	
Effective Green, g (s)	21.5	21.5	21.5	9.6	9.6	12.1	7.8	24.0		2.9	18.6	
Actuated g/C Ratio	0.29	0.29	0.29	0.13	0.13	0.17	0.11	0.33		0.04	0.25	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Vehicle Extension (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	3.5		2.0	4.0	
Lane Grp Cap (vph)	1009	547	465	232	244	357	188	1120		70	834	
v/s Ratio Prot	c0.23	0.13		0.03	c0.03	0.00	0.04	c0.21		c0.03	0.08	
v/s Ratio Perm			0.11			0.01						
v/c Ratio	0.78	0.43	0.37	0.20	0.21	0.03	0.34	0.65		0.76	0.33	
Uniform Delay, d1	23.6	20.8	20.4	28.3	28.4	25.6	30.3	20.9		34.8	22.2	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	3.5	0.2	0.2	0.2	0.2	0.0	0.4	1.3		33.2	0.3	
Delay (s)	27.1	21.0	20.6	28.5	28.5	25.6	30.7	22.3		68.0	22.5	
Level of Service	C	C	C	C	C	C	C	C		E	C	
Approach Delay (s)		23.8			27.3			22.9			27.4	
Approach LOS		C			C			C			C	

Intersection Summary		
HCM 2000 Control Delay	24.4	HCM 2000 Level of Service C
HCM 2000 Volume to Capacity ratio	0.63	
Actuated Cycle Length (s)	73.1	Sum of lost time (s) 15.6
Intersection Capacity Utilization	68.6%	ICU Level of Service C
Analysis Period (min)	15	

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 27: Collier Canyon Rd & N Canyons Pkwy/Portola Ave

BART to Livermore Extension Project
 2040 BART + INP + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	308	158	161	137	876	37	269	18	166	35	17	268
Future Volume (vph)	308	158	161	137	876	37	269	18	166	35	17	268
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	2.7	2.7	4.0	2.7	2.7	4.0	3.0		4.0	4.6	4.6
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.86		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	1770	1611		1770	1863	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	1770	1611		1770	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	335	172	175	149	952	40	292	20	180	38	18	291
RTOR Reduction (vph)	0	0	118	0	0	26	0	120	0	0	0	213
Lane Group Flow (vph)	335	172	57	149	952	14	292	80	0	38	18	78
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA		Prot	NA	Perm
Protected Phases	1	6		5	2		3	8		7	4	
Permitted Phases			6			2						4
Actuated Green, G (s)	10.0	26.6	26.6	11.9	28.5	28.5	16.1	27.3		3.5	14.7	14.7
Effective Green, g (s)	10.0	27.9	27.9	11.9	29.8	29.8	16.1	28.3		3.5	14.1	14.1
Actuated g/C Ratio	0.12	0.33	0.33	0.14	0.35	0.35	0.19	0.33		0.04	0.17	0.17
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	402	1157	517	246	1236	553	334	534		72	307	261
v/s Ratio Prot	c0.10	0.05		0.08	c0.27		c0.17	0.05		0.02	0.01	
v/s Ratio Perm			0.04			0.01						c0.05
v/c Ratio	0.83	0.15	0.11	0.61	0.77	0.03	0.87	0.15		0.53	0.06	0.30
Uniform Delay, d1	36.8	20.3	20.0	34.5	24.7	18.2	33.6	20.0		40.1	30.0	31.3
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	13.8	0.1	0.1	4.2	3.0	0.0	21.5	0.1		6.8	0.1	0.6
Delay (s)	50.6	20.4	20.1	38.7	27.7	18.2	55.1	20.2		46.9	30.1	31.9
Level of Service	D	C	C	D	C	B	E	C		D	C	C
Approach Delay (s)		35.2			28.8			40.9			33.5	
Approach LOS		D			C			D			C	

Intersection Summary		
HCM 2000 Control Delay	33.3	HCM 2000 Level of Service C
HCM 2000 Volume to Capacity ratio	0.71	
Actuated Cycle Length (s)	85.3	Sum of lost time (s) 15.3
Intersection Capacity Utilization	71.7%	ICU Level of Service C
Analysis Period (min)	15	

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
28: Isabel Ave/Campus Hill Dr & Portola Ave

BART to Livermore Extension Project
2040 BART + INP + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↘	↑↑	↗↗	↘↘↘	↑↑		↘↘	↑↑	↗	↘	↑↑	↗
Traffic Volume (vph)	1	207	224	676	559	137	501	311	124	74	212	2
Future Volume (vph)	1	207	224	676	559	137	501	311	124	74	212	2
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	5.8	5.8
Lane Util. Factor	1.00	0.95	0.88	0.94	0.95		0.97	0.95	1.00	1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	0.97		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3539	2787	4990	3435		3433	3539	1583	1770	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	3539	2787	4990	3435		3433	3539	1583	1770	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	1	225	243	735	608	149	545	338	135	80	230	2
RTOR Reduction (vph)	0	0	191	0	15	0	0	0	94	0	0	2
Lane Group Flow (vph)	1	225	52	735	742	0	545	338	41	80	230	0
Turn Type	Prot	NA	Perm	Prot	NA		Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4						2			6
Actuated Green, G (s)	1.6	17.1	17.1	18.1	33.6		20.1	25.3	25.3	7.7	13.3	13.3
Effective Green, g (s)	1.6	18.4	18.4	18.1	34.9		20.1	26.6	26.6	7.7	12.4	12.4
Actuated g/C Ratio	0.02	0.21	0.21	0.21	0.40		0.23	0.31	0.31	0.09	0.14	0.14
Clearance Time (s)	4.0	5.3	5.3	4.0	5.3		4.0	5.3	5.3	4.0	4.9	4.9
Vehicle Extension (s)	2.0	3.0	3.0	2.0	3.0		2.0	3.0	3.0	2.0	3.0	3.0
Lane Grp Cap (vph)	32	750	590	1040	1381		794	1084	485	157	505	226
v/s Ratio Prot	0.00	0.06		c0.15	c0.22		c0.16	0.10		0.05	c0.06	
v/s Ratio Perm			0.02						0.03			0.00
v/c Ratio	0.03	0.30	0.09	0.71	0.54		0.69	0.31	0.09	0.51	0.46	0.00
Uniform Delay, d1	41.8	28.8	27.5	31.9	19.8		30.5	23.1	21.4	37.7	34.1	31.9
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.1	0.2	0.1	1.8	0.4		2.0	0.2	0.1	0.9	0.7	0.0
Delay (s)	42.0	29.0	27.5	33.7	20.2		32.4	23.2	21.5	38.7	34.8	31.9
Level of Service	D	C	C	C	C		C	C	C	D	C	C
Approach Delay (s)		28.3			26.8			27.9			35.8	
Approach LOS		C			C			C			D	

Intersection Summary		
HCM 2000 Control Delay	28.2	HCM 2000 Level of Service C
HCM 2000 Volume to Capacity ratio	0.63	
Actuated Cycle Length (s)	86.8	Sum of lost time (s) 17.8
Intersection Capacity Utilization	66.5%	ICU Level of Service C
Analysis Period (min)	15	

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
29: Isabel Ave & I-580 WB Ramps

BART to Livermore Extension Project
2040 BART + INP + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↔↔		↗		↑↑↑	↗		↑↑↑	↗
Traffic Volume (vph)	0	0	0	1157	0	658	0	826	0	0	819	429
Future Volume (vph)	0	0	0	1157	0	658	0	826	0	0	819	429
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0		4.0		4.8			4.8	4.8
Lane Util. Factor				0.97		1.00		0.91			0.91	1.00
Frt				1.00		0.85		1.00			1.00	0.85
Flt Protected				0.95		1.00		1.00			1.00	1.00
Satd. Flow (prot)				3433		1583		5085			5085	1583
Flt Permitted				0.95		1.00		1.00			1.00	1.00
Satd. Flow (perm)				3433		1583		5085			5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	1258	0	715	0	898	0	0	890	466
RTOR Reduction (vph)	0	0	0	0	0	9	0	0	0	0	0	311
Lane Group Flow (vph)	0	0	0	1258	0	706	0	898	0	0	890	155
Turn Type				Prot		Prot		NA	Free		NA	Prot
Protected Phases				8		8		2			6	6
Permitted Phases									Free			
Actuated Green, G (s)				31.3		31.3		20.7			20.7	20.7
Effective Green, g (s)				31.3		31.3		19.9			19.9	19.9
Actuated g/C Ratio				0.52		0.52		0.33			0.33	0.33
Clearance Time (s)				4.0		4.0		4.0			4.0	4.0
Vehicle Extension (s)				2.0		2.0		4.0			4.0	4.0
Lane Grp Cap (vph)				1790		825		1686			1686	525
v/s Ratio Prot				0.37		c0.45		c0.18			0.18	0.10
v/s Ratio Perm												
v/c Ratio				0.70		0.86		0.53			0.53	0.29
Uniform Delay, d1				10.8		12.4		16.3			16.2	14.9
Progression Factor				1.00		1.00		0.71			1.00	1.00
Incremental Delay, d2				1.0		8.4		1.1			1.2	1.4
Delay (s)				11.9		20.8		12.7			17.4	16.3
Level of Service				B		C		B			B	B
Approach Delay (s)		0.0			15.1			12.7			17.0	
Approach LOS		A			B			B			B	

























Intersection Summary

HCM 2000 Control Delay	15.2	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.73		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.8
Intersection Capacity Utilization	64.0%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
30: Isabel Ave & I-580 EB Ramps

BART to Livermore Extension Project
2040 BART + INP + Garage AM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 		 					  			  	
Traffic Volume (vph)	459	0	401	0	0	0	0	812	447	0	1597	460
Future Volume (vph)	459	0	401	0	0	0	0	812	447	0	1597	460
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0					4.0	4.0		4.0	4.0
Lane Util. Factor	0.97		0.88					0.91	1.00		0.91	1.00
Frt	1.00		0.85					1.00	0.85		1.00	0.85
Flt Protected	0.95		1.00					1.00	1.00		1.00	1.00
Satd. Flow (prot)	3433		2787					5085	1583		5085	1583
Flt Permitted	0.95		1.00					1.00	1.00		1.00	1.00
Satd. Flow (perm)	3433		2787					5085	1583		5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	499	0	436	0	0	0	0	883	486	0	1736	500
RTOR Reduction (vph)	0	0	30	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	499	0	406	0	0	0	0	883	486	0	1736	500
Turn Type	Prot		Perm					NA	Free		NA	Free
Protected Phases	4							2			6	
Permitted Phases			4						Free			Free
Actuated Green, G (s)	12.9		12.9					38.1	60.0		38.1	60.0
Effective Green, g (s)	12.9		12.9					39.1	60.0		39.1	60.0
Actuated g/C Ratio	0.22		0.22					0.65	1.00		0.65	1.00
Clearance Time (s)	4.0		4.0					5.0			5.0	
Vehicle Extension (s)	2.0		2.0					4.0			4.0	
Lane Grp Cap (vph)	738		599					3313	1583		3313	1583
v/s Ratio Prot	0.15							0.17			c0.34	
v/s Ratio Perm			c0.15						0.31			0.32
v/c Ratio	0.68		0.68					0.27	0.31		0.52	0.32
Uniform Delay, d1	21.6		21.6					4.4	0.0		5.5	0.0
Progression Factor	1.00		1.00					1.00	1.00		0.91	1.00
Incremental Delay, d2	1.9		2.4					0.2	0.5		0.5	0.4
Delay (s)	23.6		24.0					4.6	0.5		5.5	0.4
Level of Service	C		C					A	A		A	A
Approach Delay (s)		23.8			0.0			3.1			4.4	
Approach LOS		C			A			A			A	
Intersection Summary												
HCM 2000 Control Delay			8.0								HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio			0.56									
Actuated Cycle Length (s)			60.0								Sum of lost time (s)	8.0
Intersection Capacity Utilization			51.6%								ICU Level of Service	A
Analysis Period (min)			15									
c Critical Lane Group												



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↑	↗	↖	↑	↗	↖	↑↑↑	↗	↖↗	↑↑↑	↗
Traffic Volume (vph)	1	147	579	315	383	187	318	1075	179	697	1292	15
Future Volume (vph)	1	147	579	315	383	187	318	1075	179	697	1292	15
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.2	5.2	5.6	5.2	5.2	5.6	4.0	4.0	4.0	4.0	4.0	5.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.91	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	1863	1583	1770	1863	1583	1770	5085	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	1863	1583	1770	1863	1583	1770	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	1	160	629	342	416	203	346	1168	195	758	1404	16
RTOR Reduction (vph)	0	0	98	0	0	78	0	0	133	0	0	11
Lane Group Flow (vph)	1	160	531	342	416	125	346	1168	62	758	1404	5
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4	5	3	8	1	5	2		1	NA	6
Permitted Phases			4			8			2			6
Actuated Green, G (s)	0.7	18.0	33.1	14.5	31.8	46.9	15.1	29.5	29.5	15.1	29.5	29.5
Effective Green, g (s)	0.1	17.4	31.9	13.9	31.2	45.7	16.1	30.5	30.5	16.1	30.5	29.5
Actuated g/C Ratio	0.00	0.18	0.33	0.14	0.32	0.47	0.17	0.32	0.32	0.17	0.32	0.31
Clearance Time (s)	4.6	4.6	5.0	4.6	4.6	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	5.0	3.0	5.0	5.0
Lane Grp Cap (vph)	1	336	524	255	603	751	295	1610	501	573	1610	484
v/s Ratio Prot	0.00	0.09	c0.15	c0.19	0.22	0.03	c0.20	0.23		c0.22	c0.28	
v/s Ratio Perm			0.18			0.05			0.04			0.00
v/c Ratio	1.00	0.48	1.01	1.34	0.69	0.17	1.17	0.73	0.12	1.32	0.87	0.01
Uniform Delay, d1	48.1	35.4	32.2	41.2	28.3	14.4	40.1	29.2	23.4	40.1	31.1	23.2
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	900.0	1.1	42.5	177.5	3.3	0.1	107.7	2.0	0.2	157.2	6.0	0.0
Delay (s)	948.1	36.4	74.7	218.7	31.6	14.5	147.8	31.2	23.6	197.3	37.0	23.3
Level of Service	F	D	E	F	C	B	F	C	C	F	D	C
Approach Delay (s)		68.1			94.6			54.0			92.7	
Approach LOS		E			F			D			F	


































Intersection Summary

HCM 2000 Control Delay	77.8	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.15		
Actuated Cycle Length (s)	96.3	Sum of lost time (s)	20.0
Intersection Capacity Utilization	90.6%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 32: Isabel Ave & Jack London Blvd

BART to Livermore Extension Project
 2040 BART + INP + Garage AM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 	 			 		 	  		 	  	
Traffic Volume (vph)	26	56	67	301	966	342	449	960	117	174	1519	331
Future Volume (vph)	26	56	67	301	966	342	449	960	117	174	1519	331
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.97	0.91	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	3433	5085	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	3433	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	28	61	73	327	1050	372	488	1043	127	189	1651	360
RTOR Reduction (vph)	0	0	59	0	0	59	0	0	83	0	0	110
Lane Group Flow (vph)	28	61	14	327	1050	313	488	1043	44	189	1651	250
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8	1	5	2		1	NA	6
Permitted Phases			4			8			2			6
Actuated Green, G (s)	3.8	21.2	21.2	19.4	36.8	48.0	12.9	38.6	38.6	11.2	36.9	36.9
Effective Green, g (s)	3.8	21.2	21.2	19.4	36.8	48.0	12.9	38.6	38.6	11.2	36.9	36.9
Actuated g/C Ratio	0.03	0.19	0.19	0.17	0.33	0.43	0.12	0.35	0.35	0.10	0.33	0.33
Clearance Time (s)	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	116	672	300	307	1166	756	396	1758	547	344	1681	523
v/s Ratio Prot	0.01	0.02		c0.18	c0.30	0.04	c0.14	0.21		0.06	c0.32	
v/s Ratio Perm			0.01			0.16			0.03			0.16
v/c Ratio	0.24	0.09	0.05	1.07	0.90	0.41	1.23	0.59	0.08	0.55	0.98	0.48
Uniform Delay, d1	52.5	37.3	36.9	46.1	35.7	22.0	49.3	30.0	24.6	47.8	37.0	29.7
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.1	0.1	0.1	69.7	9.7	0.4	124.8	0.5	0.1	1.8	17.8	0.7
Delay (s)	53.6	37.3	37.0	115.8	45.3	22.4	174.1	30.6	24.6	49.6	54.8	30.4
Level of Service	D	D	D	F	D	C	F	C	C	D	D	C
Approach Delay (s)		40.0			53.6			72.4			50.3	
Approach LOS		D			D			E			D	

Intersection Summary		
HCM 2000 Control Delay	57.4	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	1.04	E
Actuated Cycle Length (s)	111.6	Sum of lost time (s)
Intersection Capacity Utilization	82.1%	21.2
Analysis Period (min)	15	ICU Level of Service
		E

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 33: Isabel Ave Connector & Stanley Blvd



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑	↑	↔	↑↑	↔	↔
Traffic Volume (vph)	355	137	763	2518	577	717
Future Volume (vph)	355	137	763	2518	577	717
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	2.3	2.3	4.0	2.3	2.5	2.5
Lane Util. Factor	0.95	1.00	0.97	0.95	0.97	0.88
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	3539	1583	3433	3539	3433	2787
Flt Permitted	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (perm)	3539	1583	3433	3539	3433	2787
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	386	149	829	2737	627	779
RTOR Reduction (vph)	0	11	0	0	0	215
Lane Group Flow (vph)	386	138	829	2737	627	564
Turn Type	NA	pm+ov	Prot	NA	Prot	pm+ov
Protected Phases	2	8	1	6	8	1
Permitted Phases		2				8
Actuated Green, G (s)	45.7	70.4	32.4	82.1	24.7	57.1
Effective Green, g (s)	47.4	73.8	32.4	83.8	26.2	60.1
Actuated g/C Ratio	0.41	0.64	0.28	0.73	0.23	0.52
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Grp Cap (vph)	1461	1049	968	2583	783	1519
v/s Ratio Prot	0.11	0.03	0.24	c0.77	c0.18	0.11
v/s Ratio Perm		0.06				0.09
v/c Ratio	0.26	0.13	0.86	1.06	0.80	0.37
Uniform Delay, d1	22.2	8.0	39.0	15.5	41.8	16.2
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.0	0.0	7.3	36.0	5.6	0.1
Delay (s)	22.2	8.0	46.3	51.5	47.4	16.2
Level of Service	C	A	D	D	D	B
Approach Delay (s)	18.3			50.3	30.1	
Approach LOS	B			D	C	

Intersection Summary

HCM 2000 Control Delay	42.1	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	1.03		
Actuated Cycle Length (s)	114.8	Sum of lost time (s)	8.8
Intersection Capacity Utilization	92.7%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 34: Murrieta Blvd/Driveway & Portola Ave

BART to Livermore Extension Project
 2040 BART + INP + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗		↖	↗		↖	↗	↗		↗	
Traffic Volume (vph)	0	712	147	268	1251	1	204	6	181	1	3	0
Future Volume (vph)	0	712	147	268	1251	1	204	6	181	1	3	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.8		4.0	5.8		5.2	5.2	5.2		4.0	
Lane Util. Factor		0.95		1.00	0.95		0.95	0.95	1.00		1.00	
Frt		0.97		1.00	1.00		1.00	1.00	0.85		1.00	
Flt Protected		1.00		0.95	1.00		0.95	0.96	1.00		0.99	
Satd. Flow (prot)		3448		1770	3539		1681	1690	1583		1840	
Flt Permitted		1.00		0.95	1.00		0.95	0.96	1.00		0.99	
Satd. Flow (perm)		3448		1770	3539		1681	1690	1583		1840	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	774	160	291	1360	1	222	7	197	1	3	0
RTOR Reduction (vph)	0	19	0	0	0	0	0	0	171	0	0	0
Lane Group Flow (vph)	0	915	0	291	1361	0	115	114	26	0	4	0
Turn Type	Prot	NA		Prot	NA		Split	NA	Perm		Split	NA
Protected Phases	5	2		1	6		8	8			4	4
Permitted Phases									8			
Actuated Green, G (s)		21.8		14.4	40.2		9.0	9.0	9.0		0.6	
Effective Green, g (s)		20.9		14.4	39.3		8.4	8.4	8.4		0.6	
Actuated g/C Ratio		0.33		0.23	0.62		0.13	0.13	0.13		0.01	
Clearance Time (s)		4.9		4.0	4.9		4.6	4.6	4.6		4.0	
Vehicle Extension (s)		2.0		2.0	2.0		2.0	2.0	2.0		2.0	
Lane Grp Cap (vph)		1138		402	2197		223	224	210		17	
v/s Ratio Prot		c0.27		c0.16	0.38		c0.07	0.07			c0.00	
v/s Ratio Perm									0.02			
v/c Ratio		0.80		0.72	0.62		0.52	0.51	0.12		0.24	
Uniform Delay, d1		19.3		22.6	7.4		25.6	25.5	24.2		31.1	
Progression Factor		1.00		1.00	1.00		1.00	1.00	1.00		1.00	
Incremental Delay, d2		4.0		5.4	0.4		0.8	0.7	0.1		2.6	
Delay (s)		23.3		28.0	7.8		26.4	26.2	24.3		33.7	
Level of Service		C		C	A		C	C	C		C	
Approach Delay (s)		23.3			11.3			25.4			33.7	
Approach LOS		C			B			C			C	

Intersection Summary

HCM 2000 Control Delay	17.1	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.72		
Actuated Cycle Length (s)	63.3	Sum of lost time (s)	19.0
Intersection Capacity Utilization	64.2%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
35: Murrieta Blvd & Jack London Blvd

BART to Livermore Extension Project
2040 BART + INP + Garage AM



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	92	296	996	376	265	166
Future Volume (vph)	92	296	996	376	265	166
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00	1.00	0.95	0.91	
Frt	1.00	0.85	1.00	1.00	0.94	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1770	1583	1770	3539	4792	
Flt Permitted	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	1770	1583	1770	3539	4792	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	100	322	1083	409	288	180
RTOR Reduction (vph)	0	287	0	0	106	0
Lane Group Flow (vph)	100	35	1083	409	362	0
Turn Type	Prot	Perm	Prot	NA	NA	
Protected Phases	4		5	2	6	
Permitted Phases		4				
Actuated Green, G (s)	11.1	11.1	66.2	83.0	12.8	
Effective Green, g (s)	11.1	11.1	66.2	83.0	12.8	
Actuated g/C Ratio	0.11	0.11	0.65	0.81	0.13	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	192	172	1147	2876	600	
v/s Ratio Prot	c0.06		c0.61	0.12	c0.08	
v/s Ratio Perm		0.02				
v/c Ratio	0.52	0.20	0.94	0.14	0.60	
Uniform Delay, d1	43.0	41.5	16.3	2.0	42.2	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	2.5	0.6	15.0	0.0	1.7	
Delay (s)	45.5	42.1	31.3	2.0	44.0	
Level of Service	D	D	C	A	D	
Approach Delay (s)	42.9			23.3	44.0	
Approach LOS	D			C	D	

Intersection Summary

HCM 2000 Control Delay	30.8	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.84		
Actuated Cycle Length (s)	102.1	Sum of lost time (s)	12.0
Intersection Capacity Utilization	79.1%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
36: Murrieta Blvd & Stanley Blvd

BART to Livermore Extension Project
2040 BART + INP + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↗↘	↕	↖	↗	↕	↖	↗↘	↕		↗	↕	↖
Traffic Volume (vph)	247	842	250	24	1403	164	713	466	19	224	191	471
Future Volume (vph)	247	842	250	24	1403	164	713	466	19	224	191	471
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	5.8	5.8	4.0	5.8	4.9	4.9	5.8		4.9	5.8	4.9
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.97	0.95		1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	3433	3518		1770	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	3433	3518		1770	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	268	915	272	26	1525	178	775	507	21	243	208	512
RTOR Reduction (vph)	0	0	114	0	0	24	0	2	0	0	0	61
Lane Group Flow (vph)	268	915	158	26	1525	154	775	526	0	243	208	451
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Prot	NA		Prot	NA	Perm
Protected Phases	1	6		5	2	3	7	4		3	8	
Permitted Phases			6			2						8
Actuated Green, G (s)	8.0	61.1	61.1	3.6	56.7	79.5	25.0	36.3		22.8	34.1	34.1
Effective Green, g (s)	8.0	60.2	60.2	3.6	55.8	77.7	24.1	35.4		21.9	33.2	34.1
Actuated g/C Ratio	0.06	0.43	0.43	0.03	0.39	0.55	0.17	0.25		0.15	0.23	0.24
Clearance Time (s)	4.0	4.9	4.9	4.0	4.9	4.0	4.0	4.9		4.0	4.9	4.9
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	193	1504	672	45	1394	868	584	879		273	829	381
v/s Ratio Prot	c0.08	0.26		0.01	c0.43	0.03	c0.23	0.15		0.14	0.06	
v/s Ratio Perm			0.10			0.07						c0.29
v/c Ratio	1.39	0.61	0.23	0.58	1.09	0.18	1.33	0.60		0.89	0.25	1.18
Uniform Delay, d1	66.8	31.6	26.0	68.2	42.9	16.0	58.8	46.8		58.7	44.1	53.8
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	203.5	0.7	0.2	16.7	54.0	0.1	158.8	1.1		28.1	0.2	106.6
Delay (s)	270.3	32.3	26.2	85.0	96.9	16.1	217.5	47.9		86.7	44.2	160.4
Level of Service	F	C	C	F	F	B	F	D		F	D	F
Approach Delay (s)		75.0			88.4			148.8			116.7	
Approach LOS		E			F			F			F	

Intersection Summary

HCM 2000 Control Delay	104.3	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.19		
Actuated Cycle Length (s)	141.6	Sum of lost time (s)	20.5
Intersection Capacity Utilization	101.3%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
37: Livermore Ave & I-580 WB Ramps

BART to Livermore Extension Project
2040 BART + INP + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↰	↔		↰	↑			↗	
Traffic Volume (vph)	0	0	0	344	91	24	572	86	0	0	151	0
Future Volume (vph)	0	0	0	344	91	24	572	86	0	0	151	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)					4.0		4.0	4.0			4.0	
Lane Util. Factor					0.95		0.97	1.00			0.95	
Frt					0.99		1.00	1.00			1.00	
Flt Protected					0.96		0.95	1.00			1.00	
Satd. Flow (prot)					1692		3433	1863			3539	
Flt Permitted					0.96		0.95	1.00			1.00	
Satd. Flow (perm)					1692		3433	1863			3539	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	374	99	26	622	93	0	0	164	0
RTOR Reduction (vph)	0	0	0	0	3	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	0	496	0	622	93	0	0	164	0
Turn Type				Split	NA		Prot	NA			NA	
Protected Phases				8	8		5	2			6	
Permitted Phases												
Actuated Green, G (s)					20.4		14.1	29.9			12.3	
Effective Green, g (s)					20.4		13.6	31.6			14.0	
Actuated g/C Ratio					0.34		0.23	0.53			0.23	
Clearance Time (s)					4.0		3.5	5.7			5.7	
Vehicle Extension (s)					2.0		2.0	2.5			2.5	
Lane Grp Cap (vph)					575		778	981			825	
v/s Ratio Prot					c0.29		c0.18	0.05			c0.05	
v/s Ratio Perm												
v/c Ratio					0.86		0.80	0.09			0.20	
Uniform Delay, d1					18.5		21.9	7.1			18.5	
Progression Factor					1.00		0.79	0.49			1.00	
Incremental Delay, d2					12.2		4.2	0.1			0.5	
Delay (s)					30.7		21.6	3.6			19.0	
Level of Service					C		C	A			B	
Approach Delay (s)		0.0			30.7			19.2			19.0	
Approach LOS		A			C			B			B	

Intersection Summary

HCM 2000 Control Delay	23.4	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.65		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	67.4%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 38: Livermore Ave & I-580 EB Ramps

BART to Livermore Extension Project
 2040 BART + INP + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕	↗					↕		↘	↕	
Traffic Volume (vph)	11	2	697	0	0	0	0	644	632	27	474	0
Future Volume (vph)	11	2	697	0	0	0	0	644	632	27	474	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0					3.0		5.0	3.0	
Lane Util. Factor		0.95	0.95					0.95		1.00	0.95	
Frt		0.86	0.85					0.93		1.00	1.00	
Flt Protected		1.00	1.00					1.00		0.95	1.00	
Satd. Flow (prot)		1511	1504					3276		1770	3539	
Flt Permitted		1.00	1.00					1.00		0.95	1.00	
Satd. Flow (perm)		1511	1504					3276		1770	3539	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	12	2	758	0	0	0	0	700	687	29	515	0
RTOR Reduction (vph)	0	281	281	0	0	0	0	236	0	0	0	0
Lane Group Flow (vph)	0	104	106	0	0	0	0	1151	0	29	515	0
Turn Type	Prot	NA	Perm					NA		Prot	NA	
Protected Phases	7	4						2		1	6	
Permitted Phases			4									
Actuated Green, G (s)		13.1	13.1					33.3		1.6	38.9	
Effective Green, g (s)		13.1	13.1					34.3		0.6	39.9	
Actuated g/C Ratio		0.22	0.22					0.57		0.01	0.66	
Clearance Time (s)		4.0	4.0					4.0		4.0	4.0	
Vehicle Extension (s)		2.0	2.0					2.5		2.0	2.5	
Lane Grp Cap (vph)		329	328					1872		17	2353	
v/s Ratio Prot								c0.35		c0.02	0.15	
v/s Ratio Perm		0.07	c0.07									
v/c Ratio		0.32	0.32					0.61		1.71	0.22	
Uniform Delay, d1		19.7	19.7					8.5		29.7	3.9	
Progression Factor		1.00	1.00					1.00		1.23	0.13	
Incremental Delay, d2		0.2	0.2					1.5		461.2	0.2	
Delay (s)		19.9	19.9					10.0		497.7	0.7	
Level of Service		B	B					B		F	A	
Approach Delay (s)		19.9			0.0			10.0			27.2	
Approach LOS		B			A			B			C	

Intersection Summary		
HCM 2000 Control Delay	16.3	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.55	B
Actuated Cycle Length (s)	60.0	Sum of lost time (s)
Intersection Capacity Utilization	67.4%	12.0
Analysis Period (min)	15	ICU Level of Service
		C

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 39: Livermore Ave & Portola Ave

BART to Livermore Extension Project
 2040 BART + INP + Garage AM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	450	302	126	33	767	114	250	571	62	128	786	465
Future Volume (vph)	450	302	126	33	767	114	250	571	62	128	786	465
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	2.7	4.0	4.0	2.7	4.0	4.0	4.9		4.0	4.9	4.9
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	1.00	0.95		1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	1770	3488		1770	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	1770	3488		1770	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	489	328	137	36	834	124	272	621	67	139	854	505
RTOR Reduction (vph)	0	0	81	0	0	85	0	7	0	0	0	31
Lane Group Flow (vph)	489	328	56	36	834	39	272	681	0	139	854	474
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA		Prot	NA	pm+ov
Protected Phases	3	8		7	4		1	6		5	2	3
Permitted Phases			8			4						2
Actuated Green, G (s)	18.0	48.1	48.1	3.5	33.6	33.6	19.0	37.4		13.5	31.9	49.9
Effective Green, g (s)	18.0	49.4	48.1	3.5	34.9	33.6	19.0	36.5		13.5	31.0	48.1
Actuated g/C Ratio	0.15	0.42	0.41	0.03	0.29	0.28	0.16	0.31		0.11	0.26	0.41
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	521	1475	642	52	1042	448	283	1074		201	925	708
v/s Ratio Prot	c0.14	0.09		0.02	c0.24		c0.15	0.20		0.08	c0.24	c0.10
v/s Ratio Perm			0.04			0.02						0.20
v/c Ratio	0.94	0.22	0.09	0.69	0.80	0.09	0.96	0.63		0.69	0.92	0.67
Uniform Delay, d1	49.7	22.2	21.7	57.0	38.6	31.2	49.4	35.3		50.5	42.6	28.7
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	24.7	0.1	0.1	33.0	4.5	0.1	42.7	1.2		9.8	14.4	2.4
Delay (s)	74.4	22.3	21.7	89.9	43.1	31.3	92.1	36.5		60.3	57.0	31.1
Level of Service	E	C	C	F	D	C	F	D		E	E	C
Approach Delay (s)		48.9			43.3			52.3			48.6	
Approach LOS		D			D			D			D	

Intersection Summary		
HCM 2000 Control Delay	48.3	HCM 2000 Level of Service D
HCM 2000 Volume to Capacity ratio	0.90	
Actuated Cycle Length (s)	118.5	Sum of lost time (s) 16.5
Intersection Capacity Utilization	83.7%	ICU Level of Service E
Analysis Period (min)	15	

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
40: First St/Springtown Blvd & I-580 WB Ramps

BART to Livermore Extension Project
2040 BART + INP + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations			↗↘			↗	↗↘	↑			↗↘	↗
Traffic Volume (vph)	0	0	443	0	0	0	341	375	0	0	881	557
Future Volume (vph)	0	0	443	0	0	0	341	375	0	0	881	557
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)			4.5				4.5	4.0			4.5	4.5
Lane Util. Factor			0.88				0.97	1.00			0.95	1.00
Frt			0.85				1.00	1.00			1.00	0.85
Flt Protected			1.00				0.95	1.00			1.00	1.00
Satd. Flow (prot)			2787				3433	1863			3539	1583
Flt Permitted			1.00				0.95	1.00			1.00	1.00
Satd. Flow (perm)			2787				3433	1863			3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	482	0	0	0	371	408	0	0	958	605
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	70
Lane Group Flow (vph)	0	0	482	0	0	0	371	408	0	0	958	535
Turn Type			Over			Free	Prot	NA			NA	Perm
Protected Phases			5				5	2			6	
Permitted Phases						Free						6
Actuated Green, G (s)			14.2				14.2	60.0			37.8	37.8
Effective Green, g (s)			13.7				13.7	60.0			37.3	37.3
Actuated g/C Ratio			0.23				0.23	1.00			0.62	0.62
Clearance Time (s)			4.0				4.0	4.0			4.0	4.0
Vehicle Extension (s)			2.0				2.0	0.2			4.0	4.0
Lane Grp Cap (vph)			636				783	1863			2200	984
v/s Ratio Prot			c0.17				0.11	0.22			0.27	
v/s Ratio Perm												c0.34
v/c Ratio			0.76				0.47	0.22			0.44	0.54
Uniform Delay, d1			21.6				20.0	0.0			5.9	6.5
Progression Factor			1.00				0.64	1.00			1.00	1.00
Incremental Delay, d2			4.6				0.1	0.2			0.6	2.2
Delay (s)			26.2				12.9	0.2			6.5	8.6
Level of Service			C				B	A			A	A
Approach Delay (s)		26.2			0.0			6.3			7.3	
Approach LOS		C			A			A			A	




















Intersection Summary

HCM 2000 Control Delay	10.3	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.60		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	51.7%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
41: First St & I-580 EB Ramps

BART to Livermore Extension Project
2040 BART + INP + Garage AM

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations													
Traffic Volume (vph)	75	2	383	0	0	0	0	971	913	89	1209	0	
Future Volume (vph)	75	2	383	0	0	0	0	971	913	89	1209	0	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)		4.0	4.0					5.0	5.0	5.0	5.0		
Lane Util. Factor		1.00	0.88					0.95	1.00	1.00	0.95		
Frt		1.00	0.85					1.00	0.85	1.00	1.00		
Flt Protected		0.95	1.00					1.00	1.00	0.95	1.00		
Satd. Flow (prot)		1776	2787					3539	1583	1770	3539		
Flt Permitted		0.95	1.00					1.00	1.00	0.95	1.00		
Satd. Flow (perm)		1776	2787					3539	1583	1770	3539		
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	
Adj. Flow (vph)	82	2	416	0	0	0	0	1055	992	97	1314	0	
RTOR Reduction (vph)	0	0	148	0	0	0	0	0	316	0	0	0	
Lane Group Flow (vph)	0	84	268	0	0	0	0	1055	676	97	1314	0	
Turn Type	Perm	NA	Perm					NA	Perm	Prot	NA		
Protected Phases		4						2		1	6		
Permitted Phases	4		4						2				
Actuated Green, G (s)		8.1	8.1					34.4	34.4	5.5	43.9		
Effective Green, g (s)		7.6	7.6					33.9	33.9	4.5	43.4		
Actuated g/C Ratio		0.13	0.13					0.56	0.56	0.08	0.72		
Clearance Time (s)		3.5	3.5					4.5	4.5	4.0	4.5		
Vehicle Extension (s)		2.5	2.5					4.0	4.0	2.0	4.0		
Lane Grp Cap (vph)		224	353					1999	894	132	2559		
v/s Ratio Prot								0.30		0.05	c0.37		
v/s Ratio Perm		0.05	c0.10						c0.43				
v/c Ratio		0.38	0.76					0.53	0.76	0.73	0.51		
Uniform Delay, d1		24.0	25.3					8.1	9.9	27.2	3.7		
Progression Factor		1.00	1.00					1.00	1.00	1.10	0.54		
Incremental Delay, d2		0.8	8.9					1.0	5.9	14.8	0.7		
Delay (s)		24.8	34.2					9.1	15.8	44.8	2.6		
Level of Service		C	C					A	B	D	A		
Approach Delay (s)		32.6			0.0			12.4			5.5		
Approach LOS		C			A			B			A		
Intersection Summary													
HCM 2000 Control Delay			12.5									HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio			0.76										
Actuated Cycle Length (s)			60.0									Sum of lost time (s)	14.0
Intersection Capacity Utilization			77.4%									ICU Level of Service	D
Analysis Period (min)			15										
c Critical Lane Group													

HCM Signalized Intersection Capacity Analysis
42: 1st St & Mines Rd

BART to Livermore Extension Project
2040 BART + INP + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	41	58	46	519	101	359	27	1448	348	176	1380	22
Future Volume (vph)	41	58	46	519	101	359	27	1448	348	176	1380	22
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		0.97	1.00	1.00	1.00	0.91		0.97	0.91	
Frt	1.00	0.93		1.00	1.00	0.85	1.00	0.97		1.00	1.00	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1739		3433	1863	1583	1770	4938		3433	5073	
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	1739		3433	1863	1583	1770	4938		3433	5073	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	45	63	50	564	110	390	29	1574	378	191	1500	24
RTOR Reduction (vph)	0	35	0	0	0	47	0	41	0	0	1	0
Lane Group Flow (vph)	45	78	0	564	110	343	29	1911	0	191	1523	0
Turn Type	Prot	NA		Prot	NA	pm+ov	Prot	NA		Prot	NA	
Protected Phases	7	4		3	8	1	5	2		1	6	
Permitted Phases						8						
Actuated Green, G (s)	3.4	8.5		15.7	20.8	26.8	1.9	38.9		6.0	43.0	
Effective Green, g (s)	3.4	8.5		15.7	20.8	26.8	1.9	38.9		6.0	43.0	
Actuated g/C Ratio	0.04	0.10		0.18	0.24	0.31	0.02	0.46		0.07	0.51	
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	70	173		633	455	572	39	2257		242	2563	
v/s Ratio Prot	0.03	0.04		c0.16	0.06	c0.04	0.02	c0.39		c0.06	0.30	
v/s Ratio Perm						0.17						
v/c Ratio	0.64	0.45		0.89	0.24	0.60	0.74	0.85		0.79	0.59	
Uniform Delay, d1	40.3	36.1		33.9	25.8	24.6	41.4	20.5		38.9	14.9	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	18.4	1.9		14.7	0.3	1.7	54.3	3.1		15.6	0.4	
Delay (s)	58.7	38.0		48.6	26.1	26.3	95.6	23.6		54.5	15.3	
Level of Service	E	D		D	C	C	F	C		D	B	
Approach Delay (s)		43.9			38.1			24.7			19.6	
Approach LOS		D			D			C			B	























Intersection Summary

HCM 2000 Control Delay	26.4	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.87		
Actuated Cycle Length (s)	85.1	Sum of lost time (s)	16.0
Intersection Capacity Utilization	72.2%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Unsignalized Intersection Capacity Analysis
43: Vasco Rd & I-580 WB Ramps

BART to Livermore Extension Project
2040 BART + INP + Garage AM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations								  			  	
Traffic Volume (veh/h)	0	0	0	0	0	143	0	1044	0	0	1884	0
Future Volume (Veh/h)	0	0	0	0	0	143	0	1044	0	0	1884	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	0	0	0	155	0	1135	0	0	2048	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage (veh)												
Upstream signal (ft)											524	
pX, platoon unblocked												
vC, conflicting volume	2581	3183	683	1818	3183	378	2048			1135		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	2581	3183	683	1818	3183	378	2048			1135		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	100	100	75	100			100		
cM capacity (veh/h)	9	10	392	49	10	619	271			611		
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	NB 4	SB 1	SB 2	SB 3	SB 4		
Volume Total	0	155	378	378	378	0	683	683	683	0		
Volume Left	0	0	0	0	0	0	0	0	0	0		
Volume Right	0	155	0	0	0	0	0	0	0	0		
cSH	1700	619	1700	1700	1700	1700	1700	1700	1700	1700		
Volume to Capacity	0.00	0.25	0.22	0.22	0.22	0.00	0.40	0.40	0.40	0.00		
Queue Length 95th (ft)	0	25	0	0	0	0	0	0	0	0		
Control Delay (s)	0.0	12.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
Lane LOS	A	B										
Approach Delay (s)	0.0	12.7	0.0				0.0					
Approach LOS	A	B										
Intersection Summary												
Average Delay			0.6									
Intersection Capacity Utilization			39.7%		ICU Level of Service				A			
Analysis Period (min)			15									

HCM Unsignalized Intersection Capacity Analysis
 44: Vasco Rd & I-580 EB Ramps

BART to Livermore Extension Project
 2040 BART + INP + Garage AM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	0	0	0	0	977	0	73	2019	0
Future Volume (Veh/h)	0	0	0	0	0	0	0	977	0	73	2019	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	0	0	0	0	0	1062	0	79	2195	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	2707	3415	732	1952	3415	354	2195			1062		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	2707	3415	732	1952	3415	354	2195			1062		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	100	100	100	100			88		
cM capacity (veh/h)	9	6	364	35	6	642	237			652		
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	NB 4	SB 1	SB 2	SB 3	SB 4		
Volume Total	0	0	354	354	354	0	79	732	732	732		
Volume Left	0	0	0	0	0	0	79	0	0	0		
Volume Right	0	0	0	0	0	0	0	0	0	0		
cSH	1700	1700	1700	1700	1700	1700	652	1700	1700	1700		
Volume to Capacity	0.00	0.00	0.21	0.21	0.21	0.00	0.12	0.43	0.43	0.43		
Queue Length 95th (ft)	0	0	0	0	0	0	10	0	0	0		
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	11.3	0.0	0.0	0.0		
Lane LOS	A	A					B					
Approach Delay (s)	0.0	0.0	0.0				0.4					
Approach LOS	A	A										
Intersection Summary												
Average Delay			0.3									
Intersection Capacity Utilization			42.3%		ICU Level of Service				A			
Analysis Period (min)			15									

HCM Signalized Intersection Capacity Analysis
45: Vasco Rd & East Ave

BART to Livermore Extension Project
2040 BART + INP + Garage AM





















Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	297	365	50	10	24	19	63	257	196	264	289	295
Future Volume (vph)	297	365	50	10	24	19	63	257	196	264	289	295
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	0.95		0.97	1.00	1.00
Frt	1.00	0.98		1.00	0.93		1.00	0.94		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	3476		1770	3302		1770	3309		3433	1863	1583
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1770	3476		1770	3302		1770	3309		3433	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	323	397	54	11	26	21	68	279	213	287	314	321
RTOR Reduction (vph)	0	18	0	0	20	0	0	156	0	0	0	216
Lane Group Flow (vph)	323	433	0	11	27	0	68	336	0	287	314	105
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												6
Actuated Green, G (s)	12.5	15.0		0.6	3.1		2.2	13.4		5.2	16.4	16.4
Effective Green, g (s)	12.5	15.0		0.6	3.1		2.2	13.4		5.2	16.4	16.4
Actuated g/C Ratio	0.25	0.30		0.01	0.06		0.04	0.27		0.10	0.33	0.33
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	440	1038		21	203		77	883		355	608	517
v/s Ratio Prot	c0.18	c0.12		0.01	0.01		0.04	0.10		c0.08	c0.17	
v/s Ratio Perm												0.07
v/c Ratio	0.73	0.42		0.52	0.13		0.88	0.38		0.81	0.52	0.20
Uniform Delay, d1	17.3	14.1		24.7	22.3		23.9	15.0		22.0	13.7	12.2
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	6.2	0.3		21.6	0.3		64.2	0.3		12.7	0.7	0.2
Delay (s)	23.6	14.4		46.2	22.6		88.1	15.3		34.7	14.4	12.4
Level of Service	C	B		D	C		F	B		C	B	B
Approach Delay (s)		18.2			27.1			24.1			20.0	
Approach LOS		B			C			C			C	

Intersection Summary		
HCM 2000 Control Delay	20.6	HCM 2000 Level of Service C
HCM 2000 Volume to Capacity ratio	0.67	
Actuated Cycle Length (s)	50.2	Sum of lost time (s) 16.0
Intersection Capacity Utilization	54.0%	ICU Level of Service A
Analysis Period (min)	15	

c Critical Lane Group






















HCM Signalized Intersection Capacity Analysis
46: Greenville Rd & I-580 WB Ramps

BART to Livermore Extension Project
2040 BART + INP + Garage AM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	309	0	64	0	229	336	0	934	66
Future Volume (vph)	0	0	0	309	0	64	0	229	336	0	934	66
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0		4.0		4.0	4.0		4.0	
Lane Util. Factor				0.97		1.00		0.95	1.00		0.95	
Frt				1.00		0.85		1.00	0.85		0.99	
Flt Protected				0.95		1.00		1.00	1.00		1.00	
Satd. Flow (prot)				3433		1583		3539	1583		3504	
Flt Permitted				0.95		1.00		1.00	1.00		1.00	
Satd. Flow (perm)				3433		1583		3539	1583		3504	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	336	0	70	0	249	365	0	1015	72
RTOR Reduction (vph)	0	0	0	0	0	57	0	0	116	0	7	0
Lane Group Flow (vph)	0	0	0	336	0	13	0	249	249	0	1080	0
Turn Type				Prot		Prot		NA	Perm		NA	
Protected Phases				3		3		2			6	
Permitted Phases									2			
Actuated Green, G (s)				11.1		11.1		40.9	40.9		40.9	
Effective Green, g (s)				11.1		11.1		40.9	40.9		40.9	
Actuated g/C Ratio				0.18		0.18		0.68	0.68		0.68	
Clearance Time (s)				4.0		4.0		4.0	4.0		4.0	
Vehicle Extension (s)				3.0		3.0		3.0	3.0		3.0	
Lane Grp Cap (vph)				635		292		2412	1079		2388	
v/s Ratio Prot				c0.10		0.01		0.07			c0.31	
v/s Ratio Perm									0.16			
v/c Ratio				0.53		0.04		0.10	0.23		0.45	
Uniform Delay, d1				22.1		20.1		3.3	3.6		4.4	
Progression Factor				1.00		1.00		0.76	0.47		1.00	
Incremental Delay, d2				0.8		0.1		0.1	0.5		0.6	
Delay (s)				22.9		20.2		2.6	2.2		5.0	
Level of Service				C		C		A	A		A	
Approach Delay (s)		0.0			22.4			2.3			5.0	
Approach LOS		A			C			A			A	
Intersection Summary												
HCM 2000 Control Delay			7.6	HCM 2000 Level of Service					A			
HCM 2000 Volume to Capacity ratio			0.47									
Actuated Cycle Length (s)			60.0	Sum of lost time (s)					8.0			
Intersection Capacity Utilization			43.4%	ICU Level of Service					A			
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis
47: Greenville Rd & I-580 EB Ramps

BART to Livermore Extension Project
2040 BART + INP + Garage AM

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations	 							 			 		
Traffic Volume (vph)	16	0	22	0	0	0	0	557	73	0	874	30	
Future Volume (vph)	16	0	22	0	0	0	0	557	73	0	874	30	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)	4.0		4.0					4.0	4.0		4.0	4.0	
Lane Util. Factor	0.97		1.00					0.95	1.00		0.95	1.00	
Frt	1.00		0.85					1.00	0.85		1.00	0.85	
Flt Protected	0.95		1.00					1.00	1.00		1.00	1.00	
Satd. Flow (prot)	3433		1583					3539	1583		3539	1583	
Flt Permitted	0.95		1.00					1.00	1.00		1.00	1.00	
Satd. Flow (perm)	3433		1583					3539	1583		3539	1583	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	
Adj. Flow (vph)	17	0	24	0	0	0	0	605	79	0	950	33	
RTOR Reduction (vph)	0	0	23	0	0	0	0	0	14	0	0	6	
Lane Group Flow (vph)	17	0	1	0	0	0	0	605	65	0	950	27	
Turn Type	Prot		Prot					NA	Perm		NA	Perm	
Protected Phases	7		7					2			6		
Permitted Phases									2			6	
Actuated Green, G (s)	2.7		2.7					49.3	49.3		49.3	49.3	
Effective Green, g (s)	2.7		2.7					49.3	49.3		49.3	49.3	
Actuated g/C Ratio	0.05		0.05					0.82	0.82		0.82	0.82	
Clearance Time (s)	4.0		4.0					4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0		3.0					3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	154		71					2907	1300		2907	1300	
v/s Ratio Prot	c0.00		0.00					0.17			c0.27		
v/s Ratio Perm									0.04			0.02	
v/c Ratio	0.11		0.02					0.21	0.05		0.33	0.02	
Uniform Delay, d1	27.5		27.4					1.2	1.0		1.3	1.0	
Progression Factor	1.00		1.00					1.00	1.00		0.67	0.55	
Incremental Delay, d2	0.3		0.1					0.2	0.1		0.3	0.0	
Delay (s)	27.8		27.5					1.3	1.1		1.1	0.6	
Level of Service	C		C					A	A		A	A	
Approach Delay (s)		27.6			0.0			1.3			1.1		
Approach LOS		C			A			A			A		
Intersection Summary													
HCM 2000 Control Delay			1.8									HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio			0.32										
Actuated Cycle Length (s)			60.0									Sum of lost time (s)	8.0
Intersection Capacity Utilization			34.2%									ICU Level of Service	A
Analysis Period (min)			15										

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 48: Greenville Rd & Northfront Road/Altamont Pass Road

BART to Livermore Extension Project
 2040 BART + INP + Garage AM



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↑	↑	↑	↑	↑
Traffic Volume (vph)	11	646	276	989	236	56
Future Volume (vph)	11	646	276	989	236	56
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	1863	1583	1770	1863	1770	1583
Flt Permitted	1.00	1.00	0.75	1.00	0.95	1.00
Satd. Flow (perm)	1863	1583	1397	1863	1770	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	12	702	300	1075	257	61
RTOR Reduction (vph)	0	249	0	0	0	48
Lane Group Flow (vph)	12	453	300	1075	257	13
Turn Type	NA	Perm	Perm	NA	Prot	Perm
Protected Phases	4			8	2	
Permitted Phases		4	8			2
Actuated Green, G (s)	38.3	38.3	38.3	38.3	13.1	13.1
Effective Green, g (s)	38.3	38.3	38.3	38.3	13.1	13.1
Actuated g/C Ratio	0.64	0.64	0.64	0.64	0.22	0.22
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	1201	1020	900	1201	390	349
v/s Ratio Prot	0.01			c0.58	c0.15	
v/s Ratio Perm		0.29	0.21			0.01
v/c Ratio	0.01	0.44	0.33	0.90	0.66	0.04
Uniform Delay, d1	3.8	5.2	4.8	8.9	21.1	18.2
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.0	0.3	0.2	8.9	4.0	0.0
Delay (s)	3.8	5.6	5.0	17.7	25.1	18.2
Level of Service	A	A	A	B	C	B
Approach Delay (s)	5.5			15.0	23.8	
Approach LOS	A			B	C	

Intersection Summary

HCM 2000 Control Delay	13.3	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.83		
Actuated Cycle Length (s)	59.4	Sum of lost time (s)	8.0
Intersection Capacity Utilization	71.8%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
49: Greenville Rd & Southfront Rd

BART to Livermore Extension Project
2040 BART + INP + Garage AM



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	105	185	113	531	787	128
Future Volume (vph)	105	185	113	531	787	128
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.2	5.2	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.88	0.97	0.95	0.95	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	3433	2787	3433	3539	3539	1583
Flt Permitted	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (perm)	3433	2787	3433	3539	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	114	201	123	577	855	139
RTOR Reduction (vph)	0	178	0	0	0	69
Lane Group Flow (vph)	114	23	123	577	855	70
Turn Type	Prot	Perm	Prot	NA	NA	Perm
Protected Phases	8		1	6	2	
Permitted Phases		8				2
Actuated Green, G (s)	5.4	5.4	3.2	27.0	19.8	19.8
Effective Green, g (s)	4.8	4.8	3.2	28.7	21.5	21.5
Actuated g/C Ratio	0.11	0.11	0.07	0.67	0.50	0.50
Clearance Time (s)	4.6	4.6	4.0	5.7	5.7	5.7
Vehicle Extension (s)	5.0	5.0	6.0	2.5	2.5	2.5
Lane Grp Cap (vph)	385	313	257	2378	1781	797
v/s Ratio Prot	c0.03		c0.04	0.16	c0.24	
v/s Ratio Perm		0.01				0.04
v/c Ratio	0.30	0.07	0.48	0.24	0.48	0.09
Uniform Delay, d1	17.4	17.0	18.9	2.7	6.9	5.5
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.9	0.2	3.9	0.0	0.1	0.0
Delay (s)	18.3	17.2	22.9	2.8	7.1	5.5
Level of Service	B	B	C	A	A	A
Approach Delay (s)	17.6			6.3	6.9	
Approach LOS	B			A	A	

Intersection Summary

HCM 2000 Control Delay	8.4	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.45		
Actuated Cycle Length (s)	42.7	Sum of lost time (s)	13.2
Intersection Capacity Utilization	39.4%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
50: Greenville Rd & Patterson Pass Rd

BART to Livermore Extension Project
2040 BART + INP + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	46	5	67	262	404	407	14	151	1	7	354	48
Future Volume (vph)	46	5	67	262	404	407	14	151	1	7	354	48
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.86		1.00	0.92		1.00	1.00		1.00	0.98	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1601		1770	1723		1770	1861		1770	1829	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	1601		1770	1723		1770	1861		1770	1829	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	50	5	73	285	439	442	15	164	1	8	385	52
RTOR Reduction (vph)	0	55	0	0	38	0	0	0	0	0	5	0
Lane Group Flow (vph)	50	23	0	285	843	0	15	165	0	8	432	0
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												
Actuated Green, G (s)	3.1	21.6		24.7	43.2		0.7	23.1		0.7	23.1	
Effective Green, g (s)	3.1	21.6		24.7	43.2		0.7	23.1		0.7	23.1	
Actuated g/C Ratio	0.04	0.25		0.29	0.50		0.01	0.27		0.01	0.27	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	63	401		507	864		14	499		14	490	
v/s Ratio Prot	0.03	0.01		c0.16	c0.49		c0.01	0.09		0.00	c0.24	
v/s Ratio Perm												
v/c Ratio	0.79	0.06		0.56	0.98		1.07	0.33		0.57	0.88	
Uniform Delay, d1	41.2	24.5		26.1	20.9		42.7	25.3		42.6	30.2	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	48.2	0.1		1.4	24.5		265.6	1.8		46.0	19.9	
Delay (s)	89.4	24.6		27.5	45.4		308.3	27.1		88.5	50.1	
Level of Service	F	C		C	D		F	C		F	D	
Approach Delay (s)		49.9			41.0			50.5			50.8	
Approach LOS		D			D			D			D	

Intersection Summary

HCM 2000 Control Delay	44.8	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.94		
Actuated Cycle Length (s)	86.1	Sum of lost time (s)	16.0
Intersection Capacity Utilization	74.4%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
1: Dougherty Rd & Amador Valley Rd



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	390	460	911	2277	1143	330
Future Volume (vph)	390	460	911	2277	1143	330
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00	0.97	0.91	0.91	
Frt	1.00	0.85	1.00	1.00	0.97	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1770	1583	3433	5085	4914	
Flt Permitted	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	1770	1583	3433	5085	4914	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	424	500	990	2475	1242	359
RTOR Reduction (vph)	0	342	0	0	50	0
Lane Group Flow (vph)	424	158	990	2475	1551	0
Turn Type	Perm	Perm	Prot	NA	NA	
Protected Phases			5	2	6	
Permitted Phases	4	4				
Actuated Green, G (s)	27.4	27.4	27.0	67.8	36.8	
Effective Green, g (s)	27.4	27.4	27.0	67.8	36.8	
Actuated g/C Ratio	0.27	0.27	0.26	0.66	0.36	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	469	420	898	3340	1752	
v/s Ratio Prot			c0.29	0.49	c0.32	
v/s Ratio Perm	c0.24	0.10				
v/c Ratio	0.90	0.38	1.10	0.74	0.89	
Uniform Delay, d1	36.6	30.9	38.1	11.8	31.2	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	20.6	0.6	62.1	0.9	5.8	
Delay (s)	57.2	31.5	100.2	12.7	37.0	
Level of Service	E	C	F	B	D	
Approach Delay (s)	43.3			37.7	37.0	
Approach LOS	D			D	D	

Intersection Summary

HCM 2000 Control Delay	38.4	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.95		
Actuated Cycle Length (s)	103.2	Sum of lost time (s)	12.0
Intersection Capacity Utilization	87.0%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

2: Hopyard Road/Dougherty Rd & Dublin Blvd

BART to Livermore Extension Project
2040 BART + INP + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↑↑↑	↖↗	↖↗↘	↑↑↑	↖	↖↗↘	↑↑↑	↖↗	↖↗	↑↑↑	↖↗
Traffic Volume (vph)	95	1237	859	744	1191	1141	799	2059	355	760	1179	36
Future Volume (vph)	95	1237	859	744	1191	1141	799	2059	355	760	1179	36
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	6.0	5.0	5.0	5.5	5.0	5.0	5.5	5.0	5.0	5.5	
Lane Util. Factor	0.97	0.91	0.88	0.94	0.91	1.00	0.94	0.91	0.88	0.97	0.86	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	3433	5085	2787	4990	5085	1583	4990	5085	2787	3433	6379	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	3433	5085	2787	4990	5085	1583	4990	5085	2787	3433	6379	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	103	1345	934	809	1295	1240	868	2238	386	826	1282	39
RTOR Reduction (vph)	0	0	59	0	0	68	0	0	57	0	3	0
Lane Group Flow (vph)	103	1345	875	809	1295	1172	868	2238	329	826	1318	0
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	
Protected Phases	5	2	3	1	6	7	3	8	1	7	4	
Permitted Phases			2			6			8			
Actuated Green, G (s)	15.6	34.5	55.6	20.0	39.4	53.4	21.1	45.0	65.0	14.0	37.9	
Effective Green, g (s)	15.6	34.5	55.6	20.0	39.4	53.4	21.1	45.0	65.0	14.0	37.9	
Actuated g/C Ratio	0.12	0.26	0.41	0.15	0.29	0.40	0.16	0.33	0.48	0.10	0.28	
Clearance Time (s)	5.0	6.0	5.0	5.0	5.5	5.0	5.0	5.5	5.0	5.0	5.5	
Vehicle Extension (s)	2.0	4.5	2.0	2.0	4.5	2.0	2.0	4.5	2.0	2.0	4.5	
Lane Grp Cap (vph)	396	1299	1147	739	1484	626	779	1695	1341	356	1790	
v/s Ratio Prot	0.03	c0.26	0.12	0.16	0.25	c0.19	0.17	c0.44	0.04	c0.24	0.21	
v/s Ratio Perm			0.19			0.55			0.08			
v/c Ratio	0.26	1.04	0.76	1.09	0.87	1.87	1.11	1.32	0.25	2.32	0.74	
Uniform Delay, d1	54.4	50.2	34.0	57.5	45.4	40.8	57.0	45.0	20.6	60.5	44.0	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.1	34.6	2.8	62.0	6.3	398.4	68.4	148.4	0.0	602.9	1.8	
Delay (s)	54.6	84.8	36.8	119.5	51.7	439.2	125.3	193.4	20.6	663.4	45.9	
Level of Service	D	F	D	F	D	F	F	F	C	F	D	
Approach Delay (s)		64.7			211.8			157.4			283.4	
Approach LOS		E			F			F			F	

Intersection Summary

HCM 2000 Control Delay	177.8	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.62		
Actuated Cycle Length (s)	135.0	Sum of lost time (s)	21.5
Intersection Capacity Utilization	135.8%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
3: Dougherty Rd/Hopyard Road & I-580 WB Ramps

BART to Livermore Extension Project
2040 BART + INP + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↔↔		↔↔		↑↑↑			↑↑↑	↔
Traffic Volume (vph)	0	0	0	320	0	591	0	2719	0	0	1697	0
Future Volume (vph)	0	0	0	320	0	591	0	2719	0	0	1697	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0		4.0		4.0			4.0	
Lane Util. Factor				0.97		0.88		0.91			0.86	
Frt				1.00		0.85		1.00			1.00	
Flt Protected				0.95		1.00		1.00			1.00	
Satd. Flow (prot)				3433		2787		5085			4806	
Flt Permitted				0.95		1.00		1.00			1.00	
Satd. Flow (perm)				3433		2787		5085			4806	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	348	0	642	0	2955	0	0	1845	0
RTOR Reduction (vph)	0	0	0	0	0	18	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	348	0	624	0	2955	0	0	1845	0
Turn Type				Prot		Prot		NA			NA	Perm
Protected Phases				4		4		2			6	
Permitted Phases												6
Actuated Green, G (s)				26.7		26.7		72.5			72.5	
Effective Green, g (s)				28.1		28.1		73.9			73.9	
Actuated g/C Ratio				0.26		0.26		0.67			0.67	
Clearance Time (s)				5.4		5.4		5.4			5.4	
Vehicle Extension (s)				3.0		3.0		3.0			3.0	
Lane Grp Cap (vph)				876		711		3416			3228	
v/s Ratio Prot				0.10		c0.22		c0.58			0.38	
v/s Ratio Perm												
v/c Ratio				0.40		0.88		0.87			0.57	
Uniform Delay, d1				33.9		39.3		14.1			9.6	
Progression Factor				1.00		1.00		1.02			1.00	
Incremental Delay, d2				0.3		11.9		0.3			0.7	
Delay (s)				34.2		51.2		14.7			10.4	
Level of Service				C		D		B			B	
Approach Delay (s)		0.0			45.2			14.7			10.4	
Approach LOS		A			D			B			B	

Intersection Summary

HCM 2000 Control Delay	18.5	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.87		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	79.9%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
4: Hopyard Rd/Dougherty Rd & I-580 EB Ramps

BART to Livermore Extension Project
2040 BART + INP + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗		↖↗					↑↑↑	↖		↑↑↑	↖
Traffic Volume (vph)	1397	0	823	0	0	0	0	2641	0	0	1321	0
Future Volume (vph)	1397	0	823	0	0	0	0	2641	0	0	1321	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0					4.0			4.0	
Lane Util. Factor	0.97		0.88					0.91			0.86	
Frt	1.00		0.85					1.00			1.00	
Flt Protected	0.95		1.00					1.00			1.00	
Satd. Flow (prot)	3433		2787					5085			4806	
Flt Permitted	0.95		1.00					1.00			1.00	
Satd. Flow (perm)	3433		2787					5085			4806	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	1518	0	895	0	0	0	0	2871	0	0	1436	0
RTOR Reduction (vph)	0	0	27	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	1518	0	868	0	0	0	0	2871	0	0	1436	0
Turn Type	Prot		Prot					NA	Free		NA	Perm
Protected Phases	4		4					2			6	
Permitted Phases									Free			6
Actuated Green, G (s)	43.4		43.4					55.8			55.8	
Effective Green, g (s)	44.8		44.8					57.2			57.2	
Actuated g/C Ratio	0.41		0.41					0.52			0.52	
Clearance Time (s)	5.4		5.4					5.4			5.4	
Vehicle Extension (s)	3.0		3.0					3.0			3.0	
Lane Grp Cap (vph)	1398		1135					2644			2499	
v/s Ratio Prot	c0.44		0.31					c0.56			0.30	
v/s Ratio Perm												
v/c Ratio	1.09		0.77					1.09			0.57	
Uniform Delay, d1	32.6		28.1					26.4			18.1	
Progression Factor	1.00		1.00					0.53			0.74	
Incremental Delay, d2	51.0		3.1					45.1			0.8	
Delay (s)	83.6		31.2					59.2			14.2	
Level of Service	F		C					E			B	
Approach Delay (s)		64.1			0.0			59.2			14.2	
Approach LOS		E			A			E			B	

Intersection Summary

HCM 2000 Control Delay	51.3	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	1.09		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	97.5%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

5: Hopyard Rd & Owens Rd

BART to Livermore Extension Project

2040 BART + INP + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	381	243	291	611	304	357	259	992	273	368	1585	237
Future Volume (vph)	381	243	291	611	304	357	259	992	273	368	1585	237
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	2.7	2.7		2.7	2.7	2.7	4.0	2.3	2.3	4.0	2.3	
Lane Util. Factor	0.91	0.91		1.00	0.95	0.95	1.00	0.91	1.00	0.97	0.91	
Frt	1.00	0.94		1.00	0.96	0.85	1.00	1.00	0.85	1.00	0.98	
Flt Protected	0.95	0.99		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1610	3142		1770	1699	1504	1770	5085	1583	3433	4986	
Flt Permitted	0.95	0.99		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1610	3142		1770	1699	1504	1770	5085	1583	3433	4986	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	414	264	316	664	330	388	282	1078	297	400	1723	258
RTOR Reduction (vph)	0	98	0	0	12	27	0	0	205	0	18	0
Lane Group Flow (vph)	228	668	0	664	438	241	282	1078	92	400	1963	0
Turn Type	Split	NA		Split	NA	pm+ov	Prot	NA	Perm	Prot	NA	
Protected Phases	8	8		4	4	1	5	2		1	6	
Permitted Phases						4			2			
Actuated Green, G (s)	14.0	14.0		28.0	28.0	47.7	12.0	32.3	32.3	19.7	40.0	
Effective Green, g (s)	15.3	15.3		29.3	29.3	50.3	12.0	34.0	34.0	19.7	41.7	
Actuated g/C Ratio	0.14	0.14		0.27	0.27	0.46	0.11	0.31	0.31	0.18	0.38	
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	223	437		471	452	724	193	1571	489	614	1890	
v/s Ratio Prot	0.14	c0.21		c0.38	0.26	0.06	c0.16	0.21		0.12	c0.39	
v/s Ratio Perm						0.10			0.06			
v/c Ratio	1.02	1.53		1.41	0.97	0.33	1.46	0.69	0.19	0.65	1.04	
Uniform Delay, d1	47.4	47.4		40.4	39.9	19.1	49.0	33.3	27.9	42.0	34.1	
Progression Factor	1.00	1.00		0.87	0.85	0.62	1.00	1.00	1.00	0.97	0.81	
Incremental Delay, d2	66.2	249.1		196.5	33.7	0.3	233.7	2.5	0.8	1.9	29.1	
Delay (s)	113.5	296.4		231.6	67.5	12.1	282.7	35.8	28.7	42.4	56.8	
Level of Service	F	F		F	E	B	F	D	C	D	E	
Approach Delay (s)		254.5			135.6			76.5			54.4	
Approach LOS		F			F			E			D	

Intersection Summary

HCM 2000 Control Delay	108.6	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.27		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	11.7
Intersection Capacity Utilization	115.5%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

6: Hopyard Rd & Stoneridge Dr

BART to Livermore Extension Project
2040 BART + INP + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	285	1100	698	116	1319	197	595	859	80	275	1013	229
Future Volume (vph)	285	1100	698	116	1319	197	595	859	80	275	1013	229
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.91	1.00	0.97	0.91	1.00	0.94	0.95	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5085	1583	3433	5085	1583	4990	3539	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5085	1583	3433	5085	1583	4990	3539	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	310	1196	759	126	1434	214	647	934	87	299	1101	249
RTOR Reduction (vph)	0	0	180	0	0	155	0	0	63	0	0	121
Lane Group Flow (vph)	310	1196	579	126	1434	59	647	934	24	299	1101	128
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	NA	6
Permitted Phases			4			8			2			6
Actuated Green, G (s)	5.0	18.6	18.6	3.2	16.8	16.8	6.0	17.0	17.0	6.0	17.0	17.0
Effective Green, g (s)	5.0	18.6	18.6	3.2	16.8	16.8	6.0	17.0	17.0	6.0	17.0	17.0
Actuated g/C Ratio	0.08	0.31	0.31	0.05	0.28	0.28	0.10	0.28	0.28	0.10	0.28	0.28
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	282	1555	484	180	1405	437	492	989	442	338	1421	442
v/s Ratio Prot	c0.09	0.24		0.04	0.28		c0.13	c0.26		0.09	0.22	
v/s Ratio Perm			c0.37			0.04			0.02			0.08
v/c Ratio	1.10	0.77	1.20	0.70	1.02	0.14	1.32	0.94	0.06	0.88	0.77	0.29
Uniform Delay, d1	27.9	19.2	21.1	28.3	22.0	16.5	27.4	21.4	16.0	27.1	20.1	17.2
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	82.8	2.4	107.2	11.3	29.3	0.1	155.7	16.7	0.1	22.9	2.7	0.4
Delay (s)	110.7	21.5	128.3	39.6	51.3	16.7	183.1	38.2	16.1	50.0	22.8	17.5
Level of Service	F	C	F	D	D	B	F	D	B	D	C	B
Approach Delay (s)		69.5			46.3			93.2			27.0	
Approach LOS		E			D			F			C	

Intersection Summary

HCM 2000 Control Delay	59.8	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.15		
Actuated Cycle Length (s)	60.8	Sum of lost time (s)	16.0
Intersection Capacity Utilization	78.5%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 7: Hopyard Rd & Las Positas Blvd

BART to Livermore Extension Project
 2040 BART + INP + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↑↑	↖	↖↗	↑↑	↖	↖↗	↑↑↑	↖	↖↗	↑↑↑	↖
Traffic Volume (vph)	101	262	509	596	431	47	399	963	259	73	1613	81
Future Volume (vph)	101	262	509	596	431	47	399	963	259	73	1613	81
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.95	1.00	0.97	0.95	1.00	0.97	0.91	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	3433	3539	1583	3433	5085	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	3433	3539	1583	3433	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	110	285	553	648	468	51	434	1047	282	79	1753	88
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	57
Lane Group Flow (vph)	110	285	553	648	468	51	434	1047	282	79	1753	31
Turn Type	Prot	NA	Free	Prot	NA	Free	Prot	NA	Free	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1		6
Permitted Phases			Free			Free			Free			6
Actuated Green, G (s)	4.8	13.1	88.0	17.0	25.3	88.0	11.0	37.9	88.0	4.0	30.9	30.9
Effective Green, g (s)	4.8	13.1	88.0	17.0	25.3	88.0	11.0	37.9	88.0	4.0	30.9	30.9
Actuated g/C Ratio	0.05	0.15	1.00	0.19	0.29	1.00	0.12	0.43	1.00	0.05	0.35	0.35
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	187	526	1583	663	1017	1583	429	2190	1583	156	1785	555
v/s Ratio Prot	0.03	0.08		c0.19	c0.13		c0.13	0.21		0.02	c0.34	
v/s Ratio Perm			0.35			0.03			0.18			0.02
v/c Ratio	0.59	0.54	0.35	0.98	0.46	0.03	1.01	0.48	0.18	0.51	0.98	0.06
Uniform Delay, d1	40.6	34.7	0.0	35.3	25.7	0.0	38.5	18.0	0.0	41.0	28.3	18.9
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	4.7	1.1	0.6	29.0	0.3	0.0	46.4	0.2	0.2	2.6	17.1	0.0
Delay (s)	45.3	35.8	0.6	64.3	26.1	0.0	84.9	18.1	0.2	43.6	45.4	18.9
Level of Service	D	D	A	E	C	A	F	B	A	D	D	B
Approach Delay (s)		16.4			46.2			31.7			44.1	
Approach LOS		B			D			C			D	
































Intersection Summary

HCM 2000 Control Delay	36.2	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.91		
Actuated Cycle Length (s)	88.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	80.1%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
8: Willow Rd & Owens Rd

BART to Livermore Extension Project
2040 BART + INP + Garage PM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 	  		 	  			 			 	
Traffic Volume (vph)	112	623	190	109	701	91	182	85	0	191	88	183
Future Volume (vph)	112	623	190	109	701	91	182	85	0	191	88	183
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	5.3	4.0		5.3	4.0	4.0
Lane Util. Factor	0.97	0.91		0.97	0.91	1.00	1.00	0.95		1.00	1.00	1.00
Frt	1.00	0.96		1.00	1.00	0.85	1.00	1.00		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	4907		3433	5085	1583	1770	3539		1770	1863	1583
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.67	1.00		0.69	1.00	1.00
Satd. Flow (perm)	3433	4907		3433	5085	1583	1253	3539		1293	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	122	677	207	118	762	99	198	92	0	208	96	199
RTOR Reduction (vph)	0	34	0	0	0	43	0	0	0	0	0	153
Lane Group Flow (vph)	122	850	0	118	762	56	198	92	0	208	96	46
Turn Type	Prot	NA		Prot	NA	Perm	Perm	NA	Perm	Perm	NA	Perm
Protected Phases	1	6		5	2			4				8
Permitted Phases						2	4		4	8		8
Actuated Green, G (s)	10.3	61.8		9.1	60.6	60.6	24.1	24.1		24.1	24.1	24.1
Effective Green, g (s)	10.3	63.5		9.1	62.3	62.3	24.1	25.4		24.1	25.4	25.4
Actuated g/C Ratio	0.09	0.58		0.08	0.57	0.57	0.22	0.23		0.22	0.23	0.23
Clearance Time (s)	4.0	5.7		4.0	5.7	5.7	5.3	5.3		5.3	5.3	5.3
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	321	2832		284	2879	896	274	817		283	430	365
v/s Ratio Prot	c0.04	c0.17		0.03	0.15			0.03			0.05	
v/s Ratio Perm						0.04	0.16			c0.16		0.03
v/c Ratio	0.38	0.30		0.42	0.26	0.06	0.72	0.11		0.73	0.22	0.13
Uniform Delay, d1	46.8	11.9		47.9	12.2	10.7	39.8	33.4		40.0	34.3	33.5
Progression Factor	1.25	1.29		1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	0.5	0.2		1.0	0.2	0.1	9.1	0.1		9.5	0.3	0.2
Delay (s)	58.9	15.5		48.9	12.4	10.9	48.9	33.5		49.5	34.6	33.7
Level of Service	E	B		D	B	B	D	C		D	C	C
Approach Delay (s)		20.8			16.6			44.0			40.4	
Approach LOS		C			B			D			D	
Intersection Summary												
HCM 2000 Control Delay			25.3				HCM 2000 Level of Service				C	
HCM 2000 Volume to Capacity ratio			0.41									
Actuated Cycle Length (s)			110.0				Sum of lost time (s)				12.0	
Intersection Capacity Utilization			46.9%				ICU Level of Service				A	
Analysis Period (min)			15									

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
9: Hacienda Dr & Dublin Blvd

BART to Livermore Extension Project
2040 BART + INP + Garage PM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	53	1082	237	243	629	21	548	680	543	28	703	224
Future Volume (vph)	53	1082	237	243	629	21	548	680	543	28	703	224
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	6.0	5.0	4.5	6.0		5.0	6.0	6.0	4.5	5.5	5.5
Lane Util. Factor	0.97	0.91	0.88	0.97	0.91		0.94	0.95	0.88	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5085	2787	3433	5060		4990	3539	2787	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5085	2787	3433	5060		4990	3539	2787	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	58	1176	258	264	684	23	596	739	590	30	764	243
RTOR Reduction (vph)	0	0	62	0	3	0	0	0	194	0	0	154
Lane Group Flow (vph)	58	1176	196	264	704	0	596	739	396	30	764	89
Turn Type	Prot	NA	pm+ov	Prot	NA		Prot	NA	Perm	Prot	NA	Perm
Protected Phases	5	2	3	1	6		3	8		7	NA	4
Permitted Phases			2						8			4
Actuated Green, G (s)	4.2	33.1	45.4	9.5	38.4		12.3	34.6	34.6	2.1	24.4	24.4
Effective Green, g (s)	4.2	33.1	45.4	9.5	38.4		12.3	34.6	34.6	2.1	24.4	24.4
Actuated g/C Ratio	0.04	0.33	0.45	0.09	0.38		0.12	0.34	0.34	0.02	0.24	0.24
Clearance Time (s)	4.5	6.0	5.0	4.5	6.0		5.0	6.0	6.0	4.5	5.5	5.5
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	143	1678	1400	325	1937		611	1220	961	71	1237	385
v/s Ratio Prot	0.02	c0.23	0.02	c0.08	0.14		c0.12	c0.21		0.01	c0.15	
v/s Ratio Perm			0.05						0.14			0.06
v/c Ratio	0.41	0.70	0.14	0.81	0.36		0.98	0.61	0.41	0.42	0.62	0.23
Uniform Delay, d1	46.8	29.3	16.0	44.5	22.2		43.8	27.2	25.1	48.5	33.8	30.4
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.9	1.3	0.0	14.3	0.1		30.0	0.9	0.3	4.0	0.9	0.3
Delay (s)	48.7	30.6	16.1	58.8	22.3		73.8	28.1	25.4	52.5	34.7	30.7
Level of Service	D	C	B	E	C		E	C	C	D	C	C
Approach Delay (s)		28.8			32.2			41.4			34.3	
Approach LOS		C			C			D			C	
Intersection Summary												
HCM 2000 Control Delay			34.9			HCM 2000 Level of Service			C			
HCM 2000 Volume to Capacity ratio			0.73									
Actuated Cycle Length (s)			100.3			Sum of lost time (s)			21.0			
Intersection Capacity Utilization			69.3%			ICU Level of Service			C			
Analysis Period (min)			15									

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 10: Hacienda Dr & Martinelli Blvd/Hacienda Crossings

BART to Livermore Extension Project
 2040 BART + INP + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↗	↘	↖↗	↖↘	↘		↖↗↘	↖↗↘	↘	↖↗	↖↗↘	
Traffic Volume (vph)	35	54	491	290	32	25	427	1741	462	61	1099	76
Future Volume (vph)	35	54	491	290	32	25	427	1741	462	61	1099	76
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	2.0	2.0	4.5	2.0		3.0	2.0	2.0	4.5	2.5	
Lane Util. Factor	1.00	0.91	0.91	0.97	1.00		0.94	0.91	1.00	0.97	0.86	
Frt	1.00	0.93	0.85	1.00	0.93		1.00	1.00	0.85	1.00	0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1770	1575	2882	3433	1741		4990	5085	1583	3433	6345	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1770	1575	2882	3433	1741		4990	5085	1583	3433	6345	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	38	59	534	315	35	27	464	1892	502	66	1195	83
RTOR Reduction (vph)	0	37	261	0	20	0	0	0	162	0	7	0
Lane Group Flow (vph)	38	75	220	315	42	0	464	1892	340	66	1271	0
Turn Type	Prot	NA	Perm	Prot	NA		Prot	NA	pm+ov	Prot	NA	
Protected Phases	5	2		1	6		3	8	1	7	4	
Permitted Phases			2						8			
Actuated Green, G (s)	3.6	17.1	17.1	14.1	27.6		12.2	56.4	70.5	6.4	50.6	
Effective Green, g (s)	3.1	19.1	19.1	13.6	29.6		13.2	58.4	74.5	5.9	52.1	
Actuated g/C Ratio	0.03	0.17	0.17	0.12	0.27		0.12	0.53	0.68	0.05	0.47	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	4.0	4.0	2.0	4.0		3.0	4.0	2.0	3.0	4.0	
Lane Grp Cap (vph)	49	273	500	424	468		598	2699	1100	184	3005	
v/s Ratio Prot	0.02	0.05		c0.09	0.02		0.09	c0.37	0.05	0.02	c0.20	
v/s Ratio Perm			c0.08						0.17			
v/c Ratio	0.78	0.27	0.44	0.74	0.09		0.78	0.70	0.31	0.36	0.42	
Uniform Delay, d1	53.1	39.4	40.7	46.5	30.1		47.0	19.3	7.2	50.2	19.1	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.03	1.05	1.86	1.00	1.00	
Incremental Delay, d2	53.1	0.7	0.8	6.1	0.1		4.0	1.0	0.0	1.2	0.4	
Delay (s)	106.2	40.2	41.5	52.6	30.2		52.5	21.3	13.5	51.4	19.5	
Level of Service	F	D	D	D	C		D	C	B	D	B	
Approach Delay (s)		45.2			48.9			25.0			21.1	
Approach LOS		D			D			C			C	

Intersection Summary

HCM 2000 Control Delay	28.1	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.64		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	13.0
Intersection Capacity Utilization	71.1%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 11: Hacienda Dr & I-580 WB Ramps

BART to Livermore Extension Project
 2040 BART + INP + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↔↔		↔↔		↑↑↑			↑↑↑	↔
Traffic Volume (vph)	0	0	0	423	0	509	0	1860	841	0	1039	810
Future Volume (vph)	0	0	0	423	0	509	0	1860	841	0	1039	810
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				2.6		2.6		2.1			2.1	2.1
Lane Util. Factor				0.97		0.88		0.91			0.86	0.86
Frt				1.00		0.85		0.95			0.96	0.85
Flt Protected				0.95		1.00		1.00			1.00	1.00
Satd. Flow (prot)				3433		2787		4848			4604	1362
Flt Permitted				0.95		1.00		1.00			1.00	1.00
Satd. Flow (perm)				3433		2787		4848			4604	1362
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	460	0	553	0	2022	914	0	1129	880
RTOR Reduction (vph)	0	0	0	0	0	24	0	146	0	0	127	143
Lane Group Flow (vph)	0	0	0	460	0	529	0	2790	0	0	1442	297
Turn Type				Prot		Prot		NA			NA	Perm
Protected Phases				4		4		2			6	
Permitted Phases												6
Actuated Green, G (s)				11.8		11.8		35.2			35.2	35.2
Effective Green, g (s)				13.2		13.2		37.1			37.1	37.1
Actuated g/C Ratio				0.24		0.24		0.67			0.67	0.67
Clearance Time (s)				4.0		4.0		4.0			4.0	4.0
Vehicle Extension (s)				3.0		3.0		3.0			3.0	3.0
Lane Grp Cap (vph)				823		668		3270			3105	918
v/s Ratio Prot				0.13		c0.19		c0.58			0.31	
v/s Ratio Perm												0.22
v/c Ratio				0.56		0.79		0.85			0.46	0.32
Uniform Delay, d1				18.3		19.6		6.9			4.2	3.7
Progression Factor				1.00		1.00		0.87			0.64	1.24
Incremental Delay, d2				0.8		6.4		1.7			0.5	0.9
Delay (s)				19.2		26.0		7.7			3.2	5.5
Level of Service				B		C		A			A	A
Approach Delay (s)		0.0			22.9			7.7			3.7	
Approach LOS		A			C			A			A	
























Intersection Summary

HCM 2000 Control Delay	8.9	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.83		
Actuated Cycle Length (s)	55.0	Sum of lost time (s)	4.7
Intersection Capacity Utilization	79.2%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 12: Hacienda Dr & I-580 EB Ramps

























BART to Livermore Extension Project
 2040 BART + INP + Garage PM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 		 					  			  	
Traffic Volume (vph)	950	0	635	0	0	0	0	1912	582	0	1042	313
Future Volume (vph)	950	0	635	0	0	0	0	1912	582	0	1042	313
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0					4.0	4.0		4.0	
Lane Util. Factor	0.97		0.88					0.86	0.86		0.91	
Frt	1.00		0.85					0.99	0.85		0.97	
Flt Protected	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (prot)	3433		2787					4744	1362		4909	
Flt Permitted	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (perm)	3433		2787					4744	1362		4909	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	1033	0	690	0	0	0	0	2078	633	0	1133	340
RTOR Reduction (vph)	0	0	82	0	0	0	0	9	184	0	47	0
Lane Group Flow (vph)	1033	0	608	0	0	0	0	2265	253	0	1426	0
Turn Type	Prot		Prot					NA	Perm		NA	
Protected Phases	4		4					2			6	
Permitted Phases									2			
Actuated Green, G (s)	37.0		37.0					61.7	61.7		61.7	
Effective Green, g (s)	38.4		38.4					63.6	63.6		63.6	
Actuated g/C Ratio	0.35		0.35					0.58	0.58		0.58	
Clearance Time (s)	5.4		5.4					5.9	5.9		5.9	
Vehicle Extension (s)	2.0		2.0					2.0	2.0		2.0	
Lane Grp Cap (vph)	1198		972					2742	787		2838	
v/s Ratio Prot	c0.30		0.22					c0.48			0.29	
v/s Ratio Perm									0.19			
v/c Ratio	0.86		0.63					0.83	0.32		0.50	
Uniform Delay, d1	33.3		29.8					18.7	12.0		13.8	
Progression Factor	1.00		1.00					1.00	1.00		0.66	
Incremental Delay, d2	6.4		0.9					3.0	1.1		0.6	
Delay (s)	39.7		30.7					21.7	13.1		9.7	
Level of Service	D		C					C	B		A	
Approach Delay (s)		36.1			0.0			20.3			9.7	
Approach LOS		D			A			C			A	
Intersection Summary												
HCM 2000 Control Delay			22.3					HCM 2000 Level of Service			C	
HCM 2000 Volume to Capacity ratio			0.84									
Actuated Cycle Length (s)			110.0					Sum of lost time (s)			8.0	
Intersection Capacity Utilization			75.0%					ICU Level of Service			D	
Analysis Period (min)			15									

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 13: Hacienda Dr & Owens Rd

BART to Livermore Extension Project
 2040 BART + INP + Garage PM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	619	897	42	138	355	989	22	686	257	802	552	309
Future Volume (vph)	619	897	42	138	355	989	22	686	257	802	552	309
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	2.3	4.0	4.0	2.3	4.0	4.0	2.7	4.0	4.0	2.7
Lane Util. Factor	0.97	0.91	1.00	0.97	0.91	1.00	0.97	0.91	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5085	1583	3433	5085	1583	3433	5085	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5085	1583	3433	5085	1583	3433	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	673	975	46	150	386	1075	24	746	279	872	600	336
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	673	975	46	150	386	1075	24	746	279	872	600	336
Turn Type	Prot	NA	Free	Prot	NA	Free	Prot	NA	Free	Prot	NA	Free
Protected Phases	1	6		5	2		7	4		3	8	
Permitted Phases			Free			Free			Free			Free
Actuated Green, G (s)	30.7	36.3	115.0	8.7	14.3	115.0	2.4	22.6	115.0	28.4	48.6	115.0
Effective Green, g (s)	30.7	38.0	115.0	8.7	16.0	115.0	2.4	23.9	115.0	28.4	49.9	115.0
Actuated g/C Ratio	0.27	0.33	1.00	0.08	0.14	1.00	0.02	0.21	1.00	0.25	0.43	1.00
Clearance Time (s)	4.0	5.7		4.0	5.7		4.0	5.3		4.0	5.3	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	916	1680	1583	259	707	1583	71	1056	1583	847	2206	1583
v/s Ratio Prot	0.20	0.19		0.04	0.08		0.01	0.15		c0.25	0.12	
v/s Ratio Perm			0.03			c0.68			0.18			0.21
v/c Ratio	0.73	0.58	0.03	0.58	0.55	0.68	0.34	0.71	0.18	1.03	0.27	0.21
Uniform Delay, d1	38.4	31.9	0.0	51.4	46.1	0.0	55.5	42.3	0.0	43.3	20.9	0.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	3.1	0.5	0.0	3.1	0.9	2.4	2.8	4.0	0.2	38.7	0.3	0.3
Delay (s)	41.5	32.4	0.0	54.5	47.0	2.4	58.3	46.3	0.2	82.0	21.2	0.3
Level of Service	D	C	A	D	D	A	E	D	A	F	C	A
Approach Delay (s)		35.2			17.9			34.3			46.6	
Approach LOS		D			B			C			D	
Intersection Summary												
HCM 2000 Control Delay			33.9				HCM 2000 Level of Service			C		
HCM 2000 Volume to Capacity ratio			0.86									
Actuated Cycle Length (s)			115.0			Sum of lost time (s)			16.0			
Intersection Capacity Utilization			74.0%			ICU Level of Service			D			
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis
 14: Tassajara Rd & Dublin Blvd

BART to Livermore Extension Project
 2040 BART + INP + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔↔	↑↑↑	↔↔	↔↔↔	↑↑↑↔		↔↔↔	↑↑↑	↔	↔↔	↑↑↑	↔↔
Traffic Volume (vph)	284	1103	472	291	375	25	415	957	657	40	794	150
Future Volume (vph)	284	1103	472	291	375	25	415	957	657	40	794	150
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	6.0	6.0	5.0	6.0		5.0	6.0	6.0	5.0	5.7	5.7
Lane Util. Factor	0.97	0.86	0.88	0.94	0.91		0.94	0.86	1.00	0.97	0.86	0.88
Frt	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	6408	2787	4990	5038		4990	6408	1583	3433	6408	2787
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	6408	2787	4990	5038		4990	6408	1583	3433	6408	2787
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	309	1199	513	316	408	27	451	1040	714	43	863	163
RTOR Reduction (vph)	0	0	283	0	5	0	0	0	229	0	0	130
Lane Group Flow (vph)	309	1199	230	316	430	0	451	1040	485	43	863	33
Turn Type	Prot	NA	Perm	Prot	NA		Prot	NA	Perm	Prot	NA	Perm
Protected Phases	5	2		1	6		3	8		7		4
Permitted Phases			2						8			4
Actuated Green, G (s)	16.4	41.2	41.2	16.4	41.2		31.8	48.9	48.9	11.2	28.6	28.6
Effective Green, g (s)	16.4	41.2	41.2	16.4	41.2		31.8	48.9	48.9	11.2	28.6	28.6
Actuated g/C Ratio	0.12	0.29	0.29	0.12	0.29		0.23	0.35	0.35	0.08	0.20	0.20
Clearance Time (s)	5.0	6.0	6.0	5.0	6.0		5.0	6.0	6.0	5.0	5.7	5.7
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	403	1889	821	585	1485		1135	2243	554	275	1311	570
v/s Ratio Prot	c0.09	c0.19		0.06	0.09		c0.09	0.16		0.01	0.13	
v/s Ratio Perm			0.08						c0.31			0.01
v/c Ratio	0.77	0.63	0.28	0.54	0.29		0.40	0.46	0.88	0.16	0.66	0.06
Uniform Delay, d1	59.8	42.7	37.9	58.1	38.0		45.8	35.2	42.6	59.8	51.1	44.7
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	8.5	0.7	0.2	1.0	0.1		0.2	0.2	14.4	0.3	1.2	0.0
Delay (s)	68.3	43.4	38.0	59.1	38.1		46.0	35.4	57.0	60.1	52.3	44.8
Level of Service	E	D	D	E	D		D	D	E	E	D	D
Approach Delay (s)		45.9			46.9			44.6			51.4	
Approach LOS		D			D			D			D	

Intersection Summary			
HCM 2000 Control Delay	46.5	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.74		
Actuated Cycle Length (s)	139.7	Sum of lost time (s)	22.0
Intersection Capacity Utilization	83.3%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 15: Tassajara Rd & I-580 WB Ramps

BART to Livermore Extension Project
 2040 BART + INP + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↔↔		↔↔		↑↑	↔		↑↑↑	↔
Traffic Volume (vph)	0	0	0	627	0	231	0	1697	711	0	1308	637
Future Volume (vph)	0	0	0	627	0	231	0	1697	711	0	1308	637
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0		4.0		4.0	4.0		4.0	4.0
Lane Util. Factor				0.97		0.88		0.95	1.00		0.86	0.86
Frt				1.00		0.85		1.00	0.85		0.98	0.85
Flt Protected				0.95		1.00		1.00	1.00		1.00	1.00
Satd. Flow (prot)				3433		2787		3539	1583		4711	1362
Flt Permitted				0.95		1.00		1.00	1.00		1.00	1.00
Satd. Flow (perm)				3433		2787		3539	1583		4711	1362
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	682	0	251	0	1845	773	0	1422	692
RTOR Reduction (vph)	0	0	0	0	0	16	0	0	323	0	32	199
Lane Group Flow (vph)	0	0	0	682	0	235	0	1845	450	0	1605	278
Turn Type				Perm		Perm		NA	Perm		NA	Perm
Protected Phases								2			6	
Permitted Phases				8		8			2			6
Actuated Green, G (s)				15.0		15.0		32.0	32.0		32.0	32.0
Effective Green, g (s)				15.0		15.0		32.0	32.0		32.0	32.0
Actuated g/C Ratio				0.27		0.27		0.58	0.58		0.58	0.58
Clearance Time (s)				4.0		4.0		4.0	4.0		4.0	4.0
Vehicle Extension (s)				3.0		3.0		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)				936		760		2059	921		2740	792
v/s Ratio Prot								c0.52			0.34	
v/s Ratio Perm				c0.20		0.08			0.28			0.20
v/c Ratio				0.73		0.31		0.90	0.49		0.59	0.35
Uniform Delay, d1				18.2		15.9		10.0	6.7		7.3	6.0
Progression Factor				1.00		1.00		1.00	1.00		1.00	1.00
Incremental Delay, d2				2.9		0.2		6.6	1.9		0.9	1.2
Delay (s)				21.0		16.1		16.7	8.6		8.2	7.3
Level of Service				C		B		B	A		A	A
Approach Delay (s)		0.0			19.7			14.3			8.0	
Approach LOS		A			B			B			A	

Intersection Summary			
HCM 2000 Control Delay	12.8	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.84		
Actuated Cycle Length (s)	55.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	71.5%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 16: Santa Rita Rd & I-580 EB Ramps/Pimilco Dr

BART to Livermore Extension Project
 2040 BART + INP + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	451	86	271	143	0	315	0	1617	202	319	1149	0
Future Volume (vph)	451	86	271	143	0	315	0	1617	202	319	1149	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0		4.0		4.0		4.0	4.0	
Lane Util. Factor	0.97	1.00	1.00	0.97		0.88		0.86		1.00	0.95	
Frt	1.00	1.00	0.85	1.00		0.85		0.98		1.00	1.00	
Flt Protected	0.95	1.00	1.00	0.95		1.00		1.00		0.95	1.00	
Satd. Flow (prot)	3433	1863	1583	3433		2787		6301		1770	3539	
Flt Permitted	0.95	1.00	1.00	0.95		1.00		1.00		0.95	1.00	
Satd. Flow (perm)	3433	1863	1583	3433		2787		6301		1770	3539	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	490	93	295	155	0	342	0	1758	220	347	1249	0
RTOR Reduction (vph)	0	0	73	0	0	36	0	20	0	0	0	0
Lane Group Flow (vph)	490	93	222	155	0	307	0	1958	0	347	1249	0
Turn Type	Perm	NA	Perm	Prot		pm+ov		NA		Prot	NA	Perm
Protected Phases		4		3		1		2		1	6	
Permitted Phases	4		4			3						6
Actuated Green, G (s)	20.0	20.0	20.0	7.6		31.9		42.1		24.3	70.4	
Effective Green, g (s)	20.0	20.0	20.0	7.6		31.9		42.1		24.3	70.4	
Actuated g/C Ratio	0.18	0.18	0.18	0.07		0.29		0.38		0.22	0.64	
Clearance Time (s)	4.0	4.0	4.0	4.0		4.0		4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0		3.0		3.0		3.0	3.0	
Lane Grp Cap (vph)	624	338	287	237		808		2411		391	2264	
v/s Ratio Prot		0.05		c0.05		0.08		c0.31		c0.20	0.35	
v/s Ratio Perm	c0.14		0.14			0.03						
v/c Ratio	0.79	0.28	0.77	0.65		0.38		0.81		0.89	0.55	
Uniform Delay, d1	43.0	38.8	42.8	49.9		31.2		30.4		41.5	11.0	
Progression Factor	1.00	1.00	1.00	1.00		1.00		1.00		1.00	1.00	
Incremental Delay, d2	6.4	0.4	12.2	6.3		0.3		3.1		20.8	1.0	
Delay (s)	49.4	39.2	55.1	56.3		31.5		33.5		62.3	12.0	
Level of Service	D	D	E	E		C		C		E	B	
Approach Delay (s)		50.2			39.2			33.5			22.9	
Approach LOS		D			D			C			C	

Intersection Summary

HCM 2000 Control Delay	33.6	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.81		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	67.3%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 17: Santa Rita Rd & Valley Ave

BART to Livermore Extension Project
 2040 BART + INP + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	381	758	132	142	376	797	144	625	159	1414	1119	271
Future Volume (vph)	381	758	132	142	376	797	144	625	159	1414	1119	271
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.97	0.95		0.97	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.97		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	3433	3431		3433	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	3433	3431		3433	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	414	824	143	154	409	866	157	679	173	1537	1216	295
RTOR Reduction (vph)	0	0	94	0	0	0	0	19	0	0	0	123
Lane Group Flow (vph)	414	824	49	154	409	866	157	833	0	1537	1216	172
Turn Type	Prot	NA	Perm	Prot	NA	Free	Prot	NA		Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1		6
Permitted Phases			4			Free						6
Actuated Green, G (s)	15.0	24.0	24.0	8.0	17.0	120.0	9.5	28.0		44.0	62.5	62.5
Effective Green, g (s)	15.0	24.0	24.0	8.0	17.0	120.0	9.5	28.0		44.0	62.5	62.5
Actuated g/C Ratio	0.12	0.20	0.20	0.07	0.14	1.00	0.08	0.23		0.37	0.52	0.52
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	429	707	316	118	501	1583	271	800		1258	1843	824
v/s Ratio Prot	c0.12	c0.23		c0.09	0.12		0.05	c0.24		c0.45	0.34	
v/s Ratio Perm			0.03			0.55						0.11
v/c Ratio	0.97	1.17	0.15	1.31	0.82	0.55	0.58	1.04		1.22	0.66	0.21
Uniform Delay, d1	52.2	48.0	39.6	56.0	50.0	0.0	53.3	46.0		38.0	21.0	15.5
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	34.2	89.4	0.2	185.6	9.9	1.4	3.0	43.0		107.1	0.9	0.1
Delay (s)	86.4	137.4	39.8	241.6	59.9	1.4	56.3	89.0		145.1	21.9	15.6
Level of Service	F	F	D	F	E	A	E	F		F	C	B
Approach Delay (s)		112.0			44.0			83.9			83.4	
Approach LOS		F			D			F			F	

Intersection Summary

HCM 2000 Control Delay	81.0	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.17		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	104.8%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
18: Bernal Ave/Valley Ave & Stanley Blvd

BART to Livermore Extension Project
2040 BART + INP + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↗↘	↑↑	↗	↗↘	↑↑	↗	↗	↑↑	↗	↗↘	↑↑	
Traffic Volume (vph)	229	830	58	92	234	352	97	378	309	823	552	132
Future Volume (vph)	229	830	58	92	234	352	97	378	309	823	552	132
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	0.97	0.95	1.00	0.97	0.91	0.91	1.00	0.95	1.00	0.97	0.95	
Frt	1.00	1.00	0.85	1.00	0.94	0.85	1.00	1.00	0.85	1.00	0.97	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	3433	3539	1583	3433	3177	1441	1770	3539	1583	3433	3437	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	3433	3539	1583	3433	3177	1441	1770	3539	1583	3433	3437	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	249	902	63	100	254	383	105	411	336	895	600	143
RTOR Reduction (vph)	0	0	39	0	130	54	0	0	167	0	22	0
Lane Group Flow (vph)	249	902	24	100	308	145	105	411	169	895	721	0
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	
Protected Phases	7	4	5	3	8	1	5	2		1	6	
Permitted Phases			4			8			2			
Actuated Green, G (s)	10.3	24.9	32.6	3.0	17.6	42.9	7.7	16.1	16.1	25.3	33.7	
Effective Green, g (s)	10.3	24.9	32.6	3.0	17.6	42.9	7.7	16.1	16.1	25.3	33.7	
Actuated g/C Ratio	0.12	0.29	0.38	0.04	0.21	0.50	0.09	0.19	0.19	0.30	0.40	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	414	1033	679	120	655	792	159	667	298	1018	1357	
v/s Ratio Prot	c0.07	c0.25	0.00	0.03	0.10	0.05	0.06	c0.12		c0.26	0.21	
v/s Ratio Perm			0.01			0.05			0.11			
v/c Ratio	0.60	0.87	0.04	0.83	0.47	0.18	0.66	0.62	0.57	0.88	0.53	
Uniform Delay, d1	35.6	28.7	16.5	40.9	29.8	11.6	37.5	31.8	31.4	28.5	19.8	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	2.5	8.3	0.0	36.7	0.5	0.1	9.8	1.7	2.5	8.8	0.4	
Delay (s)	38.0	37.0	16.5	77.6	30.3	11.7	47.4	33.5	33.9	37.3	20.2	
Level of Service	D	D	B	E	C	B	D	C	C	D	C	
Approach Delay (s)		36.1			31.7			35.3			29.5	
Approach LOS		D			C			D			C	

Intersection Summary

HCM 2000 Control Delay	32.8	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.82		
Actuated Cycle Length (s)	85.3	Sum of lost time (s)	16.0
Intersection Capacity Utilization	75.6%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 19: Fallon Rd & Dublin Blvd/Croak Rd

BART to Livermore Extension Project
 2040 BART + INP + Garage PM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations													
Traffic Volume (vph)	175	702	433	111	31	101	259	855	328	134	634	22	
Future Volume (vph)	175	702	433	111	31	101	259	855	328	134	634	22	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	0.97	0.91	0.88	0.94	0.91	1.00	0.94	0.91	0.88	0.97	0.91	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	3433	5085	2787	4990	5085	1583	4990	5085	2787	3433	5085	1583	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	3433	5085	2787	4990	5085	1583	4990	5085	2787	3433	5085	1583	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	
Adj. Flow (vph)	190	763	471	121	34	110	282	929	357	146	689	24	
RTOR Reduction (vph)	0	0	72	0	0	98	0	0	186	0	0	13	
Lane Group Flow (vph)	190	763	399	121	34	12	282	929	171	146	689	11	
Turn Type	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm	
Protected Phases	7	4	5	3	8		5	2		1	NA	6	
Permitted Phases			4			8			2			6	
Actuated Green, G (s)	19.6	24.1	36.3	7.5	12.0	12.0	12.2	52.8	52.8	9.6	50.2	50.2	
Effective Green, g (s)	19.6	24.1	36.3	7.5	12.0	12.0	12.2	52.8	52.8	9.6	50.2	50.2	
Actuated g/C Ratio	0.18	0.22	0.33	0.07	0.11	0.11	0.11	0.48	0.48	0.09	0.46	0.46	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	611	1114	1021	340	554	172	553	2440	1337	299	2320	722	
v/s Ratio Prot	0.06	c0.15	0.04	c0.02	0.01		c0.06	c0.18		c0.04	0.14		
v/s Ratio Perm			0.10			0.01			0.06			0.01	
v/c Ratio	0.31	0.68	0.39	0.36	0.06	0.07	0.51	0.38	0.13	0.49	0.30	0.02	
Uniform Delay, d1	39.3	39.5	28.3	48.9	43.9	44.0	46.1	18.2	15.8	47.9	18.8	16.4	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.3	1.8	0.2	0.6	0.0	0.2	0.7	0.5	0.2	1.3	0.3	0.0	
Delay (s)	39.6	41.2	28.6	49.6	44.0	44.2	46.8	18.7	16.0	49.1	19.1	16.4	
Level of Service	D	D	C	D	D	D	D	B	B	D	B	B	
Approach Delay (s)		36.8			46.6			23.1			24.2		
Approach LOS		D			D			C			C		
Intersection Summary													
HCM 2000 Control Delay	29.6		HCM 2000 Level of Service					C					
HCM 2000 Volume to Capacity ratio	0.48												
Actuated Cycle Length (s)	110.0					Sum of lost time (s)			16.0				
Intersection Capacity Utilization	50.6%		ICU Level of Service					A					
Analysis Period (min)	15												

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 20: El Charro Rd/Fallon Rd & I-580 WB Ramps

BART to Livermore Extension Project
 2040 BART + INP + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↙	↖	↗		↑↑↑	↗		↑↑↑	↗
Traffic Volume (vph)	0	0	0	718	0	520	0	1011	245	0	959	404
Future Volume (vph)	0	0	0	718	0	520	0	1011	245	0	959	404
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0	4.0	4.0		4.0	4.0		4.0	4.0
Lane Util. Factor				0.95	0.95	0.88		0.91	1.00		0.91	1.00
Frt				1.00	1.00	0.85		1.00	0.85		1.00	0.85
Flt Protected				0.95	0.95	1.00		1.00	1.00		1.00	1.00
Satd. Flow (prot)				1681	1681	2787		5085	1583		5085	1583
Flt Permitted				0.95	0.95	1.00		1.00	1.00		1.00	1.00
Satd. Flow (perm)				1681	1681	2787		5085	1583		5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	780	0	565	0	1099	266	0	1042	439
RTOR Reduction (vph)	0	0	0	0	0	21	0	0	148	0	0	245
Lane Group Flow (vph)	0	0	0	398	382	544	0	1099	118	0	1042	194
Turn Type				Perm	NA	Perm		NA	Perm		NA	Perm
Protected Phases					8			2			6	
Permitted Phases				8		8			2			6
Actuated Green, G (s)				14.8	14.8	14.8		17.7	17.7		17.7	17.7
Effective Green, g (s)				14.3	14.3	14.3		17.7	17.7		17.7	17.7
Actuated g/C Ratio				0.36	0.36	0.36		0.44	0.44		0.44	0.44
Clearance Time (s)				3.5	3.5	3.5		4.0	4.0		4.0	4.0
Vehicle Extension (s)				2.0	2.0	2.0		2.0	2.0		2.0	2.0
Lane Grp Cap (vph)				600	600	996		2250	700		2250	700
v/s Ratio Prot								c0.22			0.20	
v/s Ratio Perm				c0.24	0.23	0.20			0.07			0.12
v/c Ratio				0.66	0.64	0.55		0.49	0.17		0.46	0.28
Uniform Delay, d1				10.8	10.7	10.3		7.9	6.7		7.8	7.1
Progression Factor				1.00	1.00	1.00		1.00	1.00		1.00	1.00
Incremental Delay, d2				2.1	1.6	0.3		0.8	0.5		0.7	1.0
Delay (s)				13.0	12.3	10.6		8.7	7.2		8.5	8.1
Level of Service				B	B	B		A	A		A	A
Approach Delay (s)		0.0			11.8			8.4			8.4	
Approach LOS		A			B			A			A	

Intersection Summary			
HCM 2000 Control Delay	9.5	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.57		
Actuated Cycle Length (s)	40.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	51.6%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 21: El Charro Rd & I-580 EB Ramps

BART to Livermore Extension Project
 2040 BART + INP + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔↔		↔↔					↕↔	↔		↕↔	↔
Traffic Volume (vph)	340	0	485	0	0	0	0	1657	281	0	1852	0
Future Volume (vph)	340	0	485	0	0	0	0	1657	281	0	1852	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0					4.0	4.0		4.0	
Lane Util. Factor	0.97		0.88					0.91	0.91		0.91	
Frt	1.00		0.85					1.00	0.85		1.00	
Flt Protected	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (prot)	3433		2787					3380	1441		3390	
Flt Permitted	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (perm)	3433		2787					3380	1441		3390	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	370	0	527	0	0	0	0	1801	305	0	2013	0
RTOR Reduction (vph)	0	0	26	0	0	0	0	3	90	0	0	0
Lane Group Flow (vph)	370	0	501	0	0	0	0	1835	178	0	2013	0
Turn Type	Prot		Perm					NA	Perm		NA	Perm
Protected Phases	4							2			6	
Permitted Phases			4						2			6
Actuated Green, G (s)	10.5		10.5					36.5	36.5		36.5	
Effective Green, g (s)	10.5		10.5					36.5	36.5		36.5	
Actuated g/C Ratio	0.19		0.19					0.66	0.66		0.66	
Clearance Time (s)	4.0		4.0					4.0	4.0		4.0	
Vehicle Extension (s)	2.0		2.0					3.0	3.0		3.0	
Lane Grp Cap (vph)	655		532					2243	956		2249	
v/s Ratio Prot	0.11							0.54			c0.59	
v/s Ratio Perm			c0.18						0.12			
v/c Ratio	0.56		0.94					0.82	0.19		0.90	
Uniform Delay, d1	20.2		21.9					6.8	3.5		7.7	
Progression Factor	1.00		1.00					1.00	1.00		1.00	
Incremental Delay, d2	0.7		25.0					3.5	0.4		6.1	
Delay (s)	20.8		47.0					10.3	4.0		13.7	
Level of Service	C		D					B	A		B	
Approach Delay (s)		36.2			0.0			9.5			13.7	
Approach LOS		D			A			A			B	

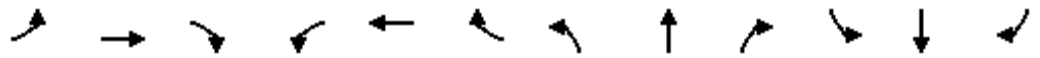
Intersection Summary

HCM 2000 Control Delay	16.0	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.91		
Actuated Cycle Length (s)	55.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	74.8%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 22: El Charro Rd & Stoneridge Dr/Jack London Blvd

BART to Livermore Extension Project
 2040 BART + INP + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔↔↔	↑↑	↗	↖	↑↑	↗↗	↖	↑↑		↖↖↖	↑	↗↗
Traffic Volume (vph)	189	574	57	107	331	739	16	496	55	924	499	81
Future Volume (vph)	189	574	57	107	331	739	16	496	55	924	499	81
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	0.94	0.95	1.00	1.00	0.95	0.88	1.00	0.95		0.94	1.00	0.88
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.98		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	4491	3185	1425	1593	3185	2508	1593	3137		4491	1676	2508
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	4491	3185	1425	1593	3185	2508	1593	3137		4491	1676	2508
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	205	624	62	116	360	803	17	539	60	1004	542	88
RTOR Reduction (vph)	0	0	49	0	0	69	0	12	0	0	0	44
Lane Group Flow (vph)	205	624	13	116	360	734	17	587	0	1004	542	44
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Prot	NA		Prot	NA	Perm
Protected Phases	7	4		3	8	1	5	2		1	6	
Permitted Phases			4			8						6
Actuated Green, G (s)	6.9	15.9	15.9	6.0	15.0	36.3	0.8	17.5		21.3	38.0	38.0
Effective Green, g (s)	6.9	15.9	15.9	6.0	15.0	36.3	0.8	17.5		21.3	38.0	38.0
Actuated g/C Ratio	0.09	0.21	0.21	0.08	0.20	0.47	0.01	0.23		0.28	0.50	0.50
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	404	660	295	124	622	1186	16	715		1247	830	1242
v/s Ratio Prot	0.05	c0.20		c0.07	0.11	0.17	0.01	c0.19		c0.22	0.32	
v/s Ratio Perm			0.01			0.12						0.02
v/c Ratio	0.51	0.95	0.04	0.94	0.58	0.62	1.06	0.82		0.81	0.65	0.04
Uniform Delay, d1	33.3	30.0	24.3	35.2	28.0	15.0	38.0	28.1		25.8	14.4	9.9
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	1.0	22.4	0.1	60.6	1.3	1.0	246.4	7.5		3.9	1.9	0.0
Delay (s)	34.3	52.3	24.4	95.7	29.3	16.0	284.4	35.7		29.7	16.3	9.9
Level of Service	C	D	C	F	C	B	F	D		C	B	A
Approach Delay (s)		46.2			27.0			42.5			24.2	
Approach LOS		D			C			D			C	

Intersection Summary		
HCM 2000 Control Delay	32.0	HCM 2000 Level of Service C
HCM 2000 Volume to Capacity ratio	0.86	
Actuated Cycle Length (s)	76.7	Sum of lost time (s) 16.0
Intersection Capacity Utilization	74.3%	ICU Level of Service D
Analysis Period (min)	15	

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 23: Stanley Blvd & El Charro Rd

BART to Livermore Extension Project
 2040 BART + INP + Garage PM



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	↖	↑↑	↑↑↑	↑	↙↘	↙↘
Traffic Volume (vph)	438	2547	819	12	181	469
Future Volume (vph)	438	2547	819	12	181	469
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95	0.91	1.00	0.97	0.88
Frt	1.00	1.00	1.00	0.85	1.00	0.85
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1770	3539	5085	1583	3433	2787
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1770	3539	5085	1583	3433	2787
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	476	2768	890	13	197	510
RTOR Reduction (vph)	0	0	0	7	0	450
Lane Group Flow (vph)	476	2768	890	6	197	60
Turn Type	Prot	NA	NA	Perm	Prot	Perm
Protected Phases	7	4	8		6	
Permitted Phases				8		6
Actuated Green, G (s)	30.3	76.1	41.8	41.8	11.3	11.3
Effective Green, g (s)	30.3	76.1	41.8	41.8	11.3	11.3
Actuated g/C Ratio	0.32	0.80	0.44	0.44	0.12	0.12
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	562	2823	2228	693	406	330
v/s Ratio Prot	0.27	c0.78	0.18		c0.06	
v/s Ratio Perm				0.00		0.02
v/c Ratio	0.85	0.98	0.40	0.01	0.49	0.18
Uniform Delay, d1	30.4	9.0	18.3	15.1	39.3	37.9
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	11.3	12.7	0.1	0.0	0.9	0.3
Delay (s)	41.7	21.7	18.4	15.1	40.2	38.2
Level of Service	D	C	B	B	D	D
Approach Delay (s)		24.6	18.3		38.7	
Approach LOS		C	B		D	

Intersection Summary

HCM 2000 Control Delay	25.5	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.96		
Actuated Cycle Length (s)	95.4	Sum of lost time (s)	12.0
Intersection Capacity Utilization	82.2%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
24: Airway Blvd/Driveway & N Canyons Pkwy

BART to Livermore Extension Project
2040 BART + INP + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑	↑	↑↑	↑	↑		↑	↑↑		↑	
Traffic Volume (vph)	0	778	328	1146	124	0	52	0	900	0	0	0
Future Volume (vph)	0	778	328	1146	124	0	52	0	900	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		2.0	2.0	2.0	2.0			4.2	2.0			
Lane Util. Factor		0.95	1.00	0.97	1.00			1.00	0.88			
Frt		1.00	0.85	1.00	1.00			1.00	0.85			
Flt Protected		1.00	1.00	0.95	1.00			0.95	1.00			
Satd. Flow (prot)		3539	1583	3433	1863			1770	2787			
Flt Permitted		1.00	1.00	0.95	1.00			0.95	1.00			
Satd. Flow (perm)		3539	1583	3433	1863			1770	2787			
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	846	357	1246	135	0	57	0	978	0	0	0
RTOR Reduction (vph)	0	0	249	0	0	0	0	0	330	0	0	0
Lane Group Flow (vph)	0	846	108	1246	135	0	0	57	648	0	0	0
Turn Type		NA	Perm	Prot	NA	Perm	Split	NA	pm+ov			
Protected Phases		2		1	6		8	8	1	4	4	
Permitted Phases			2			6			8			
Actuated Green, G (s)		33.0	33.0	63.9	100.9			11.1	75.0			
Effective Green, g (s)		35.0	35.0	65.9	102.9			10.9	79.0			
Actuated g/C Ratio		0.29	0.29	0.55	0.86			0.09	0.66			
Clearance Time (s)		4.0	4.0	4.0	4.0			4.0	4.0			
Vehicle Extension (s)		3.0	3.0	3.0	3.0			3.0	3.0			
Lane Grp Cap (vph)		1032	461	1885	1597			160	1881			
v/s Ratio Prot		c0.24		c0.36	0.07			0.03	c0.19			
v/s Ratio Perm			0.07						0.04			
v/c Ratio		0.82	0.24	0.66	0.08			0.36	0.34			
Uniform Delay, d1		39.6	32.3	19.1	1.3			51.3	9.1			
Progression Factor		1.00	1.00	1.00	1.00			1.00	1.00			
Incremental Delay, d2		7.3	1.2	0.9	0.1			1.4	0.1			
Delay (s)		46.8	33.5	20.0	1.4			52.6	9.2			
Level of Service		D	C	C	A			D	A			
Approach Delay (s)		42.9			18.2			11.6			0.0	
Approach LOS		D			B			B			A	

Intersection Summary

HCM 2000 Control Delay	24.5	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.70		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	12.2
Intersection Capacity Utilization	67.7%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
25: Airway Blvd & I-580 WB Ramps

BART to Livermore Extension Project
2040 BART + INP + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↙	↖	↗		↑↑	↗		↑↑↑	
Traffic Volume (vph)	0	0	0	267	80	286	0	742	254	0	840	728
Future Volume (vph)	0	0	0	267	80	286	0	742	254	0	840	728
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0	4.0	4.0		4.0	4.0		4.0	
Lane Util. Factor				0.95	0.95	0.88		0.95	1.00		0.91	
Frt				1.00	1.00	0.85		1.00	0.85		0.93	
Flt Protected				0.95	0.97	1.00		1.00	1.00		1.00	
Satd. Flow (prot)				1681	1717	2787		3539	1583		4731	
Flt Permitted				0.95	0.97	1.00		1.00	1.00		1.00	
Satd. Flow (perm)				1681	1717	2787		3539	1583		4731	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	290	87	311	0	807	276	0	913	791
RTOR Reduction (vph)	0	0	0	0	0	248	0	0	88	0	177	0
Lane Group Flow (vph)	0	0	0	154	223	63	0	807	188	0	1527	0
Turn Type				Split	NA	Perm		NA	Perm		NA	
Protected Phases				8	8			2			6	
Permitted Phases						8			2			
Actuated Green, G (s)				14.2	14.2	14.2		46.5	46.5		46.5	
Effective Green, g (s)				14.2	14.2	14.2		47.8	47.8		47.8	
Actuated g/C Ratio				0.20	0.20	0.20		0.68	0.68		0.68	
Clearance Time (s)				4.0	4.0	4.0		5.3	5.3		5.3	
Vehicle Extension (s)				2.0	2.0	2.0		4.0	4.0		4.0	
Lane Grp Cap (vph)				341	348	565		2416	1080		3230	
v/s Ratio Prot				0.09	c0.13			0.23			c0.32	
v/s Ratio Perm						0.02			0.12			
v/c Ratio				0.45	0.64	0.11		0.33	0.17		0.47	
Uniform Delay, d1				24.5	25.6	22.8		4.6	4.0		5.2	
Progression Factor				1.00	1.00	1.00		0.85	1.90		1.00	
Incremental Delay, d2				0.3	3.0	0.0		0.3	0.3		0.5	
Delay (s)				24.8	28.6	22.8		4.2	7.9		5.7	
Level of Service				C	C	C		A	A		A	
Approach Delay (s)		0.0			25.1			5.2			5.7	
Approach LOS		A			C			A			A	

Intersection Summary

HCM 2000 Control Delay	9.4	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.51		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	48.7%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 26: Airway Blvd & I-580 EB Ramps/Kitty Hawk Rd

BART to Livermore Extension Project
 2040 BART + INP + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↖	↑	↗	↖	↑	↗	↖	↑↕		↖	↑↕	
Traffic Volume (vph)	511	190	402	78	89	116	45	386	150	127	449	432
Future Volume (vph)	511	190	402	78	89	116	45	386	150	127	449	432
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.4	4.4	4.4	4.5	2.7		4.0	2.7	
Lane Util. Factor	0.97	1.00	1.00	1.00	1.00	1.00	1.00	0.95		1.00	0.95	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.96		1.00	0.93	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	3433	1863	1583	1770	1863	1583	1770	3391		1770	3279	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	3433	1863	1583	1770	1863	1583	1770	3391		1770	3279	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	555	207	437	85	97	126	49	420	163	138	488	470
RTOR Reduction (vph)	0	0	305	0	0	100	0	23	0	0	103	0
Lane Group Flow (vph)	555	207	132	85	97	26	49	560	0	138	855	0
Turn Type	Split	NA	Perm	Split	NA	pm+ov	Prot	NA		Prot	NA	
Protected Phases	7	7		8	8	1	5	2		1	6	
Permitted Phases			7			8						
Actuated Green, G (s)	29.2	29.2	29.2	14.5	14.5	29.7	8.9	65.1		15.2	71.4	
Effective Green, g (s)	29.2	29.2	29.2	14.1	14.1	28.9	8.4	66.4		15.2	72.7	
Actuated g/C Ratio	0.21	0.21	0.21	0.10	0.10	0.21	0.06	0.47		0.11	0.52	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Vehicle Extension (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	3.5		2.0	4.0	
Lane Grp Cap (vph)	716	388	330	178	187	376	106	1608		192	1702	
v/s Ratio Prot	c0.16	0.11		0.05	c0.05	0.01	0.03	c0.17		c0.08	c0.26	
v/s Ratio Perm			0.08			0.01						
v/c Ratio	0.78	0.53	0.40	0.48	0.52	0.07	0.46	0.35		0.72	0.50	
Uniform Delay, d1	52.3	49.3	47.8	59.5	59.7	44.7	63.6	23.2		60.3	21.9	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	0.69	0.81		1.00	0.93	
Incremental Delay, d2	4.8	0.7	0.3	0.7	1.0	0.0	0.1	0.1		9.2	1.0	
Delay (s)	57.1	50.0	48.1	60.2	60.7	44.7	44.1	18.8		69.6	21.2	
Level of Service	E	D	D	E	E	D	D	B		E	C	
Approach Delay (s)		52.6			54.1			20.8			27.3	
Approach LOS		D			D			C			C	

Intersection Summary

HCM 2000 Control Delay	38.0	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.59		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	15.6
Intersection Capacity Utilization	73.2%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 27: Collier Canyon Rd & N Canyons Pkwy/Portola Ave

BART to Livermore Extension Project
 2040 BART + INP + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↗↘	↗↗	↗	↗	↗↗	↗	↗	↗		↗	↗	↗
Traffic Volume (vph)	472	694	548	70	230	9	163	9	252	75	27	228
Future Volume (vph)	472	694	548	70	230	9	163	9	252	75	27	228
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	2.7	2.7	4.0	2.7	2.7	4.0	3.0		4.0	4.6	4.6
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.86		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	1770	1593		1770	1863	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	1770	1593		1770	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	513	754	596	76	250	10	177	10	274	82	29	248
RTOR Reduction (vph)	0	0	351	0	0	7	0	209	0	0	0	204
Lane Group Flow (vph)	513	754	245	76	250	3	177	75	0	82	29	44
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA		Prot	NA	Perm
Protected Phases	1	6		5	2		3	8		7	NA	4
Permitted Phases			6			2						4
Actuated Green, G (s)	12.2	28.6	28.6	6.5	22.9	22.9	8.1	16.1		5.4	13.4	13.4
Effective Green, g (s)	12.2	29.9	29.9	6.5	24.2	24.2	8.1	17.1		5.4	12.8	12.8
Actuated g/C Ratio	0.17	0.41	0.41	0.09	0.33	0.33	0.11	0.24		0.07	0.18	0.18
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	576	1457	651	158	1179	527	197	375		131	328	279
v/s Ratio Prot	c0.15	c0.21		0.04	0.07		c0.10	c0.05		0.05	0.02	
v/s Ratio Perm			0.16			0.00						0.03
v/c Ratio	0.89	0.52	0.38	0.48	0.21	0.01	0.90	0.20		0.63	0.09	0.16
Uniform Delay, d1	29.5	16.0	14.9	31.4	17.4	16.2	31.8	22.3		32.6	25.0	25.3
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	15.9	0.3	0.4	2.3	0.1	0.0	36.9	0.3		9.0	0.1	0.3
Delay (s)	45.4	16.3	15.2	33.7	17.5	16.2	68.7	22.5		41.6	25.1	25.6
Level of Service	D	B	B	C	B	B	E	C		D	C	C
Approach Delay (s)		24.0			21.1			40.3			29.2	
Approach LOS		C			C			D			C	

Intersection Summary

HCM 2000 Control Delay	26.8	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.60		
Actuated Cycle Length (s)	72.6	Sum of lost time (s)	15.3
Intersection Capacity Utilization	58.3%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

28: Isabel Ave/Campus Hill Dr & Portola Ave

BART to Livermore Extension Project
2040 BART + INP + Garage PM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	1	684	395	919	159	109	240	417	530	129	198	0
Future Volume (vph)	1	684	395	919	159	109	240	417	530	129	198	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	5.8	
Lane Util. Factor	1.00	0.95	0.88	0.94	0.95		0.97	0.95	1.00	1.00	0.95	
Frt	1.00	1.00	0.85	1.00	0.94		1.00	1.00	0.85	1.00	1.00	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1770	3539	2787	4990	3324		3433	3539	1583	1770	3539	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1770	3539	2787	4990	3324		3433	3539	1583	1770	3539	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	1	743	429	999	173	118	261	453	576	140	215	0
RTOR Reduction (vph)	0	0	297	0	56	0	0	0	291	0	0	0
Lane Group Flow (vph)	1	743	132	999	235	0	261	453	285	140	215	0
Turn Type	Prot	NA	Perm	Prot	NA		Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4						2			6
Actuated Green, G (s)	1.5	36.2	36.2	27.7	62.4		11.3	27.0	27.0	12.6	28.7	
Effective Green, g (s)	1.5	37.5	37.5	27.7	63.7		11.3	28.3	28.3	12.6	27.8	
Actuated g/C Ratio	0.01	0.31	0.31	0.23	0.52		0.09	0.23	0.23	0.10	0.23	
Clearance Time (s)	4.0	5.3	5.3	4.0	5.3		4.0	5.3	5.3	4.0	4.9	
Vehicle Extension (s)	2.0	3.0	3.0	2.0	3.0		2.0	3.0	3.0	2.0	3.0	
Lane Grp Cap (vph)	21	1086	855	1132	1734		317	820	366	182	805	
v/s Ratio Prot	0.00	c0.21		c0.20	0.07		0.08	0.13		c0.08	0.06	
v/s Ratio Perm			0.05						c0.18			
v/c Ratio	0.05	0.68	0.15	0.88	0.14		0.82	0.55	0.78	0.77	0.27	
Uniform Delay, d1	59.6	37.1	30.8	45.6	15.0		54.4	41.3	44.0	53.3	38.8	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.3	1.8	0.1	8.1	0.0		15.0	0.8	10.0	16.0	0.2	
Delay (s)	59.9	38.9	30.8	53.7	15.1		69.5	42.1	54.0	69.3	39.0	
Level of Service	E	D	C	D	B		E	D	D	E	D	
Approach Delay (s)		36.0			45.0			52.9			50.9	
Approach LOS		D			D			D			D	
























Intersection Summary

HCM 2000 Control Delay	45.4	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.78		
Actuated Cycle Length (s)	122.1	Sum of lost time (s)	17.8
Intersection Capacity Utilization	69.2%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group



















HCM Signalized Intersection Capacity Analysis
 29: Isabel Ave & I-580 WB Ramps

BART to Livermore Extension Project
 2040 BART + INP + Garage PM

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations				 				  			  		
Traffic Volume (vph)	0	0	0	682	0	472	0	715	0	0	997	997	
Future Volume (vph)	0	0	0	682	0	472	0	715	0	0	997	997	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)				4.0		4.0		4.8			4.8	4.8	
Lane Util. Factor				0.97		1.00		0.91			0.91	1.00	
Frt				1.00		0.85		1.00			1.00	0.85	
Flt Protected				0.95		1.00		1.00			1.00	1.00	
Satd. Flow (prot)				3433		1583		5085			5085	1583	
Flt Permitted				0.95		1.00		1.00			1.00	1.00	
Satd. Flow (perm)				3433		1583		5085			5085	1583	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	
Adj. Flow (vph)	0	0	0	741	0	513	0	777	0	0	1084	1084	
RTOR Reduction (vph)	0	0	0	0	0	120	0	0	0	0	0	449	
Lane Group Flow (vph)	0	0	0	741	0	393	0	777	0	0	1084	635	
Turn Type				Prot		Prot		NA	Free		NA	Prot	
Protected Phases				8		8		2			6	6	
Permitted Phases									Free				
Actuated Green, G (s)				20.2		20.2		41.8			41.8	41.8	
Effective Green, g (s)				20.2		20.2		41.0			41.0	41.0	
Actuated g/C Ratio				0.29		0.29		0.59			0.59	0.59	
Clearance Time (s)				4.0		4.0		4.0			4.0	4.0	
Vehicle Extension (s)				2.0		2.0		4.0			4.0	4.0	
Lane Grp Cap (vph)				990		456		2978			2978	927	
v/s Ratio Prot				0.22		c0.25		0.15			0.21	c0.40	
v/s Ratio Perm													
v/c Ratio				0.75		0.86		0.26			0.36	0.68	
Uniform Delay, d1				22.6		23.6		7.1			7.6	10.0	
Progression Factor				1.00		1.00		1.00			1.00	1.00	
Incremental Delay, d2				2.7		15.0		0.2			0.3	4.1	
Delay (s)				25.3		38.5		7.3			8.0	14.1	
Level of Service				C		D		A			A	B	
Approach Delay (s)		0.0			30.7			7.3			11.1		
Approach LOS		A			C			A			B		
Intersection Summary													
HCM 2000 Control Delay			16.2		HCM 2000 Level of Service						B		
HCM 2000 Volume to Capacity ratio			0.74										
Actuated Cycle Length (s)			70.0		Sum of lost time (s)						8.8		
Intersection Capacity Utilization			65.7%		ICU Level of Service						C		
Analysis Period (min)			15										
c Critical Lane Group													

HCM Signalized Intersection Capacity Analysis
 30: Isabel Ave & I-580 EB Ramps

BART to Livermore Extension Project
 2040 BART + INP + Garage PM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	207	0	623	0	0	0	0	1033	1520	0	1103	765
Future Volume (vph)	207	0	623	0	0	0	0	1033	1520	0	1103	765
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0					4.0	4.0		4.0	4.0
Lane Util. Factor	0.97		0.88					0.91	1.00		0.91	1.00
Frt	1.00		0.85					1.00	0.85		1.00	0.85
Flt Protected	0.95		1.00					1.00	1.00		1.00	1.00
Satd. Flow (prot)	3433		2787					5085	1583		5085	1583
Flt Permitted	0.95		1.00					1.00	1.00		1.00	1.00
Satd. Flow (perm)	3433		2787					5085	1583		5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	225	0	677	0	0	0	0	1123	1652	0	1199	832
RTOR Reduction (vph)	0	0	82	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	225	0	595	0	0	0	0	1123	1652	0	1199	832
Turn Type	Prot		Perm					NA	Free		NA	Free
Protected Phases	4							2			6	
Permitted Phases			4						Free			Free
Actuated Green, G (s)	14.9		14.9					31.1	55.0		31.1	55.0
Effective Green, g (s)	14.9		14.9					32.1	55.0		32.1	55.0
Actuated g/C Ratio	0.27		0.27					0.58	1.00		0.58	1.00
Clearance Time (s)	4.0		4.0					5.0			5.0	
Vehicle Extension (s)	2.0		2.0					4.0			4.0	
Lane Grp Cap (vph)	930		755					2967	1583		2967	1583
v/s Ratio Prot	0.07							0.22			0.24	
v/s Ratio Perm			0.21						c1.04			0.53
v/c Ratio	0.24		0.79					0.38	1.04		0.40	0.53
Uniform Delay, d1	15.6		18.6					6.1	27.5		6.2	0.0
Progression Factor	1.00		1.00					1.00	1.00		1.00	1.00
Incremental Delay, d2	0.0		5.1					0.4	34.9		0.4	1.3
Delay (s)	15.7		23.7					6.5	62.4		6.6	1.3
Level of Service	B		C					A	E		A	A
Approach Delay (s)		21.7			0.0			39.8			4.4	
Approach LOS		C			A			D			A	

Intersection Summary

HCM 2000 Control Delay	24.3	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	1.22		
Actuated Cycle Length (s)	55.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	49.8%	ICU Level of Service	A
Analysis Period (min)	15		

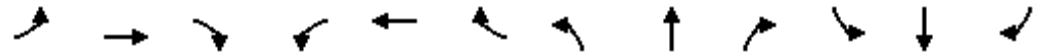
c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 31: Isabel Ave & Airway Blvd

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	8	110	447	214	58	694	455	1523	308	448	1526	22
Future Volume (vph)	8	110	447	214	58	694	455	1523	308	448	1526	22
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.2	5.2	5.6	5.2	5.2	5.6	4.0	4.0	4.0	4.0	4.0	5.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.91	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	1863	1583	1770	1863	1583	1770	5085	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	1863	1583	1770	1863	1583	1770	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	9	120	486	233	63	754	495	1655	335	487	1659	24
RTOR Reduction (vph)	0	0	60	0	0	58	0	0	150	0	0	13
Lane Group Flow (vph)	9	120	426	233	63	696	495	1655	185	487	1659	11
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4	5	3	8	1	5	2		1	NA	6
Permitted Phases			4			8			2			6
Actuated Green, G (s)	0.8	18.1	45.1	14.4	31.7	50.7	27.0	69.3	69.3	19.0	61.3	61.3
Effective Green, g (s)	0.2	17.5	43.9	13.8	31.1	49.5	28.0	70.3	70.3	20.0	62.3	61.3
Actuated g/C Ratio	0.00	0.12	0.31	0.10	0.22	0.35	0.20	0.50	0.50	0.14	0.44	0.44
Clearance Time (s)	4.6	4.6	5.0	4.6	4.6	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	5.0	5.0	3.0	5.0	5.0
Lane Grp Cap (vph)	2	232	496	174	413	559	354	2553	794	490	2262	693
v/s Ratio Prot	0.01	0.06	0.16	c0.13	0.03	c0.16	c0.28	0.33		0.14	c0.33	
v/s Ratio Perm			0.11			0.28			0.12			0.01
v/c Ratio	4.50	0.52	0.86	1.34	0.15	1.24	1.40	0.65	0.23	0.99	0.73	0.02
Uniform Delay, d1	69.9	57.3	45.2	63.1	43.8	45.2	56.0	25.7	19.6	59.9	32.0	22.3
Progression Factor	1.05	0.88	0.77	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	2257.2	1.6	12.0	186.1	0.2	124.6	195.6	1.3	0.7	38.9	2.2	0.0
Delay (s)	2330.5	51.9	46.7	249.2	44.0	169.9	251.6	27.0	20.3	98.8	34.2	22.3
Level of Service	F	D	D	F	D	F	F	C	C	F	C	C
Approach Delay (s)		81.2			179.9			70.8			48.5	
Approach LOS		F			F			E			D	
Intersection Summary												
HCM 2000 Control Delay			82.3								HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio			1.07									
Actuated Cycle Length (s)			140.0								Sum of lost time (s)	20.0
Intersection Capacity Utilization			88.1%								ICU Level of Service	E
Analysis Period (min)			15									

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 32: Isabel Ave & Jack London Blvd



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↑↑	↖	↖	↑↑	↖	↖↗	↑↑↑	↖	↖↗	↑↑↑	↖
Traffic Volume (vph)	232	880	442	247	233	380	185	1820	388	450	1657	106
Future Volume (vph)	232	880	442	247	233	380	185	1820	388	450	1657	106
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.97	0.91	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	3433	5085	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	3433	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	252	957	480	268	253	413	201	1978	422	489	1801	115
RTOR Reduction (vph)	0	0	108	0	0	36	0	0	190	0	0	67
Lane Group Flow (vph)	252	957	372	268	253	377	201	1978	232	489	1801	48
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8	1	5	2		1	NA	6
Permitted Phases			4			8			2			6
Actuated Green, G (s)	14.8	34.7	34.7	17.7	37.6	54.3	9.2	49.7	49.7	16.7	57.2	57.2
Effective Green, g (s)	14.8	34.7	34.7	17.7	37.6	54.3	9.2	49.7	49.7	16.7	57.2	57.2
Actuated g/C Ratio	0.11	0.25	0.25	0.13	0.27	0.39	0.07	0.36	0.36	0.12	0.41	0.41
Clearance Time (s)	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	362	877	392	223	950	673	225	1805	561	409	2077	646
v/s Ratio Prot	0.07	c0.27		c0.15	0.07	c0.07	0.06	c0.39		c0.14	0.35	
v/s Ratio Perm			0.23			0.17			0.15			0.03
v/c Ratio	0.70	1.09	0.95	1.20	0.27	0.56	0.89	1.10	0.41	1.20	0.87	0.07
Uniform Delay, d1	60.4	52.6	51.8	61.1	40.3	33.5	64.9	45.1	34.1	61.6	37.9	25.2
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	5.7	58.3	32.0	125.6	0.2	1.1	32.8	52.5	0.5	109.6	4.1	0.0
Delay (s)	66.2	111.0	83.8	186.7	40.5	34.6	97.7	97.6	34.6	171.3	42.0	25.3
Level of Service	E	F	F	F	D	C	F	F	C	F	D	C
Approach Delay (s)		96.6			79.8			87.4			67.5	
Approach LOS		F			E			F			E	

Intersection Summary

HCM 2000 Control Delay	82.2	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.12		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	21.2
Intersection Capacity Utilization	103.7%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 33: Isabel Ave Connector & Stanley Blvd



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑	↑	↔	↑↑	↔	↔
Traffic Volume (vph)	2002	802	856	559	185	1117
Future Volume (vph)	2002	802	856	559	185	1117
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	2.3	2.3	4.0	2.3	2.5	2.5
Lane Util. Factor	0.95	1.00	0.97	0.95	0.97	0.88
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	3539	1583	3433	3539	3433	2787
Flt Permitted	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (perm)	3539	1583	3433	3539	3433	2787
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	2176	872	930	608	201	1214
RTOR Reduction (vph)	0	0	0	0	0	2
Lane Group Flow (vph)	2176	872	930	608	201	1212
Turn Type	NA	pm+ov	Prot	NA	Prot	pm+ov
Protected Phases	2	8	1	6	8	1
Permitted Phases		2				8
Actuated Green, G (s)	56.1	68.5	22.1	82.2	12.4	34.5
Effective Green, g (s)	57.8	71.9	22.1	83.9	13.9	37.5
Actuated g/C Ratio	0.56	0.70	0.22	0.82	0.14	0.37
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Grp Cap (vph)	1993	1144	739	2893	465	1086
v/s Ratio Prot	c0.61	0.10	0.27	0.17	0.06	c0.26
v/s Ratio Perm		0.45				0.18
v/c Ratio	1.09	0.76	1.26	0.21	0.43	1.12
Uniform Delay, d1	22.4	9.9	40.2	2.1	40.7	32.5
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	50.2	2.8	127.2	0.0	0.2	65.0
Delay (s)	72.6	12.6	167.4	2.1	41.0	97.6
Level of Service	E	B	F	A	D	F
Approach Delay (s)	55.4			102.0	89.6	
Approach LOS	E			F	F	






















Intersection Summary

HCM 2000 Control Delay	75.4	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.15		
Actuated Cycle Length (s)	102.6	Sum of lost time (s)	8.8
Intersection Capacity Utilization	101.1%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 34: Murrieta Blvd/Driveway & Portola Ave

BART to Livermore Extension Project
 2040 BART + INP + Garage PM

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations													
Traffic Volume (vph)	0	1219	216	394	1116	1	268	5	462	4	7	0	
Future Volume (vph)	0	1219	216	394	1116	1	268	5	462	4	7	0	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)		5.8		4.0	5.8	4.9	5.2	5.2	5.2		4.0		
Lane Util. Factor		0.95		1.00	0.95	1.00	0.95	0.95	1.00		1.00		
Frt		0.98		1.00	1.00	0.85	1.00	1.00	0.85		1.00		
Flt Protected		1.00		0.95	1.00	1.00	0.95	0.95	1.00		0.98		
Satd. Flow (prot)		3459		1770	3539	1583	1681	1688	1583		1832		
Flt Permitted		1.00		0.95	1.00	1.00	0.95	0.95	1.00		0.98		
Satd. Flow (perm)		3459		1770	3539	1583	1681	1688	1583		1832		
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	
Adj. Flow (vph)	0	1325	235	428	1213	1	291	5	502	4	8	0	
RTOR Reduction (vph)	0	9	0	0	0	0	0	0	366	0	0	0	
Lane Group Flow (vph)	0	1551	0	428	1213	1	151	145	136	0	12	0	
Turn Type	Prot	NA		Prot	NA	Perm	Split	NA	Perm	Split	NA		
Protected Phases	5	2		1	6		8	8		4	4		
Permitted Phases						6			8				
Actuated Green, G (s)		57.8		33.4	95.2	95.2	17.3	17.3	17.3		1.4		
Effective Green, g (s)		56.9		33.4	94.3	95.2	16.7	16.7	16.7		1.4		
Actuated g/C Ratio		0.45		0.26	0.74	0.75	0.13	0.13	0.13		0.01		
Clearance Time (s)		4.9		4.0	4.9	4.9	4.6	4.6	4.6		4.0		
Vehicle Extension (s)		2.0		2.0	2.0	2.0	2.0	2.0	2.0		2.0		
Lane Grp Cap (vph)		1544		464	2619	1182	220	221	207		20		
v/s Ratio Prot		c0.45		c0.24	0.34		c0.09	0.09			c0.01		
v/s Ratio Perm						0.00			0.09				
v/c Ratio		1.00		0.92	0.46	0.00	0.69	0.66	0.66		0.60		
Uniform Delay, d1		35.2		45.7	6.5	4.1	52.8	52.6	52.6		62.7		
Progression Factor		1.00		1.00	1.00	1.00	1.00	1.00	1.00		1.00		
Incremental Delay, d2		23.9		23.6	0.0	0.0	6.9	5.3	5.6		28.2		
Delay (s)		59.2		69.3	6.6	4.1	59.7	57.9	58.3		91.0		
Level of Service		E		E	A	A	E	E	E		F		
Approach Delay (s)		59.2			22.9			58.5			91.0		
Approach LOS		E			C			E			F		
Intersection Summary													
HCM 2000 Control Delay			44.3		HCM 2000 Level of Service					D			
HCM 2000 Volume to Capacity ratio			0.92										
Actuated Cycle Length (s)			127.4		Sum of lost time (s)					19.0			
Intersection Capacity Utilization			89.1%		ICU Level of Service					E			
Analysis Period (min)			15										
c Critical Lane Group													

HCM Signalized Intersection Capacity Analysis
35: Murrieta Blvd & Jack London Blvd

BART to Livermore Extension Project
2040 BART + INP + Garage PM



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	369	1175	653	235	534	353
Future Volume (vph)	369	1175	653	235	534	353
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00	1.00	0.95	0.91	
Frt	1.00	0.85	1.00	1.00	0.94	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1770	1583	1770	3539	4781	
Flt Permitted	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	1770	1583	1770	3539	4781	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	401	1277	710	255	580	384
RTOR Reduction (vph)	0	448	0	0	120	0
Lane Group Flow (vph)	401	829	710	255	844	0
Turn Type	Prot	Perm	Prot	NA	NA	
Protected Phases	4		5	2	6	
Permitted Phases		4				
Actuated Green, G (s)	38.0	38.0	33.0	54.0	17.0	
Effective Green, g (s)	38.0	38.0	33.0	54.0	17.0	
Actuated g/C Ratio	0.38	0.38	0.33	0.54	0.17	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	672	601	584	1911	812	
v/s Ratio Prot	0.23		c0.40	0.07	c0.18	
v/s Ratio Perm		c0.52				
v/c Ratio	0.60	1.38	1.22	0.13	1.04	
Uniform Delay, d1	24.9	31.0	33.5	11.4	41.5	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	1.4	180.8	112.1	0.0	42.4	
Delay (s)	26.3	211.8	145.6	11.4	83.9	
Level of Service	C	F	F	B	F	
Approach Delay (s)	167.5			110.2	83.9	
Approach LOS	F			F	F	

Intersection Summary

HCM 2000 Control Delay	129.8	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.25		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	97.6%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
36: Murrieta Blvd & Stanley Blvd

BART to Livermore Extension Project
2040 BART + INP + Garage PM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	396	1449	866	76	1046	237	287	366	16	238	407	239
Future Volume (vph)	396	1449	866	76	1046	237	287	366	16	238	407	239
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	5.8	5.8	4.0	5.8	4.9	4.9	5.8		4.9	5.8	4.9
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.97	0.95		1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	3433	3517		1770	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	3433	3517		1770	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	430	1575	941	83	1137	258	312	398	17	259	442	260
RTOR Reduction (vph)	0	0	209	0	0	46	0	3	0	0	0	154
Lane Group Flow (vph)	430	1575	732	83	1137	212	312	412	0	259	442	106
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Prot	NA		Prot	NA	Perm
Protected Phases	1	6		5	2	3	7	4		3	8	
Permitted Phases			6			2						8
Actuated Green, G (s)	15.0	51.3	51.3	5.0	41.3	57.3	13.5	18.8		16.0	21.3	21.3
Effective Green, g (s)	15.0	50.4	50.4	5.0	40.4	55.5	12.6	17.9		15.1	20.4	21.3
Actuated g/C Ratio	0.14	0.46	0.46	0.05	0.37	0.51	0.12	0.16		0.14	0.19	0.20
Clearance Time (s)	4.0	4.9	4.9	4.0	4.9	4.0	4.0	4.9		4.0	4.9	4.9
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	472	1637	732	81	1312	806	397	578		245	662	309
v/s Ratio Prot	c0.13	0.45		0.05	0.32	0.04	0.09	0.12		c0.15	c0.12	
v/s Ratio Perm			c0.46			0.10						0.07
v/c Ratio	0.91	0.96	1.00	1.02	0.87	0.26	0.79	0.71		1.06	0.67	0.34
Uniform Delay, d1	46.3	28.3	29.3	52.0	31.8	15.1	46.8	43.1		46.9	41.1	37.8
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	21.7	14.2	33.3	106.9	6.3	0.2	9.8	4.2		73.4	2.6	0.7
Delay (s)	68.0	42.6	62.5	158.9	38.0	15.3	56.7	47.2		120.3	43.7	38.4
Level of Service	E	D	E	F	D	B	E	D		F	D	D
Approach Delay (s)		52.7			40.8			51.3			62.9	
Approach LOS		D			D			D			E	

Intersection Summary		
HCM 2000 Control Delay	51.2	HCM 2000 Level of Service D
HCM 2000 Volume to Capacity ratio	0.97	
Actuated Cycle Length (s)	108.9	Sum of lost time (s) 20.5
Intersection Capacity Utilization	85.2%	ICU Level of Service E
Analysis Period (min)	15	

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
37: Livermore Ave & I-580 WB Ramps

BART to Livermore Extension Project
2040 BART + INP + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↰	↔		↰	↑			↕	
Traffic Volume (vph)	0	0	0	704	23	32	580	450	0	0	111	0
Future Volume (vph)	0	0	0	704	23	32	580	450	0	0	111	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)					4.0		4.0	4.0			4.0	
Lane Util. Factor					0.95		0.97	1.00			0.95	
Frt					0.99		1.00	1.00			1.00	
Flt Protected					0.96		0.95	1.00			1.00	
Satd. Flow (prot)					1680		3433	1863			3539	
Flt Permitted					0.96		0.95	1.00			1.00	
Satd. Flow (perm)					1680		3433	1863			3539	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	765	25	35	630	489	0	0	121	0
RTOR Reduction (vph)	0	0	0	0	1	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	0	824	0	630	489	0	0	121	0
Turn Type				Split	NA		Prot	NA			NA	
Protected Phases				8	8		5	2			6	
Permitted Phases												
Actuated Green, G (s)					77.0		29.4	53.3			20.4	
Effective Green, g (s)					77.0		28.9	55.0			22.1	
Actuated g/C Ratio					0.55		0.21	0.39			0.16	
Clearance Time (s)					4.0		3.5	5.7			5.7	
Vehicle Extension (s)					2.0		2.0	2.5			2.5	
Lane Grp Cap (vph)					924		708	731			558	
v/s Ratio Prot					c0.49		c0.18	c0.26			0.03	
v/s Ratio Perm												
v/c Ratio					0.89		0.89	0.67			0.22	
Uniform Delay, d1					27.8		54.0	35.0			51.4	
Progression Factor					1.00		0.39	0.26			1.00	
Incremental Delay, d2					10.5		1.4	0.4			0.9	
Delay (s)					38.4		22.7	9.5			52.3	
Level of Service					D		C	A			D	
Approach Delay (s)		0.0			38.4			16.9			52.3	
Approach LOS		A			D			B			D	

Intersection Summary

HCM 2000 Control Delay	27.6	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.86		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	117.0%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
38: Livermore Ave & I-580 EB Ramps

BART to Livermore Extension Project
2040 BART + INP + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕	↗					↕		↗	↕	
Traffic Volume (vph)	242	12	1500	0	0	0	0	806	227	110	703	0
Future Volume (vph)	242	12	1500	0	0	0	0	806	227	110	703	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0					3.0		5.0	3.0	
Lane Util. Factor		0.95	0.95					0.95		1.00	0.95	
Frt		0.89	0.85					0.97		1.00	1.00	
Flt Protected		0.99	1.00					1.00		0.95	1.00	
Satd. Flow (prot)		1553	1504					3422		1770	3539	
Flt Permitted		0.99	1.00					1.00		0.95	1.00	
Satd. Flow (perm)		1553	1504					3422		1770	3539	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	263	13	1630	0	0	0	0	876	247	120	764	0
RTOR Reduction (vph)	0	52	52	0	0	0	0	18	0	0	0	0
Lane Group Flow (vph)	0	1023	779	0	0	0	0	1105	0	120	764	0
Turn Type	Prot	NA	Perm					NA		Prot	NA	
Protected Phases	7	4						2		1	6	
Permitted Phases			4									
Actuated Green, G (s)		72.0	72.0					45.0		11.0	60.0	
Effective Green, g (s)		72.0	72.0					46.0		10.0	61.0	
Actuated g/C Ratio		0.51	0.51					0.33		0.07	0.44	
Clearance Time (s)		4.0	4.0					4.0		4.0	4.0	
Vehicle Extension (s)		2.0	2.0					2.5		2.0	2.5	
Lane Grp Cap (vph)		798	773					1124		126	1541	
v/s Ratio Prot								c0.32		c0.07	0.22	
v/s Ratio Perm		0.66	0.52									
v/c Ratio		1.28	1.01					0.98		0.95	0.50	
Uniform Delay, d1		34.0	34.0					46.6		64.8	28.4	
Progression Factor		1.00	1.00					1.00		0.80	1.08	
Incremental Delay, d2		136.4	34.3					23.1		49.4	0.7	
Delay (s)		170.4	68.3					69.7		100.9	31.5	
Level of Service		F	E					E		F	C	
Approach Delay (s)		125.9			0.0			69.7			40.9	
Approach LOS		F			A			E			D	

Intersection Summary

HCM 2000 Control Delay	90.6	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.15		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	117.0%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	679	793	206	27	545	86	347	838	158	290	1107	570
Future Volume (vph)	679	793	206	27	545	86	347	838	158	290	1107	570
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	2.7	4.0	4.0	2.7	4.0	4.0	4.9		4.0	4.9	4.9
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	1.00	0.95		1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.98		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	1770	3455		1770	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	1770	3455		1770	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	738	862	224	29	592	93	377	911	172	315	1203	620
RTOR Reduction (vph)	0	0	117	0	0	72	0	11	0	0	0	36
Lane Group Flow (vph)	738	862	107	29	592	21	377	1072	0	315	1203	584
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA		Prot	NA	pm+ov
Protected Phases	3	8		7	4		1	6		5	2	3
Permitted Phases			8			4						2
Actuated Green, G (s)	24.0	48.8	48.8	5.3	30.1	30.1	23.0	43.1		23.0	43.1	67.1
Effective Green, g (s)	24.0	50.1	48.8	5.3	31.4	30.1	23.0	42.2		23.0	42.2	65.3
Actuated g/C Ratio	0.18	0.37	0.36	0.04	0.23	0.22	0.17	0.31		0.17	0.31	0.48
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	604	1301	567	68	815	349	298	1070		298	1096	758
v/s Ratio Prot	c0.21	c0.24		0.02	c0.17		c0.21	0.31		0.18	c0.34	0.13
v/s Ratio Perm			0.07			0.01						0.24
v/c Ratio	1.22	0.66	0.19	0.43	0.73	0.06	1.27	1.00		1.06	1.10	0.77
Uniform Delay, d1	56.1	36.0	30.1	64.0	48.4	41.9	56.6	47.0		56.6	47.0	29.3
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	114.2	1.3	0.2	4.3	3.2	0.1	143.3	28.0		68.0	57.9	4.7
Delay (s)	170.3	37.3	30.2	68.2	51.7	41.9	199.9	75.0		124.6	104.9	34.0
Level of Service	F	D	C	E	D	D	F	E		F	F	C
Approach Delay (s)		90.2			51.1			107.2			87.3	
Approach LOS		F			D			F			F	

Intersection Summary

HCM 2000 Control Delay	88.7	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.06		
Actuated Cycle Length (s)	136.2	Sum of lost time (s)	16.5
Intersection Capacity Utilization	98.3%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
40: First St/Springtown Blvd & I-580 WB Ramps

BART to Livermore Extension Project
2040 BART + INP + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations			↗↗			↗	↗↗	↑			↖↖	↖
Traffic Volume (vph)	0	0	262	0	0	0	386	1439	0	0	421	209
Future Volume (vph)	0	0	262	0	0	0	386	1439	0	0	421	209
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)			4.5				4.5	4.0			4.5	4.5
Lane Util. Factor			0.88				0.97	1.00			0.95	1.00
Frt			0.85				1.00	1.00			1.00	0.85
Flt Protected			1.00				0.95	1.00			1.00	1.00
Satd. Flow (prot)			2787				3433	1863			3539	1583
Flt Permitted			1.00				0.95	1.00			1.00	1.00
Satd. Flow (perm)			2787				3433	1863			3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	285	0	0	0	420	1564	0	0	458	227
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	9
Lane Group Flow (vph)	0	0	285	0	0	0	420	1564	0	0	458	218
Turn Type			Over			Free	Prot	NA			NA	Perm
Protected Phases			5				5	2			6	
Permitted Phases						Free						6
Actuated Green, G (s)			21.1				21.1	140.0			110.9	110.9
Effective Green, g (s)			20.6				20.6	140.0			110.4	110.4
Actuated g/C Ratio			0.15				0.15	1.00			0.79	0.79
Clearance Time (s)			4.0				4.0	4.0			4.0	4.0
Vehicle Extension (s)			2.0				2.0	0.2			4.0	4.0
Lane Grp Cap (vph)			410				505	1863			2790	1248
v/s Ratio Prot			0.10				0.12	c0.84			0.13	
v/s Ratio Perm												0.14
v/c Ratio			0.70				0.83	0.84			0.16	0.17
Uniform Delay, d1			56.7				58.0	0.0			3.6	3.6
Progression Factor			1.00				1.06	1.00			1.00	1.00
Incremental Delay, d2			4.1				3.4	1.4			0.1	0.3
Delay (s)			60.8				65.1	1.4			3.7	3.9
Level of Service			E				E	A			A	A
Approach Delay (s)		60.8			0.0			14.9			3.8	
Approach LOS		E			A			B			A	

Intersection Summary




















HCM 2000 Control Delay	16.8	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.90		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	79.1%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

41: First St & I-580 EB Ramps

BART to Livermore Extension Project
2040 BART + INP + Garage PM

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations													
Traffic Volume (vph)	533	4	796	0	0	0	0	1566	442	102	1349	0	
Future Volume (vph)	533	4	796	0	0	0	0	1566	442	102	1349	0	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)		4.0	4.0					5.0	5.0	5.0	5.0		
Lane Util. Factor		1.00	0.88					0.95	1.00	1.00	0.95		
Frt		1.00	0.85					1.00	0.85	1.00	1.00		
Flt Protected		0.95	1.00					1.00	1.00	0.95	1.00		
Satd. Flow (prot)		1775	2787					3539	1583	1770	3539		
Flt Permitted		0.95	1.00					1.00	1.00	0.95	1.00		
Satd. Flow (perm)		1775	2787					3539	1583	1770	3539		
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	
Adj. Flow (vph)	579	4	865	0	0	0	0	1702	480	111	1466	0	
RTOR Reduction (vph)	0	0	48	0	0	0	0	0	152	0	0	0	
Lane Group Flow (vph)	0	583	817	0	0	0	0	1702	329	111	1466	0	
Turn Type	Perm	NA	Perm					NA	Perm	Prot	NA		
Protected Phases		4						2		1	6		
Permitted Phases	4		4						2				
Actuated Green, G (s)		47.5	47.5					70.5	70.5	10.0	84.5		
Effective Green, g (s)		47.0	47.0					70.0	70.0	9.0	84.0		
Actuated g/C Ratio		0.34	0.34					0.50	0.50	0.06	0.60		
Clearance Time (s)		3.5	3.5					4.5	4.5	4.0	4.5		
Vehicle Extension (s)		2.5	2.5					4.0	4.0	2.0	4.0		
Lane Grp Cap (vph)		595	935					1769	791	113	2123		
v/s Ratio Prot								c0.48		c0.06	0.41		
v/s Ratio Perm		0.33	0.29						0.21				
v/c Ratio		0.98	0.87					0.96	0.42	0.98	0.69		
Uniform Delay, d1		46.0	43.7					33.7	22.1	65.4	19.1		
Progression Factor		1.00	1.00					1.00	1.00	0.89	0.73		
Incremental Delay, d2		31.4	9.0					14.1	1.6	78.3	1.9		
Delay (s)		77.4	52.8					47.9	23.7	136.7	15.8		
Level of Service		E	D					D	C	F	B		
Approach Delay (s)		62.7			0.0			42.5			24.3		
Approach LOS		E			A			D			C		
Intersection Summary													
HCM 2000 Control Delay			42.6									HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio			0.97										
Actuated Cycle Length (s)			140.0									Sum of lost time (s)	14.0
Intersection Capacity Utilization			90.3%									ICU Level of Service	E
Analysis Period (min)			15										

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
42: 1st St & Mines Rd























BART to Livermore Extension Project
2040 BART + INP + Garage PM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	74	328	121	508	297	242	130	1597	1210	353	1274	61
Future Volume (vph)	74	328	121	508	297	242	130	1597	1210	353	1274	61
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	0.97	1.00	1.00	1.00	0.91	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	1863	1583	3433	1863	1583	1770	5085	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	1863	1583	3433	1863	1583	1770	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	80	357	132	552	323	263	141	1736	1315	384	1385	66
RTOR Reduction (vph)	0	0	110	0	0	49	0	0	158	0	0	34
Lane Group Flow (vph)	80	357	22	552	323	214	141	1736	1157	384	1385	32
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8	1	5	2		1	6	
Permitted Phases			4			8			2			6
Actuated Green, G (s)	8.7	23.0	23.0	17.0	31.3	42.3	15.7	73.0	73.0	11.0	68.3	68.3
Effective Green, g (s)	8.7	23.0	23.0	17.0	31.3	42.3	15.7	73.0	73.0	11.0	68.3	68.3
Actuated g/C Ratio	0.06	0.16	0.16	0.12	0.22	0.30	0.11	0.52	0.52	0.08	0.49	0.49
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	109	306	260	416	416	523	198	2651	825	269	2480	772
v/s Ratio Prot	0.05	c0.19		c0.16	0.17	0.03	0.08	0.34		c0.11	0.27	
v/s Ratio Perm			0.01			0.10			c0.73			0.02
v/c Ratio	0.73	1.17	0.08	1.33	0.78	0.41	0.71	0.65	1.40	1.43	0.56	0.04
Uniform Delay, d1	64.5	58.5	49.6	61.5	51.1	38.9	60.0	24.3	33.5	64.5	25.2	18.7
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	22.3	104.5	0.1	163.0	8.8	0.5	11.4	0.6	188.2	212.6	0.3	0.0
Delay (s)	86.9	163.0	49.7	224.5	59.9	39.4	71.4	24.9	221.7	277.1	25.5	18.8
Level of Service	F	F	D	F	E	D	E	C	F	F	C	B
Approach Delay (s)		126.0			135.0			108.0			77.9	
Approach LOS		F			F			F			E	
Intersection Summary												
HCM 2000 Control Delay			105.9			HCM 2000 Level of Service			F			
HCM 2000 Volume to Capacity ratio			1.35									
Actuated Cycle Length (s)			140.0			Sum of lost time (s)			16.0			
Intersection Capacity Utilization			112.3%			ICU Level of Service			H			
Analysis Period (min)			15									

c Critical Lane Group























HCM Unsignalized Intersection Capacity Analysis
43: Vasco Rd & I-580 WB Ramps

BART to Livermore Extension Project
2040 BART + INP + Garage PM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations								  			  	
Traffic Volume (veh/h)	0	0	0	0	0	166	0	2350	0	0	698	0
Future Volume (Veh/h)	0	0	0	0	0	166	0	2350	0	0	698	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	0	0	0	180	0	2554	0	0	759	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage (veh)												
Upstream signal (ft)											524	
pX, platoon unblocked												
vC, conflicting volume	1790	3313	253	2807	3313	851	759			2554		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1790	3313	253	2807	3313	851	759			2554		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	100	100	41	100			100		
cM capacity (veh/h)	21	8	746	8	8	303	848			171		
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	NB 4	SB 1	SB 2	SB 3	SB 4		
Volume Total	0	180	851	851	851	0	253	253	253	0		
Volume Left	0	0	0	0	0	0	0	0	0	0		
Volume Right	0	180	0	0	0	0	0	0	0	0		
cSH	1700	303	1700	1700	1700	1700	1700	1700	1700	1700		
Volume to Capacity	0.00	0.59	0.50	0.50	0.50	0.00	0.15	0.15	0.15	0.00		
Queue Length 95th (ft)	0	89	0	0	0	0	0	0	0	0		
Control Delay (s)	0.0	32.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
Lane LOS	A	D										
Approach Delay (s)	0.0	32.8	0.0				0.0					
Approach LOS	A	D										
Intersection Summary												
Average Delay			1.7									
Intersection Capacity Utilization			62.4%		ICU Level of Service					B		
Analysis Period (min)			15									






















HCM Unsignalized Intersection Capacity Analysis
44: Vasco Rd & I-580 EB Ramps

BART to Livermore Extension Project
2040 BART + INP + Garage PM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations								  			  	
Traffic Volume (veh/h)	0	0	0	0	0	0	0	2710	0	64	823	0
Future Volume (Veh/h)	0	0	0	0	0	0	0	2710	0	64	823	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	0	0	0	0	0	2946	0	70	895	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	2017	3981	298	3384	3981	982	895			2946		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	2017	3981	298	3384	3981	982	895			2946		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	100	100	100	100			41		
cM capacity (veh/h)	18	1	698	2	1	248	754			119		
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	NB 4	SB 1	SB 2	SB 3	SB 4		
Volume Total	0	0	982	982	982	0	70	298	298	298		
Volume Left	0	0	0	0	0	0	70	0	0	0		
Volume Right	0	0	0	0	0	0	0	0	0	0		
cSH	1700	1700	1700	1700	1700	1700	119	1700	1700	1700		
Volume to Capacity	0.00	0.00	0.58	0.58	0.58	0.00	0.59	0.18	0.18	0.18		
Queue Length 95th (ft)	0	0	0	0	0	0	73	0	0	0		
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	71.6	0.0	0.0	0.0		
Lane LOS	A	A					F					
Approach Delay (s)	0.0	0.0	0.0				5.2					
Approach LOS	A	A										
Intersection Summary												
Average Delay			1.3									
Intersection Capacity Utilization			56.5%		ICU Level of Service					B		
Analysis Period (min)			15									

HCM Signalized Intersection Capacity Analysis
 45: Vasco Rd & East Ave

BART to Livermore Extension Project
 2040 BART + INP + Garage PM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	814	38	121	128	381	291	105	412	12	17	415	501
Future Volume (vph)	814	38	121	128	381	291	105	412	12	17	415	501
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	0.95		0.97	1.00	1.00
Frt	1.00	0.89		1.00	0.94		1.00	1.00		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	3134		1770	3309		1770	3524		3433	1863	1583
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1770	3134		1770	3309		1770	3524		3433	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	885	41	132	139	414	316	114	448	13	18	451	545
RTOR Reduction (vph)	0	75	0	0	112	0	0	2	0	0	0	410
Lane Group Flow (vph)	885	98	0	139	618	0	114	459	0	18	451	135
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												6
Actuated Green, G (s)	41.0	44.5		12.5	16.0		4.0	27.8		1.6	25.4	25.4
Effective Green, g (s)	41.0	44.5		12.5	16.0		4.0	27.8		1.6	25.4	25.4
Actuated g/C Ratio	0.40	0.43		0.12	0.16		0.04	0.27		0.02	0.25	0.25
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	708	1361		216	517		69	956		53	462	392
v/s Ratio Prot	c0.50	0.03		0.08	c0.19		c0.06	0.13		0.01	c0.24	
v/s Ratio Perm												0.09
v/c Ratio	1.25	0.07		0.64	1.19		1.65	0.48		0.34	0.98	0.34
Uniform Delay, d1	30.7	16.9		42.8	43.2		49.2	31.2		49.9	38.2	31.7
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	124.0	0.0		6.4	105.5		349.0	0.4		3.8	35.4	0.5
Delay (s)	154.7	16.9		49.2	148.7		398.2	31.6		53.7	73.6	32.2
Level of Service	F	B		D	F		F	C		D	E	C
Approach Delay (s)		132.2			132.8			104.3			51.0	
Approach LOS		F			F			F			D	

Intersection Summary

HCM 2000 Control Delay	104.4	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.16		
Actuated Cycle Length (s)	102.4	Sum of lost time (s)	16.0
Intersection Capacity Utilization	106.0%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

46: Greenville Rd & I-580 WB Ramps

BART to Livermore Extension Project

2040 BART + INP + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↰↰		↰		↕↕	↰		↕↕	
Traffic Volume (vph)	0	0	0	102	0	19	0	1309	813	0	136	24
Future Volume (vph)	0	0	0	102	0	19	0	1309	813	0	136	24
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0		4.0		4.0	4.0		4.0	
Lane Util. Factor				0.97		1.00		0.95	1.00		0.95	
Frt				1.00		0.85		1.00	0.85		0.98	
Flt Protected				0.95		1.00		1.00	1.00		1.00	
Satd. Flow (prot)				3433		1583		3539	1583		3460	
Flt Permitted				0.95		1.00		1.00	1.00		1.00	
Satd. Flow (perm)				3433		1583		3539	1583		3460	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	111	0	21	0	1423	884	0	148	26
RTOR Reduction (vph)	0	0	0	0	0	20	0	0	111	0	3	0
Lane Group Flow (vph)	0	0	0	111	0	1	0	1423	773	0	171	0
Turn Type				Prot		Prot		NA	Perm		NA	
Protected Phases				3		3		2			6	
Permitted Phases									2			
Actuated Green, G (s)				9.6		9.6		122.4	122.4		122.4	
Effective Green, g (s)				9.6		9.6		122.4	122.4		122.4	
Actuated g/C Ratio				0.07		0.07		0.87	0.87		0.87	
Clearance Time (s)				4.0		4.0		4.0	4.0		4.0	
Vehicle Extension (s)				3.0		3.0		3.0	3.0		3.0	
Lane Grp Cap (vph)				235		108		3094	1383		3025	
v/s Ratio Prot				c0.03		0.00		0.40			0.05	
v/s Ratio Perm									c0.49			
v/c Ratio				0.47		0.01		0.46	0.56		0.06	
Uniform Delay, d1				62.8		60.8		1.9	2.2		1.2	
Progression Factor				1.00		1.00		0.83	2.98		1.00	
Incremental Delay, d2				1.5		0.0		0.5	1.6		0.0	
Delay (s)				64.3		60.8		2.0	8.0		1.2	
Level of Service				E		E		A	A		A	
Approach Delay (s)		0.0			63.7			4.3			1.2	
Approach LOS		A			E			A			A	

Intersection Summary

HCM 2000 Control Delay	7.1	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.55		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	53.7%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

47: Greenville Rd & I-580 EB Ramps

BART to Livermore Extension Project
 2040 BART + INP + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↗↘		↗					↗↘	↗		↗↘	↗
Traffic Volume (vph)	143	0	63	0	0	0	0	1379	479	0	194	35
Future Volume (vph)	143	0	63	0	0	0	0	1379	479	0	194	35
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0					4.0	4.0		4.0	4.0
Lane Util. Factor	0.97		1.00					0.95	1.00		0.95	1.00
Frt	1.00		0.85					1.00	0.85		1.00	0.85
Flt Protected	0.95		1.00					1.00	1.00		1.00	1.00
Satd. Flow (prot)	3433		1583					3539	1583		3539	1583
Flt Permitted	0.95		1.00					1.00	1.00		1.00	1.00
Satd. Flow (perm)	3433		1583					3539	1583		3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	155	0	68	0	0	0	0	1499	521	0	211	38
RTOR Reduction (vph)	0	0	62	0	0	0	0	0	73	0	0	5
Lane Group Flow (vph)	155	0	6	0	0	0	0	1499	448	0	211	33
Turn Type	Prot		Prot					NA	Perm		NA	Perm
Protected Phases	7		7					2			6	
Permitted Phases									2			6
Actuated Green, G (s)	11.7		11.7					120.3	120.3		120.3	120.3
Effective Green, g (s)	11.7		11.7					120.3	120.3		120.3	120.3
Actuated g/C Ratio	0.08		0.08					0.86	0.86		0.86	0.86
Clearance Time (s)	4.0		4.0					4.0	4.0		4.0	4.0
Vehicle Extension (s)	3.0		3.0					3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	286		132					3041	1360		3041	1360
v/s Ratio Prot	c0.05		0.00					c0.42			0.06	
v/s Ratio Perm									0.28			0.02
v/c Ratio	0.54		0.04					0.49	0.33		0.07	0.02
Uniform Delay, d1	61.6		59.0					2.4	1.9		1.5	1.4
Progression Factor	1.00		1.00					1.06	3.31		2.04	5.71
Incremental Delay, d2	2.1		0.1					0.4	0.5		0.0	0.0
Delay (s)	63.7		59.1					3.0	6.9		3.1	8.1
Level of Service	E		E					A	A		A	A
Approach Delay (s)		62.3			0.0			4.0			3.8	
Approach LOS		E			A			A			A	

Intersection Summary

HCM 2000 Control Delay	9.2	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.50		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	48.9%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
48: Greenville Rd & Northfront Road/Altamont Pass Road

BART to Livermore Extension Project
2040 BART + INP + Garage PM



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↑	↑	↑	↑	↑
Traffic Volume (vph)	561	145	2	73	267	1223
Future Volume (vph)	561	145	2	73	267	1223
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	1863	1583	1770	1863	1770	1583
Flt Permitted	1.00	1.00	0.12	1.00	0.95	1.00
Satd. Flow (perm)	1863	1583	226	1863	1770	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	610	158	2	79	290	1329
RTOR Reduction (vph)	0	70	0	0	0	19
Lane Group Flow (vph)	610	88	2	79	290	1310
Turn Type	NA	Perm	Perm	NA	Prot	Perm
Protected Phases	4			8	2	
Permitted Phases		4	8			2
Actuated Green, G (s)	33.0	33.0	33.0	33.0	79.0	79.0
Effective Green, g (s)	33.0	33.0	33.0	33.0	79.0	79.0
Actuated g/C Ratio	0.28	0.28	0.28	0.28	0.66	0.66
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	512	435	62	512	1165	1042
v/s Ratio Prot	c0.33			0.04	0.16	
v/s Ratio Perm		0.06	0.01			c0.83
v/c Ratio	1.19	0.20	0.03	0.15	0.25	1.26
Uniform Delay, d1	43.5	33.4	31.8	32.9	8.4	20.5
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	104.2	0.2	0.2	0.1	0.1	123.6
Delay (s)	147.7	33.6	32.0	33.1	8.5	144.1
Level of Service	F	C	C	C	A	F
Approach Delay (s)	124.2			33.1	119.8	
Approach LOS	F			C	F	

Intersection Summary

HCM 2000 Control Delay	118.3	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.24		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	111.9%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
49: Greenville Rd & Southfront Rd



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	397	116	223	1574	156	101
Future Volume (vph)	397	116	223	1574	156	101
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.2	5.2	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.88	0.97	0.95	0.95	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	3433	2787	3433	3539	3539	1583
Flt Permitted	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (perm)	3433	2787	3433	3539	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	432	126	242	1711	170	110
RTOR Reduction (vph)	0	105	0	0	0	86
Lane Group Flow (vph)	432	21	242	1711	170	24
Turn Type	Prot	Perm	Prot	NA	NA	Perm
Protected Phases	8		1	6	2	
Permitted Phases		8				2
Actuated Green, G (s)	12.4	12.4	29.8	47.3	13.5	13.5
Effective Green, g (s)	11.8	11.8	29.8	49.0	15.2	15.2
Actuated g/C Ratio	0.17	0.17	0.43	0.70	0.22	0.22
Clearance Time (s)	4.6	4.6	4.0	5.7	5.7	5.7
Vehicle Extension (s)	5.0	5.0	6.0	2.5	2.5	2.5
Lane Grp Cap (vph)	578	469	1461	2477	768	343
v/s Ratio Prot	c0.13		0.07	c0.48	0.05	
v/s Ratio Perm		0.01				0.02
v/c Ratio	0.75	0.05	0.17	0.69	0.22	0.07
Uniform Delay, d1	27.7	24.4	12.4	6.1	22.5	21.8
Progression Factor	1.00	1.00	1.00	1.00	0.90	1.36
Incremental Delay, d2	6.3	0.1	0.2	1.6	0.7	0.4
Delay (s)	34.0	24.5	12.6	7.7	20.9	29.9
Level of Service	C	C	B	A	C	C
Approach Delay (s)	31.8			8.3	24.5	
Approach LOS	C			A	C	

Intersection Summary

HCM 2000 Control Delay	14.6	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.75		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	13.2
Intersection Capacity Utilization	62.5%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
50: Greenville Rd & Patterson Pass Rd

BART to Livermore Extension Project
2040 BART + INP + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	41	609	69	6	13	8	80	492	393	431	212	43
Future Volume (vph)	41	609	69	6	13	8	80	492	393	431	212	43
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.98		1.00	0.94		1.00	0.93		1.00	0.97	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1834		1770	1753		1770	1739		1770	1815	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	1834		1770	1753		1770	1739		1770	1815	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	45	662	75	7	14	9	87	535	427	468	230	47
RTOR Reduction (vph)	0	4	0	0	7	0	0	23	0	0	6	0
Lane Group Flow (vph)	45	733	0	7	16	0	87	939	0	468	271	0
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												
Actuated Green, G (s)	4.7	34.0		0.8	30.1		8.7	45.8		21.0	58.1	
Effective Green, g (s)	4.7	34.0		0.8	30.1		8.7	45.8		21.0	58.1	
Actuated g/C Ratio	0.04	0.29		0.01	0.26		0.07	0.39		0.18	0.49	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	70	530		12	448		130	677		316	896	
v/s Ratio Prot	c0.03	c0.40		0.00	0.01		0.05	c0.54		c0.26	0.15	
v/s Ratio Perm												
v/c Ratio	0.64	1.38		0.58	0.04		0.67	1.39		1.48	0.30	
Uniform Delay, d1	55.6	41.8		58.2	32.9		53.0	35.9		48.3	17.7	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	18.4	184.2		56.2	0.0		12.3	183.1		232.8	0.9	
Delay (s)	74.1	226.0		114.5	32.9		65.4	219.0		281.1	18.6	
Level of Service	E	F		F	C		E	F		F	B	
Approach Delay (s)		217.3			51.9			206.2			183.5	
Approach LOS		F			D			F			F	

Intersection Summary			
HCM 2000 Control Delay	201.3	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.41		
Actuated Cycle Length (s)	117.6	Sum of lost time (s)	16.0
Intersection Capacity Utilization	120.0%	ICU Level of Service	H
Analysis Period (min)	15		
c	Critical Lane Group		

HCM Signalized Intersection Capacity Analysis
1: Dougherty Rd & Amador Valley Rd

BART to Livermore Extension Project
2040 DMU + INP + Garage AM



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	104	891	480	839	2264	129
Future Volume (vph)	104	891	480	839	2264	129
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00	0.97	0.91	0.91	
Frt	1.00	0.85	1.00	1.00	0.99	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1770	1583	3433	5085	5044	
Flt Permitted	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	1770	1583	3433	5085	5044	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	113	968	522	912	2461	140
RTOR Reduction (vph)	0	135	0	0	5	0
Lane Group Flow (vph)	113	833	522	912	2596	0
Turn Type	Perm	Perm	Prot	NA	NA	
Protected Phases			5	2	6	
Permitted Phases	4	4				
Actuated Green, G (s)	53.0	53.0	15.0	79.0	60.0	
Effective Green, g (s)	53.0	53.0	15.0	79.0	60.0	
Actuated g/C Ratio	0.38	0.38	0.11	0.56	0.43	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	670	599	367	2869	2161	
v/s Ratio Prot			c0.15	0.18	c0.51	
v/s Ratio Perm	0.06	c0.53				
v/c Ratio	0.17	1.39	1.42	0.32	1.20	
Uniform Delay, d1	28.9	43.5	62.5	16.2	40.0	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.1	185.6	205.3	0.1	95.4	
Delay (s)	29.0	229.1	267.8	16.3	135.4	
Level of Service	C	F	F	B	F	
Approach Delay (s)	208.2			107.8	135.4	
Approach LOS	F			F	F	

Intersection Summary

HCM 2000 Control Delay	143.0	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.30		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	108.5%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
2: Hopyard Road/Dougherty Rd & Dublin Blvd

BART to Livermore Extension Project
2040 DMU + INP + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↶↶	↶↶↶	↶↶	↶↶↶	↶↶↶	↶	↶↶↶	↶↶↶	↶↶	↶↶	↶↶↶	↶
Traffic Volume (vph)	57	561	544	324	802	471	701	1107	144	1058	2292	107
Future Volume (vph)	57	561	544	324	802	471	701	1107	144	1058	2292	107
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	6.0	5.0	5.0	5.5	5.0	5.0	5.5	5.0	5.0	5.5	
Lane Util. Factor	0.97	0.91	0.88	0.94	0.91	1.00	0.94	0.91	0.88	0.97	0.86	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	3433	5085	2787	4990	5085	1583	4990	5085	2787	3433	6365	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	3433	5085	2787	4990	5085	1583	4990	5085	2787	3433	6365	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	62	610	591	352	872	512	762	1203	157	1150	2491	116
RTOR Reduction (vph)	0	0	65	0	0	78	0	0	60	0	4	0
Lane Group Flow (vph)	62	610	526	352	872	434	762	1203	97	1150	2603	0
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	
Protected Phases	5	2	3	1	6	7	3	8	1	7	4	
Permitted Phases			2			6			8			
Actuated Green, G (s)	12.0	30.5	46.5	15.0	34.0	62.0	16.0	45.0	60.0	28.0	57.0	
Effective Green, g (s)	12.0	30.5	46.5	15.0	34.0	62.0	16.0	45.0	60.0	28.0	57.0	
Actuated g/C Ratio	0.09	0.22	0.33	0.11	0.24	0.44	0.11	0.32	0.43	0.20	0.41	
Clearance Time (s)	5.0	6.0	5.0	5.0	5.5	5.0	5.0	5.5	5.0	5.0	5.5	
Vehicle Extension (s)	2.0	4.5	2.0	2.0	4.5	2.0	2.0	4.5	2.0	2.0	4.5	
Lane Grp Cap (vph)	294	1107	925	534	1234	701	570	1634	1194	686	2591	
v/s Ratio Prot	0.02	0.12	c0.06	0.07	c0.17	0.12	c0.15	0.24	0.01	c0.33	c0.41	
v/s Ratio Perm			0.12			0.15			0.03			
v/c Ratio	0.21	0.55	0.57	0.66	0.71	0.62	1.34	0.74	0.08	1.68	1.00	
Uniform Delay, d1	59.6	48.7	38.5	60.0	48.4	29.9	62.0	42.2	23.7	56.0	41.5	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.05	1.08	1.49	1.00	1.00	
Incremental Delay, d2	0.1	2.0	0.5	2.2	3.4	1.2	160.9	1.6	0.0	310.7	18.8	
Delay (s)	59.7	50.6	39.0	62.3	51.9	31.1	226.1	47.4	35.4	366.7	60.3	
Level of Service	E	D	D	E	D	C	F	D	D	F	E	
Approach Delay (s)		45.6			47.9			110.7			154.1	
Approach LOS		D			D			F			F	

Intersection Summary

HCM 2000 Control Delay	107.5	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.07		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	21.5
Intersection Capacity Utilization	97.1%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
3: Dougherty Rd/Hopyard Road & I-580 WB Ramps

BART to Livermore Extension Project
2040 DMU + INP + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	390	0	637	0	1710	0	0	2280	0
Future Volume (vph)	0	0	0	390	0	637	0	1710	0	0	2280	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0		4.0		4.0			4.0	
Lane Util. Factor				0.97		0.88		0.91			0.86	
Frt				1.00		0.85		1.00			1.00	
Flt Protected				0.95		1.00		1.00			1.00	
Satd. Flow (prot)				3433		2787		5085			4806	
Flt Permitted				0.95		1.00		1.00			1.00	
Satd. Flow (perm)				3433		2787		5085			4806	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	424	0	692	0	1859	0	0	2478	0
RTOR Reduction (vph)	0	0	0	0	0	24	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	424	0	668	0	1859	0	0	2478	0
Turn Type				Prot		Prot		NA			NA	Perm
Protected Phases				4		4		2			6	
Permitted Phases												6
Actuated Green, G (s)				38.7		38.7		90.5			90.5	
Effective Green, g (s)				40.1		40.1		91.9			91.9	
Actuated g/C Ratio				0.29		0.29		0.66			0.66	
Clearance Time (s)				5.4		5.4		5.4			5.4	
Vehicle Extension (s)				3.0		3.0		3.0			3.0	
Lane Grp Cap (vph)				983		798		3337			3154	
v/s Ratio Prot				0.12		c0.24		0.37			c0.52	
v/s Ratio Perm												
v/c Ratio				0.43		0.84		0.56			0.79	
Uniform Delay, d1				40.7		46.9		13.0			17.1	
Progression Factor				1.00		1.00		0.93			1.24	
Incremental Delay, d2				0.3		7.6		0.6			0.9	
Delay (s)				41.0		54.5		12.7			22.0	
Level of Service				D		D		B			C	
Approach Delay (s)		0.0			49.4			12.7			22.0	
Approach LOS		A			D			B			C	

Intersection Summary

HCM 2000 Control Delay	24.4	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.80		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	62.0%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 4: Hopyard Rd/Dougherty Rd & I-580 EB Ramps

BART to Livermore Extension Project
 2040 DMU + INP + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔↔		↔↔					↑↑↑	↔		↑↑↑	↔
Traffic Volume (vph)	896	0	1451	0	0	0	0	914	0	0	1772	0
Future Volume (vph)	896	0	1451	0	0	0	0	914	0	0	1772	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0					4.0			4.0	
Lane Util. Factor	0.97		0.88					0.91			0.86	
Frt	1.00		0.85					1.00			1.00	
Flt Protected	0.95		1.00					1.00			1.00	
Satd. Flow (prot)	3433		2787					5085			4806	
Flt Permitted	0.95		1.00					1.00			1.00	
Satd. Flow (perm)	3433		2787					5085			4806	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	974	0	1577	0	0	0	0	993	0	0	1926	0
RTOR Reduction (vph)	0	0	9	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	974	0	1568	0	0	0	0	993	0	0	1926	0
Turn Type	Prot		Prot					NA	Free		NA	Perm
Protected Phases	4		4					2			6	
Permitted Phases									Free			6
Actuated Green, G (s)	73.6		73.6					55.6			55.6	
Effective Green, g (s)	75.0		75.0					57.0			57.0	
Actuated g/C Ratio	0.54		0.54					0.41			0.41	
Clearance Time (s)	5.4		5.4					5.4			5.4	
Vehicle Extension (s)	3.0		3.0					3.0			3.0	
Lane Grp Cap (vph)	1839		1493					2070			1956	
v/s Ratio Prot	0.28		c0.56					0.20			c0.40	
v/s Ratio Perm												
v/c Ratio	0.53		1.05					0.48			0.98	
Uniform Delay, d1	21.1		32.5					30.6			41.1	
Progression Factor	1.00		1.00					1.00			1.00	
Incremental Delay, d2	0.3		37.8					0.8			13.4	
Delay (s)	21.3		70.3					31.4			54.5	
Level of Service	C		E					C			D	
Approach Delay (s)		51.6			0.0			31.4			54.5	
Approach LOS		D			A			C			D	

Intersection Summary			
HCM 2000 Control Delay	48.9	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	1.02		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	91.7%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

5: Hopyard Rd & Owens Rd

BART to Livermore Extension Project

2040 DMU + INP + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↵	↔		↵	↔	↗	↵	↑↑↑	↗	↗↵	↑↑↵	
Traffic Volume (vph)	201	98	50	132	134	234	149	845	178	956	1773	544
Future Volume (vph)	201	98	50	132	134	234	149	845	178	956	1773	544
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	2.7	2.7		2.7	2.7	2.7	4.0	2.3	2.3	4.0	2.3	
Lane Util. Factor	0.91	0.91		1.00	0.95	0.95	1.00	0.91	1.00	0.97	0.91	
Frt	1.00	0.97		1.00	0.95	0.85	1.00	1.00	0.85	1.00	0.96	
Flt Protected	0.95	0.98		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1610	3223		1770	1676	1504	1770	5085	1583	3433	4906	
Flt Permitted	0.95	0.98		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1610	3223		1770	1676	1504	1770	5085	1583	3433	4906	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	218	107	54	143	146	254	162	918	193	1039	1927	591
RTOR Reduction (vph)	0	25	0	0	22	30	0	0	135	0	62	0
Lane Group Flow (vph)	120	234	0	143	203	145	162	918	58	1039	2456	0
Turn Type	Split	NA		Split	NA	pm+ov	Prot	NA	Perm	Prot	NA	
Protected Phases	8	8		4	4	1	5	2		1	6	
Permitted Phases						4			2			
Actuated Green, G (s)	6.0	6.0		10.0	10.0	42.8	9.0	25.2	25.2	32.8	49.0	
Effective Green, g (s)	7.3	7.3		11.3	11.3	45.4	9.0	26.9	26.9	32.8	50.7	
Actuated g/C Ratio	0.08	0.08		0.13	0.13	0.50	0.10	0.30	0.30	0.36	0.56	
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	130	261		222	210	803	177	1519	473	1251	2763	
v/s Ratio Prot	c0.07	0.07		0.08	c0.12	0.07	0.09	0.18		c0.30	c0.50	
v/s Ratio Perm						0.03			0.04			
v/c Ratio	0.92	0.90		0.64	0.97	0.18	0.92	0.60	0.12	0.83	0.89	
Uniform Delay, d1	41.1	41.0		37.4	39.2	12.2	40.1	27.0	23.0	26.1	17.2	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	55.6	30.1		6.3	52.2	0.1	43.8	1.8	0.5	4.8	4.8	
Delay (s)	96.7	71.1		43.7	91.4	12.3	83.9	28.8	23.5	30.9	22.0	
Level of Service	F	E		D	F	B	F	C	C	C	C	
Approach Delay (s)		79.2			53.3			35.0			24.6	
Approach LOS		E			D			C			C	

Intersection Summary

HCM 2000 Control Delay	33.2	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.92		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	11.7
Intersection Capacity Utilization	86.6%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

6: Hopyard Rd & Stoneridge Dr

BART to Livermore Extension Project
2040 DMU + INP + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↑↑↑	↗	↖↗	↑↑↑	↗	↖↗	↑↑	↗	↖↗	↑↑↑	↗
Traffic Volume (vph)	221	789	475	65	908	126	617	830	71	294	1027	284
Future Volume (vph)	221	789	475	65	908	126	617	830	71	294	1027	284
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.91	1.00	0.97	0.91	1.00	0.94	0.95	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5085	1583	3433	5085	1583	4990	3539	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5085	1583	3433	5085	1583	4990	3539	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	240	858	516	71	987	137	671	902	77	320	1116	309
RTOR Reduction (vph)	0	0	204	0	0	98	0	0	54	0	0	127
Lane Group Flow (vph)	240	858	312	71	987	39	671	902	23	320	1116	182
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8			2			6
Actuated Green, G (s)	4.0	18.9	18.9	2.4	17.3	17.3	8.0	18.0	18.0	6.0	16.0	16.0
Effective Green, g (s)	4.0	18.9	18.9	2.4	17.3	17.3	8.0	18.0	18.0	6.0	16.0	16.0
Actuated g/C Ratio	0.07	0.31	0.31	0.04	0.28	0.28	0.13	0.29	0.29	0.10	0.26	0.26
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	224	1567	488	134	1435	446	651	1039	464	336	1327	413
v/s Ratio Prot	c0.07	0.17		0.02	0.19		c0.13	c0.25		0.09	0.22	
v/s Ratio Perm			c0.20			0.02			0.01			0.11
v/c Ratio	1.07	0.55	0.64	0.53	0.69	0.09	1.03	0.87	0.05	0.95	0.84	0.44
Uniform Delay, d1	28.6	17.6	18.3	28.9	19.6	16.2	26.6	20.5	15.5	27.5	21.4	18.9
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	80.4	0.4	2.8	3.7	1.4	0.1	43.4	7.8	0.0	36.5	5.0	0.8
Delay (s)	109.0	18.0	21.0	32.6	21.0	16.3	70.0	28.3	15.6	64.0	26.4	19.7
Level of Service	F	B	C	C	C	B	E	C	B	E	C	B
Approach Delay (s)		32.5			21.1			44.7			32.1	
Approach LOS		C			C			D			C	

























Intersection Summary

HCM 2000 Control Delay	33.5	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.87		
Actuated Cycle Length (s)	61.3	Sum of lost time (s)	16.0
Intersection Capacity Utilization	68.8%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 7: Hopyard Rd & Las Positas Blvd

BART to Livermore Extension Project
 2040 DMU + INP + Garage AM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	158	482	405	358	454	56	473	1276	405	114	1080	95
Future Volume (vph)	158	482	405	358	454	56	473	1276	405	114	1080	95
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.95	1.00	0.97	0.95	1.00	0.97	0.91	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	3433	3539	1583	3433	5085	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	3433	3539	1583	3433	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	172	524	440	389	493	61	514	1387	440	124	1174	103
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	73
Lane Group Flow (vph)	172	524	440	389	493	61	514	1387	440	124	1174	30
Turn Type	Prot	NA	Free	Prot	NA	Free	Prot	NA	Free	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1		6
Permitted Phases			Free			Free			Free			6
Actuated Green, G (s)	6.9	14.5	69.4	8.0	15.6	69.4	11.0	27.7	69.4	3.2	19.9	19.9
Effective Green, g (s)	6.9	14.5	69.4	8.0	15.6	69.4	11.0	27.7	69.4	3.2	19.9	19.9
Actuated g/C Ratio	0.10	0.21	1.00	0.12	0.22	1.00	0.16	0.40	1.00	0.05	0.29	0.29
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	341	739	1583	395	795	1583	544	2029	1583	158	1458	453
v/s Ratio Prot	0.05	c0.15		c0.11	0.14		c0.15	0.27		0.04	c0.23	
v/s Ratio Perm			0.28			0.04			c0.28			0.02
v/c Ratio	0.50	0.71	0.28	0.98	0.62	0.04	0.94	0.68	0.28	0.78	0.81	0.07
Uniform Delay, d1	29.6	25.5	0.0	30.6	24.2	0.0	28.9	17.2	0.0	32.8	23.0	18.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.2	3.1	0.4	40.9	1.5	0.0	25.4	1.0	0.4	22.1	3.3	0.1
Delay (s)	30.8	28.6	0.4	71.6	25.7	0.0	54.3	18.2	0.4	54.8	26.3	18.1
Level of Service	C	C	A	E	C	A	D	B	A	D	C	B
Approach Delay (s)		18.0			43.0			22.8			28.2	
Approach LOS		B			D			C			C	

Intersection Summary

HCM 2000 Control Delay	26.4	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.84		
Actuated Cycle Length (s)	69.4	Sum of lost time (s)	16.0
Intersection Capacity Utilization	71.2%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

8: Willow Rd & Owens Rd

BART to Livermore Extension Project
2040 DMU + INP + Garage AM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	132	472	247	107	345	81	117	99	0	107	84	88
Future Volume (vph)	132	472	247	107	345	81	117	99	0	107	84	88
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	5.3	4.0		5.3	4.0	4.0
Lane Util. Factor	0.97	0.91		0.97	0.91	1.00	1.00	0.95		1.00	1.00	1.00
Frt	1.00	0.95		1.00	1.00	0.85	1.00	1.00		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	4824		3433	5085	1583	1770	3539		1770	1863	1583
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.70	1.00		0.68	1.00	1.00
Satd. Flow (perm)	3433	4824		3433	5085	1583	1300	3539		1274	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	143	513	268	116	375	88	127	108	0	116	91	96
RTOR Reduction (vph)	0	128	0	0	0	52	0	0	0	0	0	76
Lane Group Flow (vph)	143	653	0	116	375	36	127	108	0	116	91	20
Turn Type	Prot	NA		Prot	NA	Perm	Perm	NA	Perm	Perm	NA	Perm
Protected Phases	1	6		5	2			4			8	
Permitted Phases						2	4		4	8		8
Actuated Green, G (s)	4.5	17.0		3.8	16.3	16.3	8.0	8.0		8.0	8.0	8.0
Effective Green, g (s)	4.5	18.7		3.8	18.0	18.0	8.0	9.3		8.0	9.3	9.3
Actuated g/C Ratio	0.10	0.43		0.09	0.41	0.41	0.18	0.21		0.18	0.21	0.21
Clearance Time (s)	4.0	5.7		4.0	5.7	5.7	5.3	5.3		5.3	5.3	5.3
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	352	2059		297	2089	650	237	751		232	395	336
v/s Ratio Prot	0.04	c0.14		c0.03	0.07			0.03			0.05	
v/s Ratio Perm						0.02	c0.10			0.09		0.01
v/c Ratio	0.41	0.32		0.39	0.18	0.06	0.54	0.14		0.50	0.23	0.06
Uniform Delay, d1	18.4	8.3		18.9	8.2	7.8	16.2	14.0		16.1	14.3	13.8
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	0.8	0.1		0.9	0.0	0.0	2.3	0.1		1.7	0.3	0.1
Delay (s)	19.2	8.4		19.8	8.2	7.8	18.5	14.1		17.8	14.6	13.8
Level of Service	B	A		B	A	A	B	B		B	B	B
Approach Delay (s)		10.1			10.5			16.5			15.6	
Approach LOS		B			B			B			B	

Intersection Summary			
HCM 2000 Control Delay	11.7	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.37		
Actuated Cycle Length (s)	43.8	Sum of lost time (s)	12.0
Intersection Capacity Utilization	41.1%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 9: Hacienda Dr & Dublin Blvd

BART to Livermore Extension Project
 2040 DMU + INP + Garage AM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	88	390	119	286	764	80	180	708	124	11	396	130
Future Volume (vph)	88	390	119	286	764	80	180	708	124	11	396	130
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	6.0	5.0	4.5	6.0		5.0	6.0	6.0	4.5	5.5	5.5
Lane Util. Factor	0.97	0.91	0.88	0.97	0.91		0.94	0.95	0.88	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5085	2787	3433	5013		4990	3539	2787	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5085	2787	3433	5013		4990	3539	2787	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	96	424	129	311	830	87	196	770	135	12	430	141
RTOR Reduction (vph)	0	0	53	0	8	0	0	0	97	0	0	122
Lane Group Flow (vph)	96	424	76	311	909	0	196	770	38	12	430	19
Turn Type	Prot	NA	pm+ov	Prot	NA		Prot	NA	Perm	Prot	NA	Perm
Protected Phases	5	2	3	1	6		3	8		7	4	
Permitted Phases			2						8			4
Actuated Green, G (s)	9.3	59.6	82.6	17.9	68.2		23.0	38.9	38.9	2.6	18.5	18.5
Effective Green, g (s)	9.3	59.6	82.6	17.9	68.2		23.0	38.9	38.9	2.6	18.5	18.5
Actuated g/C Ratio	0.07	0.43	0.59	0.13	0.49		0.16	0.28	0.28	0.02	0.13	0.13
Clearance Time (s)	4.5	6.0	5.0	4.5	6.0		5.0	6.0	6.0	4.5	5.5	5.5
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	228	2164	1644	438	2442		819	983	774	63	671	209
v/s Ratio Prot	0.03	0.08	0.01	c0.09	c0.18		0.04	c0.22		0.00	c0.08	
v/s Ratio Perm			0.02						0.01			0.01
v/c Ratio	0.42	0.20	0.05	0.71	0.37		0.24	0.78	0.05	0.19	0.64	0.09
Uniform Delay, d1	62.8	25.2	12.1	58.6	22.5		50.9	46.7	37.0	67.7	57.6	53.4
Progression Factor	1.00	1.00	1.00	1.00	1.00		0.78	0.77	0.43	1.00	1.00	1.00
Incremental Delay, d2	1.3	0.2	0.0	5.4	0.4		0.1	4.0	0.0	1.5	2.1	0.2
Delay (s)	64.0	25.4	12.1	63.9	22.9		40.1	40.0	16.0	69.1	59.7	53.5
Level of Service	E	C	B	E	C		D	D	B	E	E	D
Approach Delay (s)		28.5			33.3			37.1			58.4	
Approach LOS		C			C			D			E	

Intersection Summary

HCM 2000 Control Delay	37.7	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.58		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	21.0
Intersection Capacity Utilization	60.3%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

10: Hacienda Dr & Martinelli Blvd/Hacienda Crossings



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↙	↘	↙↘	↙↘	↘		↙↘↙	↙↘↙	↙	↙↘	↙↘↙	
Traffic Volume (vph)	16	11	229	107	13	9	255	967	109	17	736	55
Future Volume (vph)	16	11	229	107	13	9	255	967	109	17	736	55
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	2.0	2.0	4.5	2.0		3.0	2.0	2.0	4.5	2.5	
Lane Util. Factor	1.00	0.91	0.91	0.97	1.00		0.94	0.91	1.00	0.97	0.86	
Frt	1.00	0.90	0.85	1.00	0.94		1.00	1.00	0.85	1.00	0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1770	1523	2882	3433	1746		4990	5085	1583	3433	6341	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1770	1523	2882	3433	1746		4990	5085	1583	3433	6341	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	17	12	249	116	14	10	277	1051	118	18	800	60
RTOR Reduction (vph)	0	23	202	0	9	0	0	0	25	0	4	0
Lane Group Flow (vph)	17	15	22	116	15	0	277	1051	93	18	856	0
Turn Type	Prot	NA	Perm	Prot	NA		Prot	NA	pm+ov	Prot	NA	
Protected Phases	5	2		1	6		3	8	1	7	4	
Permitted Phases			2						8			
Actuated Green, G (s)	4.8	12.0	12.0	11.5	18.7		13.1	95.2	106.7	5.3	87.4	
Effective Green, g (s)	4.3	14.0	14.0	11.0	20.7		14.1	97.2	110.7	4.8	88.9	
Actuated g/C Ratio	0.03	0.10	0.10	0.08	0.15		0.10	0.69	0.79	0.03	0.64	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	4.0	4.0	2.0	4.0		3.0	4.0	2.0	3.0	4.0	
Lane Grp Cap (vph)	54	152	288	269	258		502	3530	1274	117	4026	
v/s Ratio Prot	0.01	c0.01		c0.03	0.01		c0.06	c0.21	0.01	0.01	c0.13	
v/s Ratio Perm			0.01						0.05			
v/c Ratio	0.31	0.10	0.08	0.43	0.06		0.55	0.30	0.07	0.15	0.21	
Uniform Delay, d1	66.4	57.2	57.1	61.5	51.3		59.9	8.2	3.3	65.6	10.8	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.01	1.03	1.89	0.77	0.15	
Incremental Delay, d2	3.3	0.4	0.2	0.4	0.1		1.2	0.2	0.0	0.6	0.1	
Delay (s)	69.7	57.6	57.3	61.9	51.4		61.5	8.7	6.2	50.8	1.7	
Level of Service	E	E	E	E	D		E	A	A	D	A	
Approach Delay (s)		58.1			60.1			18.6			2.7	
Approach LOS		E			E			B			A	

Intersection Summary		
HCM 2000 Control Delay	19.6	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.32	B
Actuated Cycle Length (s)	140.0	Sum of lost time (s)
Intersection Capacity Utilization	44.1%	13.0
Analysis Period (min)	15	ICU Level of Service
		A

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 11: Hacienda Dr & I-580 WB Ramps

BART to Livermore Extension Project
 2040 DMU + INP + Garage AM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	190	0	444	0	1260	259	0	736	416
Future Volume (vph)	0	0	0	190	0	444	0	1260	259	0	736	416
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				2.6		2.6		2.1			2.1	2.1
Lane Util. Factor				0.97		0.88		0.91			0.86	0.86
Frt				1.00		0.85		0.97			0.97	0.85
Flt Protected				0.95		1.00		1.00			1.00	1.00
Satd. Flow (prot)				3433		2787		4955			4647	1362
Flt Permitted				0.95		1.00		1.00			1.00	1.00
Satd. Flow (perm)				3433		2787		4955			4647	1362
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	207	0	483	0	1370	282	0	800	452
RTOR Reduction (vph)	0	0	0	0	0	67	0	35	0	0	53	71
Lane Group Flow (vph)	0	0	0	207	0	416	0	1617	0	0	973	155
Turn Type				Prot		Prot		NA			NA	Perm
Protected Phases				4		4		2			6	
Permitted Phases												6
Actuated Green, G (s)				15.8		15.8		46.2			46.2	46.2
Effective Green, g (s)				17.2		17.2		48.1			48.1	48.1
Actuated g/C Ratio				0.25		0.25		0.69			0.69	0.69
Clearance Time (s)				4.0		4.0		4.0			4.0	4.0
Vehicle Extension (s)				3.0		3.0		3.0			3.0	3.0
Lane Grp Cap (vph)				843		684		3404			3193	935
v/s Ratio Prot				0.06		c0.15		c0.33			0.21	
v/s Ratio Perm												0.11
v/c Ratio				0.25		0.61		0.48			0.30	0.17
Uniform Delay, d1				21.2		23.4		5.1			4.3	3.9
Progression Factor				1.00		1.00		0.68			0.44	0.73
Incremental Delay, d2				0.2		1.5		0.4			0.2	0.4
Delay (s)				21.3		24.9		3.9			2.2	3.2
Level of Service				C		C		A			A	A
Approach Delay (s)		0.0			23.9			3.9			2.4	
Approach LOS		A			C			A			A	
Intersection Summary												
HCM 2000 Control Delay			7.2									A
HCM 2000 Volume to Capacity ratio			0.51									
Actuated Cycle Length (s)			70.0									4.7
Intersection Capacity Utilization			52.3%									A
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis 12: Hacienda Dr & I-580 EB Ramps







































BART to Livermore Extension Project 2040 DMU + INP + Garage AM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	819	0	1153	0	0	0	0	657	166	0	973	206
Future Volume (vph)	819	0	1153	0	0	0	0	657	166	0	973	206
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0					4.0	4.0		4.0	
Lane Util. Factor	0.97		0.88					0.86	0.86		0.91	
Frt	1.00		0.85					0.99	0.85		0.97	
Flt Protected	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (prot)	3433		2787					4753	1362		4952	
Flt Permitted	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (perm)	3433		2787					4753	1362		4952	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	890	0	1253	0	0	0	0	714	180	0	1058	224
RTOR Reduction (vph)	0	0	32	0	0	0	0	12	74	0	47	0
Lane Group Flow (vph)	890	0	1221	0	0	0	0	758	50	0	1235	0
Turn Type	Prot		Prot					NA	Perm		NA	
Protected Phases	4		4					2			6	
Permitted Phases									2			
Actuated Green, G (s)	32.1		32.1					26.6	26.6		26.6	
Effective Green, g (s)	33.5		33.5					28.5	28.5		28.5	
Actuated g/C Ratio	0.48		0.48					0.41	0.41		0.41	
Clearance Time (s)	5.4		5.4					5.9	5.9		5.9	
Vehicle Extension (s)	2.0		2.0					2.0	2.0		2.0	
Lane Grp Cap (vph)	1642		1333					1935	554		2016	
v/s Ratio Prot	0.26		c0.44					0.16			c0.25	
v/s Ratio Perm									0.04			
v/c Ratio	0.54		0.92					0.39	0.09		0.61	
Uniform Delay, d1	12.8		16.9					14.6	12.8		16.4	
Progression Factor	1.00		1.00					1.00	1.00		0.85	
Incremental Delay, d2	0.2		9.8					0.6	0.3		1.4	
Delay (s)	13.0		26.8					15.2	13.1		15.4	
Level of Service	B		C					B	B		B	
Approach Delay (s)		21.1			0.0			14.9			15.4	
Approach LOS		C			A			B			B	
Intersection Summary												
HCM 2000 Control Delay			18.1								HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio			0.78									
Actuated Cycle Length (s)			70.0								Sum of lost time (s)	8.0
Intersection Capacity Utilization			70.4%								ICU Level of Service	C
Analysis Period (min)			15									

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 13: Hacienda Dr & Owens Rd

BART to Livermore Extension Project
 2040 DMU + INP + Garage AM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 	  		  	  		 	  		  	 	 
Traffic Volume (vph)	154	276	25	137	431	415	28	307	142	660	865	594
Future Volume (vph)	154	276	25	137	431	415	28	307	142	660	865	594
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	2.3	4.0	4.0	2.3	4.0	4.0	2.7	4.0	4.0	2.7
Lane Util. Factor	0.97	0.91	1.00	0.97	0.91	1.00	0.97	0.91	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5085	1583	3433	5085	1583	3433	5085	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5085	1583	3433	5085	1583	3433	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	167	300	27	149	468	451	30	334	154	717	940	646
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	167	300	27	149	468	451	30	334	154	717	940	646
Turn Type	Prot	NA	Free	Prot	NA	Free	Prot	NA	Free	Prot	NA	Free
Protected Phases	1	6		5	2		7	4		3	8	
Permitted Phases			Free			Free			Free			Free
Actuated Green, G (s)	11.9	17.4	115.0	10.8	16.3	115.0	4.2	34.9	115.0	32.9	63.6	115.0
Effective Green, g (s)	11.9	19.1	115.0	10.8	18.0	115.0	4.2	36.2	115.0	32.9	64.9	115.0
Actuated g/C Ratio	0.10	0.17	1.00	0.09	0.16	1.00	0.04	0.31	1.00	0.29	0.56	1.00
Clearance Time (s)	4.0	5.7		4.0	5.7		4.0	5.3		4.0	5.3	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	355	844	1583	322	795	1583	125	1600	1583	982	2869	1583
v/s Ratio Prot	0.05	0.06		0.04	c0.09		0.01	0.07		c0.21	0.18	
v/s Ratio Perm			0.02			0.28			0.10			c0.41
v/c Ratio	0.47	0.36	0.02	0.46	0.59	0.28	0.24	0.21	0.10	0.73	0.33	0.41
Uniform Delay, d1	48.6	42.5	0.0	49.4	45.1	0.0	53.8	28.9	0.0	37.0	13.4	0.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.0	0.3	0.0	1.1	1.1	0.5	1.0	0.3	0.1	2.8	0.3	0.8
Delay (s)	49.6	42.8	0.0	50.4	46.2	0.5	54.8	29.2	0.1	39.9	13.7	0.8
Level of Service	D	D	A	D	D	A	D	C	A	D	B	A
Approach Delay (s)		42.7			27.5			22.0			18.2	
Approach LOS		D			C			C			B	

Intersection Summary		
HCM 2000 Control Delay	23.7	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.58	C
Actuated Cycle Length (s)	115.0	Sum of lost time (s)
Intersection Capacity Utilization	50.8%	16.0
Analysis Period (min)	15	ICU Level of Service
		A

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 14: Tassajara Rd & Dublin Blvd

BART to Livermore Extension Project
 2040 DMU + INP + Garage AM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↑↑	↻	↰	↑↑↑		↰	↑↑↑	↻	↰	↑↑↑	↻
Traffic Volume (vph)	102	202	143	581	1042	59	254	497	175	35	1169	308
Future Volume (vph)	102	202	143	581	1042	59	254	497	175	35	1169	308
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	6.0	6.0	5.0	6.0		5.0	6.0	6.0	5.0	5.7	5.7
Lane Util. Factor	0.97	0.86	0.88	0.94	0.91		0.94	0.86	1.00	0.97	0.86	0.88
Frt	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	6408	2787	4990	5045		4990	6408	1583	3433	6408	2787
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	6408	2787	4990	5045		4990	6408	1583	3433	6408	2787
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	111	220	155	632	1133	64	276	540	190	38	1271	335
RTOR Reduction (vph)	0	0	115	0	4	0	0	0	139	0	0	236
Lane Group Flow (vph)	111	220	40	632	1193	0	276	540	51	38	1271	99
Turn Type	Prot	NA	Perm	Prot	NA		Prot	NA	Perm	Prot	NA	Perm
Protected Phases	5	2		1	6		3	8		7	NA	4
Permitted Phases			2						8			4
Actuated Green, G (s)	16.2	35.9	35.9	22.2	41.9		18.5	37.2	37.2	22.4	41.4	41.4
Effective Green, g (s)	16.2	35.9	35.9	22.2	41.9		18.5	37.2	37.2	22.4	41.4	41.4
Actuated g/C Ratio	0.12	0.26	0.26	0.16	0.30		0.13	0.27	0.27	0.16	0.30	0.30
Clearance Time (s)	5.0	6.0	6.0	5.0	6.0		5.0	6.0	6.0	5.0	5.7	5.7
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	398	1646	716	792	1513		660	1706	421	550	1899	825
v/s Ratio Prot	0.03	0.03		c0.13	c0.24		c0.06	0.08		c0.01	c0.20	
v/s Ratio Perm			0.01						0.03			0.04
v/c Ratio	0.28	0.13	0.06	0.80	0.79		0.42	0.32	0.12	0.07	0.67	0.12
Uniform Delay, d1	56.4	39.9	39.1	56.6	44.8		55.7	41.1	38.8	49.8	43.1	35.9
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.4	0.0	0.0	5.6	2.8		0.4	0.1	0.1	0.1	0.9	0.1
Delay (s)	56.8	40.0	39.2	62.2	47.6		56.1	41.2	39.0	49.9	44.0	35.9
Level of Service	E	D	D	E	D		E	D	D	D	D	D
Approach Delay (s)		43.6			52.7			44.8			42.5	
Approach LOS		D			D			D			D	

Intersection Summary

HCM 2000 Control Delay	46.8	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.71		
Actuated Cycle Length (s)	139.7	Sum of lost time (s)	22.0
Intersection Capacity Utilization	83.1%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
15: Tassajara Rd & I-580 WB Ramps

BART to Livermore Extension Project
2040 DMU + INP + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↖↗		↖↗		↑↑	↖		↑↑↑	↖
Traffic Volume (vph)	0	0	0	593	0	296	0	1188	474	0	1041	935
Future Volume (vph)	0	0	0	593	0	296	0	1188	474	0	1041	935
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0		4.0		4.0	4.0		4.0	4.0
Lane Util. Factor				0.97		0.88		0.95	1.00		0.86	0.86
Frt				1.00		0.85		1.00	0.85		0.95	0.85
Flt Protected				0.95		1.00		1.00	1.00		1.00	1.00
Satd. Flow (prot)				3433		2787		3539	1583		4583	1362
Flt Permitted				0.95		1.00		1.00	1.00		1.00	1.00
Satd. Flow (perm)				3433		2787		3539	1583		4583	1362
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	645	0	322	0	1291	515	0	1132	1016
RTOR Reduction (vph)	0	0	0	0	0	68	0	0	196	0	103	194
Lane Group Flow (vph)	0	0	0	645	0	254	0	1291	319	0	1537	314
Turn Type				Perm		Perm		NA	Perm		NA	Perm
Protected Phases								2			6	
Permitted Phases				8		8			2			6
Actuated Green, G (s)				18.7		18.7		43.3	43.3		43.3	43.3
Effective Green, g (s)				18.7		18.7		43.3	43.3		43.3	43.3
Actuated g/C Ratio				0.27		0.27		0.62	0.62		0.62	0.62
Clearance Time (s)				4.0		4.0		4.0	4.0		4.0	4.0
Vehicle Extension (s)				3.0		3.0		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)				917		744		2189	979		2834	842
v/s Ratio Prot								c0.36			0.34	
v/s Ratio Perm				c0.19		0.09			0.20			0.23
v/c Ratio				0.70		0.34		0.59	0.33		0.54	0.37
Uniform Delay, d1				23.1		20.7		8.0	6.4		7.7	6.6
Progression Factor				1.00		1.00		1.00	1.00		1.00	1.00
Incremental Delay, d2				2.5		0.3		1.2	0.9		0.7	1.3
Delay (s)				25.6		21.0		9.2	7.3		8.4	7.9
Level of Service				C		C		A	A		A	A
Approach Delay (s)		0.0			24.1			8.6			8.3	
Approach LOS		A			C			A			A	

Intersection Summary			
HCM 2000 Control Delay	11.5	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.62		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	56.4%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
16: Santa Rita Rd & I-580 EB Ramps/Pimilco Dr

BART to Livermore Extension Project
2040 DMU + INP + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↑	↗	↖		↗		↑↑↑		↖	↑↑	↗
Traffic Volume (vph)	546	127	752	191	0	183	0	906	138	196	1333	0
Future Volume (vph)	546	127	752	191	0	183	0	906	138	196	1333	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0		4.0		4.0		4.0	4.0	
Lane Util. Factor	0.97	1.00	1.00	0.97		0.88		0.86		1.00	0.95	
Frt	1.00	1.00	0.85	1.00		0.85		0.98		1.00	1.00	
Flt Protected	0.95	1.00	1.00	0.95		1.00		1.00		0.95	1.00	
Satd. Flow (prot)	3433	1863	1583	3433		2787		6281		1770	3539	
Flt Permitted	0.95	1.00	1.00	0.95		1.00		1.00		0.95	1.00	
Satd. Flow (perm)	3433	1863	1583	3433		2787		6281		1770	3539	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	593	138	817	208	0	199	0	985	150	213	1449	0
RTOR Reduction (vph)	0	0	0	0	0	71	0	45	0	0	0	0
Lane Group Flow (vph)	593	138	817	208	0	128	0	1090	0	213	1449	0
Turn Type	Perm	NA	Free	Prot		pm+ov		NA		Prot	NA	Perm
Protected Phases		4		3		1		2		1	6	
Permitted Phases	4		Free			3						6
Actuated Green, G (s)	14.8	14.8	60.0	4.3		13.0		16.2		8.7	28.9	
Effective Green, g (s)	14.8	14.8	60.0	4.3		13.0		16.2		8.7	28.9	
Actuated g/C Ratio	0.25	0.25	1.00	0.07		0.22		0.27		0.14	0.48	
Clearance Time (s)	4.0	4.0		4.0		4.0		4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0		3.0		3.0		3.0	3.0	
Lane Grp Cap (vph)	846	459	1583	246		603		1695		256	1704	
v/s Ratio Prot		0.07		0.06		0.03		0.17		0.12	c0.41	
v/s Ratio Perm	c0.17		c0.52			0.02						
v/c Ratio	0.70	0.30	0.52	0.85		0.21		0.64		0.83	0.85	
Uniform Delay, d1	20.6	18.4	0.0	27.5		19.3		19.3		24.9	13.7	
Progression Factor	1.00	1.00	1.00	1.00		1.00		1.00		1.00	1.00	
Incremental Delay, d2	2.6	0.4	1.2	22.5		0.2		1.9		20.0	5.5	
Delay (s)	23.2	18.8	1.2	50.0		19.5		21.2		45.0	19.2	
Level of Service	C	B	A	D		B		C		D	B	
Approach Delay (s)		11.2			35.1			21.2			22.5	
Approach LOS		B			D			C			C	

Intersection Summary

HCM 2000 Control Delay	19.6	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.89		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	59.1%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 17: Santa Rita Rd & Valley Ave



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	206	262	87	198	506	911	143	529	86	583	880	206
Future Volume (vph)	206	262	87	198	506	911	143	529	86	583	880	206
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.97	0.95		0.97	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.98		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	3433	3465		3433	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	3433	3465		3433	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	224	285	95	215	550	990	155	575	93	634	957	224
RTOR Reduction (vph)	0	0	77	0	0	0	0	18	0	0	0	140
Lane Group Flow (vph)	224	285	18	215	550	990	155	650	0	634	957	84
Turn Type	Prot	NA	Perm	Prot	NA	Free	Prot	NA		Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1		6
Permitted Phases			4			Free						6
Actuated Green, G (s)	7.8	13.5	13.5	10.1	15.8	71.3	5.0	16.8		14.9	26.7	26.7
Effective Green, g (s)	7.8	13.5	13.5	10.1	15.8	71.3	5.0	16.8		14.9	26.7	26.7
Actuated g/C Ratio	0.11	0.19	0.19	0.14	0.22	1.00	0.07	0.24		0.21	0.37	0.37
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	375	670	299	250	784	1583	240	816		717	1325	592
v/s Ratio Prot	0.07	0.08		c0.12	c0.16		0.05	0.19		c0.18	c0.27	
v/s Ratio Perm			0.01			c0.63						0.05
v/c Ratio	0.60	0.43	0.06	0.86	0.70	0.63	0.65	0.80		0.88	0.72	0.14
Uniform Delay, d1	30.3	25.5	23.7	29.9	25.6	0.0	32.3	25.6		27.4	19.1	14.7
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	2.6	0.4	0.1	24.3	2.9	1.9	5.9	5.4		12.5	2.0	0.1
Delay (s)	32.8	25.9	23.8	54.2	28.4	1.9	38.1	31.1		39.9	21.1	14.8
Level of Service	C	C	C	D	C	A	D	C		D	C	B
Approach Delay (s)		28.1			16.6			32.4			26.9	
Approach LOS		C			B			C			C	

Intersection Summary

HCM 2000 Control Delay	24.3	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.86		
Actuated Cycle Length (s)	71.3	Sum of lost time (s)	16.0
Intersection Capacity Utilization	67.2%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
18: Bernal Ave/Valley Ave & Stanley Blvd

BART to Livermore Extension Project
2040 DMU + INP + Garage AM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	217	204	55	249	895	955	174	480	102	142	366	124
Future Volume (vph)	217	204	55	249	895	955	174	480	102	142	366	124
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.95	1.00	0.97	0.91	0.91	1.00	0.95	1.00	0.97	0.95	0.95
Frt	1.00	1.00	0.85	1.00	0.96	0.85	1.00	1.00	0.85	1.00	0.96	0.96
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	3433	3238	1441	1770	3539	1583	3433	3405	3405
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	3433	3238	1441	1770	3539	1583	3433	3405	3405
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	236	222	60	271	973	1038	189	522	111	154	398	135
RTOR Reduction (vph)	0	0	30	0	47	28	0	0	88	0	37	0
Lane Group Flow (vph)	236	222	30	271	1341	595	189	522	23	154	496	0
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	NA
Protected Phases	7	4	5	3	8	1	5	2		1	6	
Permitted Phases			4			8			2			
Actuated Green, G (s)	7.0	33.0	44.6	11.1	37.1	47.0	11.6	18.1	18.1	9.9	16.4	16.4
Effective Green, g (s)	7.0	33.0	44.6	11.1	37.1	47.0	11.6	18.1	18.1	9.9	16.4	16.4
Actuated g/C Ratio	0.08	0.37	0.51	0.13	0.42	0.53	0.13	0.21	0.21	0.11	0.19	0.19
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	272	1325	873	432	1363	834	233	727	325	385	633	633
v/s Ratio Prot	c0.07	0.06	0.00	c0.08	c0.41	0.08	c0.11	c0.15		0.04	0.15	0.15
v/s Ratio Perm			0.01			0.33			0.01			
v/c Ratio	0.87	0.17	0.03	0.63	0.98	0.71	0.81	0.72	0.07	0.40	0.78	0.78
Uniform Delay, d1	40.1	18.4	10.9	36.5	25.2	15.5	37.2	32.6	28.2	36.3	34.2	34.2
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	24.0	0.1	0.0	2.8	20.5	2.9	18.9	3.4	0.1	0.7	6.3	6.3
Delay (s)	64.1	18.4	10.9	39.4	45.7	18.4	56.1	36.0	28.3	37.0	40.4	40.4
Level of Service	E	B	B	D	D	B	E	D	C	D	D	D
Approach Delay (s)		38.4			37.5			39.6			39.7	
Approach LOS		D			D			D			D	
Intersection Summary												
HCM 2000 Control Delay			38.3	HCM 2000 Level of Service						D		
HCM 2000 Volume to Capacity ratio			0.90									
Actuated Cycle Length (s)			88.1	Sum of lost time (s)						16.0		
Intersection Capacity Utilization			78.2%	ICU Level of Service						D		
Analysis Period (min)			15									
c	Critical Lane Group											

HCM Signalized Intersection Capacity Analysis
19: Fallon Rd & Dublin Blvd/Croak Rd

BART to Livermore Extension Project
2040 DMU + INP + Garage AM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	50	82	96	334	1123	395	791	287	45	84	748	312
Future Volume (vph)	50	82	96	334	1123	395	791	287	45	84	748	312
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.91	0.88	0.94	0.91	1.00	0.94	0.91	0.88	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5085	2787	4990	5085	1583	4990	5085	2787	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5085	2787	4990	5085	1583	4990	5085	2787	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	54	89	104	363	1221	429	860	312	49	91	813	339
RTOR Reduction (vph)	0	0	71	0	0	287	0	0	26	0	0	69
Lane Group Flow (vph)	54	89	33	363	1221	142	860	312	23	91	813	270
Turn Type	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4	5	3	8		5	2		1	6	
Permitted Phases			4			8			2			6
Actuated Green, G (s)	4.9	12.0	41.1	39.1	46.2	46.2	29.1	64.9	64.9	8.0	43.8	43.8
Effective Green, g (s)	4.9	12.0	41.1	39.1	46.2	46.2	29.1	64.9	64.9	8.0	43.8	43.8
Actuated g/C Ratio	0.04	0.09	0.29	0.28	0.33	0.33	0.21	0.46	0.46	0.06	0.31	0.31
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	120	435	897	1393	1678	522	1037	2357	1291	196	1590	495
v/s Ratio Prot	c0.02	0.02	0.01	0.07	c0.24		c0.17	0.06		0.03	0.16	
v/s Ratio Perm			0.00			0.09			0.01			c0.17
v/c Ratio	0.45	0.20	0.04	0.26	0.73	0.27	0.83	0.13	0.02	0.46	0.51	0.54
Uniform Delay, d1	66.2	59.6	35.3	39.2	41.4	34.5	53.1	21.5	20.3	63.9	39.3	39.8
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	0.90	0.89	1.00	1.00	1.00	1.00
Incremental Delay, d2	2.7	0.2	0.0	0.1	1.6	0.3	5.2	0.1	0.0	1.7	1.2	4.3
Delay (s)	68.9	59.8	35.3	39.3	43.0	34.8	53.2	19.2	20.3	65.7	40.5	44.1
Level of Service	E	E	D	D	D	C	D	B	C	E	D	D
Approach Delay (s)		51.5			40.6			43.2			43.3	
Approach LOS		D			D			D			D	

Intersection Summary

HCM 2000 Control Delay	42.5	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.68		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	66.1%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 20: El Charro Rd/Fallon Rd & I-580 WB Ramps

BART to Livermore Extension Project
 2040 DMU + INP + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↵	↵	↵↵		↵↵↵	↵		↵↵↵	↵
Traffic Volume (vph)	0	0	0	233	0	617	0	889	478	0	680	399
Future Volume (vph)	0	0	0	233	0	617	0	889	478	0	680	399
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0	4.0	4.0		4.0	4.0		4.0	4.0
Lane Util. Factor				0.95	0.95	0.88		0.91	1.00		0.91	1.00
Frt				1.00	1.00	0.85		1.00	0.85		1.00	0.85
Flt Protected				0.95	0.95	1.00		1.00	1.00		1.00	1.00
Satd. Flow (prot)				1681	1681	2787		5085	1583		5085	1583
Flt Permitted				0.95	0.95	1.00		1.00	1.00		1.00	1.00
Satd. Flow (perm)				1681	1681	2787		5085	1583		5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	253	0	671	0	966	520	0	739	434
RTOR Reduction (vph)	0	0	0	0	0	108	0	0	198	0	0	166
Lane Group Flow (vph)	0	0	0	129	124	563	0	966	322	0	739	268
Turn Type				Perm	NA	Perm		NA	Perm		NA	Perm
Protected Phases					8			2			6	
Permitted Phases				8		8			2			6
Actuated Green, G (s)				19.2	19.2	19.2		43.3	43.3		43.3	43.3
Effective Green, g (s)				18.7	18.7	18.7		43.3	43.3		43.3	43.3
Actuated g/C Ratio				0.27	0.27	0.27		0.62	0.62		0.62	0.62
Clearance Time (s)				3.5	3.5	3.5		4.0	4.0		4.0	4.0
Vehicle Extension (s)				2.0	2.0	2.0		2.0	2.0		2.0	2.0
Lane Grp Cap (vph)				449	449	744		3145	979		3145	979
v/s Ratio Prot								0.19			0.15	
v/s Ratio Perm				0.08	0.07	c0.20			c0.20			0.17
v/c Ratio				0.29	0.28	0.76		0.31	0.33		0.23	0.27
Uniform Delay, d1				20.4	20.3	23.6		6.3	6.4		6.0	6.1
Progression Factor				1.00	1.00	1.00		0.75	0.46		0.56	2.29
Incremental Delay, d2				0.1	0.1	3.9		0.2	0.7		0.2	0.6
Delay (s)				20.5	20.4	27.5		4.9	3.7		3.5	14.7
Level of Service				C	C	C		A	A		A	B
Approach Delay (s)		0.0			25.6			4.5			7.7	
Approach LOS		A			C			A			A	

Intersection Summary			
HCM 2000 Control Delay	11.0	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.46		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	45.4%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

21: El Charro Rd & I-580 EB Ramps

BART to Livermore Extension Project
2040 DMU + INP + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	276	0	624	0	0	0	0	1374	489	0	546	0
Future Volume (vph)	276	0	624	0	0	0	0	1374	489	0	546	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0					4.0	4.0		4.0	
Lane Util. Factor	0.97		0.88					0.91	0.91		0.91	
Frt	1.00		0.85					0.99	0.85		1.00	
Flt Protected	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (prot)	3433		2787					3369	1441		3390	
Flt Permitted	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (perm)	3433		2787					3369	1441		3390	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	300	0	678	0	0	0	0	1493	532	0	593	0
RTOR Reduction (vph)	0	0	478	0	0	0	0	3	126	0	0	0
Lane Group Flow (vph)	300	0	200	0	0	0	0	1554	342	0	593	0
Turn Type	Prot		Perm					NA	Perm		NA	Perm
Protected Phases	4							2			6	
Permitted Phases			4						2			6
Actuated Green, G (s)	10.8		10.8					51.2	51.2		51.2	
Effective Green, g (s)	10.8		10.8					51.2	51.2		51.2	
Actuated g/C Ratio	0.15		0.15					0.73	0.73		0.73	
Clearance Time (s)	4.0		4.0					4.0	4.0		4.0	
Vehicle Extension (s)	2.0		2.0					3.0	3.0		3.0	
Lane Grp Cap (vph)	529		429					2464	1053		2479	
v/s Ratio Prot	c0.09							c0.46			0.17	
v/s Ratio Perm			0.07						0.24			
v/c Ratio	0.57		0.47					0.63	0.33		0.24	
Uniform Delay, d1	27.4		27.0					4.7	3.3		3.1	
Progression Factor	1.00		1.00					1.00	1.00		1.44	
Incremental Delay, d2	0.8		0.3					1.2	0.8		0.2	
Delay (s)	28.3		27.3					5.9	4.1		4.6	
Level of Service	C		C					A	A		A	
Approach Delay (s)		27.6			0.0			5.5			4.6	
Approach LOS		C			A			A			A	

Intersection Summary

HCM 2000 Control Delay	11.4	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.62		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	57.7%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 22: El Charro Rd & Stoneridge Dr/Jack London Blvd

BART to Livermore Extension Project
 2040 DMU + INP + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔↔↔	↑↑	↗	↖	↑↑	↗↗	↖	↑↑		↖↖↖	↑	↗↗
Traffic Volume (vph)	94	129	16	64	621	805	33	598	30	330	217	111
Future Volume (vph)	94	129	16	64	621	805	33	598	30	330	217	111
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	0.94	0.95	1.00	1.00	0.95	0.88	1.00	0.95		0.94	1.00	0.88
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	4491	3185	1425	1593	3185	2508	1593	3162		4491	1676	2508
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	4491	3185	1425	1593	3185	2508	1593	3162		4491	1676	2508
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	102	140	17	70	675	875	36	650	33	359	236	121
RTOR Reduction (vph)	0	0	13	0	0	100	0	6	0	0	0	74
Lane Group Flow (vph)	102	140	4	70	675	775	36	677	0	359	236	47
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Prot	NA		Prot	NA	Perm
Protected Phases	7	4		3	8	1	5	2		1	6	
Permitted Phases			4			8						6
Actuated Green, G (s)	3.0	15.1	15.1	3.0	15.1	23.3	2.7	17.6		8.2	23.1	23.1
Effective Green, g (s)	3.0	15.1	15.1	3.0	15.1	23.3	2.7	17.6		8.2	23.1	23.1
Actuated g/C Ratio	0.05	0.25	0.25	0.05	0.25	0.39	0.05	0.29		0.14	0.39	0.39
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	224	802	359	79	802	975	71	929		614	646	967
v/s Ratio Prot	c0.02	0.04		0.04	c0.21	c0.11	0.02	c0.21		0.08	0.14	
v/s Ratio Perm			0.00			0.20						0.02
v/c Ratio	0.46	0.17	0.01	0.89	0.84	0.79	0.51	0.73		0.58	0.37	0.05
Uniform Delay, d1	27.7	17.5	16.8	28.3	21.3	16.2	27.9	19.0		24.3	13.2	11.5
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	1.5	0.1	0.0	63.8	8.0	4.5	5.6	2.9		1.4	0.4	0.0
Delay (s)	29.1	17.6	16.8	92.1	29.2	20.7	33.5	21.9		25.7	13.5	11.5
Level of Service	C	B	B	F	C	C	C	C		C	B	B
Approach Delay (s)		22.1			27.4			22.5			19.3	
Approach LOS		C			C			C			B	

Intersection Summary

HCM 2000 Control Delay	24.1	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.76		
Actuated Cycle Length (s)	59.9	Sum of lost time (s)	16.0
Intersection Capacity Utilization	64.1%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 23: Stanley Blvd & El Charro Rd

BART to Livermore Extension Project
 2040 DMU + INP + Garage AM



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	↖	↑↑	↑↑↑	↗	↙↘	↙↘
Traffic Volume (vph)	436	471	2717	127	28	118
Future Volume (vph)	436	471	2717	127	28	118
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95	0.91	1.00	0.97	0.88
Frt	1.00	1.00	1.00	0.85	1.00	0.85
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1770	3539	5085	1583	3433	2787
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1770	3539	5085	1583	3433	2787
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	474	512	2953	138	30	128
RTOR Reduction (vph)	0	0	0	30	0	120
Lane Group Flow (vph)	474	512	2953	108	30	8
Turn Type	Prot	NA	NA	Perm	Prot	Perm
Protected Phases	7	4	8		6	
Permitted Phases				8		6
Actuated Green, G (s)	22.0	95.0	69.0	69.0	6.7	6.7
Effective Green, g (s)	22.0	95.0	69.0	69.0	6.7	6.7
Actuated g/C Ratio	0.20	0.87	0.63	0.63	0.06	0.06
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	354	3064	3198	995	209	170
v/s Ratio Prot	c0.27	0.14	c0.58		c0.01	
v/s Ratio Perm				0.07		0.00
v/c Ratio	1.34	0.17	0.92	0.11	0.14	0.05
Uniform Delay, d1	43.9	1.2	18.0	8.1	48.8	48.5
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	170.5	0.0	5.1	0.0	0.3	0.1
Delay (s)	214.4	1.2	23.2	8.2	49.1	48.6
Level of Service	F	A	C	A	D	D
Approach Delay (s)		103.7	22.5		48.7	
Approach LOS		F	C		D	

Intersection Summary

HCM 2000 Control Delay	42.4	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.96		
Actuated Cycle Length (s)	109.7	Sum of lost time (s)	12.0
Intersection Capacity Utilization	90.0%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

24: Airway Blvd/Driveway & N Canyons Pkwy

BART to Livermore Extension Project

2040 DMU + INP + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑	↑	↑↑	↑	↑		↑	↑↑		↑	
Traffic Volume (vph)	0	93	77	700	688	0	1100	0	1065	0	0	0
Future Volume (vph)	0	93	77	700	688	0	1100	0	1065	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		2.0	2.0	2.0	2.0			4.2	2.0			
Lane Util. Factor		0.95	1.00	0.97	1.00			1.00	0.88			
Frt		1.00	0.85	1.00	1.00			1.00	0.85			
Flt Protected		1.00	1.00	0.95	1.00			0.95	1.00			
Satd. Flow (prot)		3539	1583	3433	1863			1770	2787			
Flt Permitted		1.00	1.00	0.95	1.00			0.95	1.00			
Satd. Flow (perm)		3539	1583	3433	1863			1770	2787			
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	101	84	761	748	0	1196	0	1158	0	0	0
RTOR Reduction (vph)	0	0	73	0	0	0	0	0	98	0	0	0
Lane Group Flow (vph)	0	101	11	761	748	0	0	1196	1060	0	0	0
Turn Type		NA	Perm	Prot	NA	Perm	Split	NA	pm+ov			
Protected Phases		2		1	6		8	8	1	4	4	
Permitted Phases			2			6			8			
Actuated Green, G (s)		10.2	10.2	32.6	46.8			42.3	74.9			
Effective Green, g (s)		12.2	12.2	34.6	48.8			42.1	78.9			
Actuated g/C Ratio		0.13	0.13	0.36	0.50			0.43	0.81			
Clearance Time (s)		4.0	4.0	4.0	4.0			4.0	4.0			
Vehicle Extension (s)		3.0	3.0	3.0	3.0			3.0	3.0			
Lane Grp Cap (vph)		444	198	1223	936			767	2322			
v/s Ratio Prot		0.03		0.22	c0.40			c0.68	0.16			
v/s Ratio Perm			0.01						0.22			
v/c Ratio		0.23	0.05	0.62	0.80			1.56	0.46			
Uniform Delay, d1		38.2	37.4	25.8	20.1			27.5	2.7			
Progression Factor		1.00	1.00	1.00	1.00			1.00	1.00			
Incremental Delay, d2		0.3	0.1	1.0	4.8			258.1	0.1			
Delay (s)		38.5	37.5	26.8	24.9			285.6	2.9			
Level of Service		D	D	C	C			F	A			
Approach Delay (s)		38.0			25.9			146.5			0.0	
Approach LOS		D			C			F			A	

Intersection Summary

HCM 2000 Control Delay	96.6	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.23		
Actuated Cycle Length (s)	97.1	Sum of lost time (s)	12.2
Intersection Capacity Utilization	104.0%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
25: Airway Blvd & I-580 WB Ramps

BART to Livermore Extension Project
2040 DMU + INP + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↙	↖	↗		↑↑	↗		↑↑↑	
Traffic Volume (vph)	0	0	0	83	46	899	0	1361	343	0	338	550
Future Volume (vph)	0	0	0	83	46	899	0	1361	343	0	338	550
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0	4.0	4.0		4.0	4.0		4.0	
Lane Util. Factor				0.95	0.95	0.88		0.95	1.00		0.91	
Frt				1.00	1.00	0.85		1.00	0.85		0.91	
Flt Protected				0.95	0.98	1.00		1.00	1.00		1.00	
Satd. Flow (prot)				1681	1730	2787		3539	1583		4613	
Flt Permitted				0.95	0.98	1.00		1.00	1.00		1.00	
Satd. Flow (perm)				1681	1730	2787		3539	1583		4613	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	90	50	977	0	1479	373	0	367	598
RTOR Reduction (vph)	0	0	0	0	0	27	0	0	186	0	298	0
Lane Group Flow (vph)	0	0	0	48	92	950	0	1479	187	0	667	0
Turn Type				Split	NA	Perm		NA	Perm		NA	
Protected Phases				8	8			2			6	
Permitted Phases						8			2			
Actuated Green, G (s)				21.5	21.5	21.5		28.4	28.4		28.4	
Effective Green, g (s)				21.5	21.5	21.5		29.7	29.7		29.7	
Actuated g/C Ratio				0.36	0.36	0.36		0.50	0.50		0.50	
Clearance Time (s)				4.0	4.0	4.0		5.3	5.3		5.3	
Vehicle Extension (s)				2.0	2.0	2.0		4.0	4.0		4.0	
Lane Grp Cap (vph)				610	628	1012		1775	794		2314	
v/s Ratio Prot				0.03	0.05			c0.42			0.14	
v/s Ratio Perm						c0.34			0.12			
v/c Ratio				0.08	0.15	0.94		0.83	0.24		0.29	
Uniform Delay, d1				12.4	12.7	18.2		12.6	8.3		8.6	
Progression Factor				1.00	1.00	1.00		1.00	1.00		1.00	
Incremental Delay, d2				0.0	0.0	15.3		3.7	0.2		0.1	
Delay (s)				12.4	12.7	33.6		16.3	8.5		8.7	
Level of Service				B	B	C		B	A		A	
Approach Delay (s)		0.0			30.9			14.7			8.7	
Approach LOS		A			C			B			A	

Intersection Summary

HCM 2000 Control Delay	17.9	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.88		
Actuated Cycle Length (s)	59.2	Sum of lost time (s)	8.0
Intersection Capacity Utilization	75.7%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
26: Airway Blvd & I-580 EB Ramps/Kitty Hawk Rd

BART to Livermore Extension Project
2040 DMU + INP + Garage AM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	718	212	439	40	41	76	44	525	162	57	198	174
Future Volume (vph)	718	212	439	40	41	76	44	525	162	57	198	174
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.4	4.4	4.4	4.5	2.7		4.0	2.7	
Lane Util. Factor	0.97	1.00	1.00	1.00	1.00	1.00	1.00	0.95		1.00	0.95	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.96		1.00	0.93	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	3433	1863	1583	1770	1863	1583	1770	3414		1770	3291	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	3433	1863	1583	1770	1863	1583	1770	3414		1770	3291	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	780	230	477	43	45	83	48	571	176	62	215	189
RTOR Reduction (vph)	0	0	347	0	0	71	0	39	0	0	136	0
Lane Group Flow (vph)	780	230	130	43	45	12	48	708	0	62	268	0
Turn Type	Split	NA	Perm	Split	NA	pm+ov	Prot	NA		Prot	NA	
Protected Phases	7	7		8	8	1	5	2		1	6	
Permitted Phases			7			8						
Actuated Green, G (s)	17.6	17.6	17.6	7.0	7.0	10.0	7.4	21.1		3.0	16.7	
Effective Green, g (s)	17.6	17.6	17.6	6.6	6.6	9.2	6.9	22.4		3.0	18.0	
Actuated g/C Ratio	0.27	0.27	0.27	0.10	0.10	0.14	0.11	0.35		0.05	0.28	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Vehicle Extension (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	3.5		2.0	4.0	
Lane Grp Cap (vph)	933	506	430	180	190	332	188	1181		82	915	
v/s Ratio Prot	c0.23	0.12		c0.02	0.02	0.00	0.03	c0.21		c0.04	0.08	
v/s Ratio Perm			0.08			0.01						
v/c Ratio	0.84	0.45	0.30	0.24	0.24	0.04	0.26	0.60		0.76	0.29	
Uniform Delay, d1	22.2	19.6	18.7	26.7	26.7	23.9	26.5	17.5		30.5	18.3	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	6.3	0.2	0.1	0.3	0.2	0.0	0.3	0.9		29.1	0.2	
Delay (s)	28.5	19.8	18.8	27.0	27.0	23.9	26.8	18.3		59.5	18.6	
Level of Service	C	B	B	C	C	C	C	B		E	B	
Approach Delay (s)		24.0			25.5			18.8			24.0	
Approach LOS		C			C			B			C	

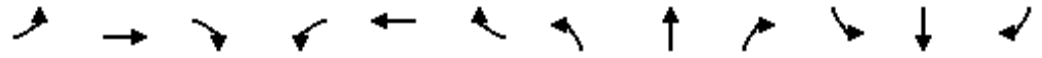
Intersection Summary

HCM 2000 Control Delay	22.7	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.65		
Actuated Cycle Length (s)	64.7	Sum of lost time (s)	15.6
Intersection Capacity Utilization	66.6%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis 27: Collier Canyon Rd & N Canyons Pkwy/Portola Ave

BART to Livermore Extension Project
2040 DMU + INP + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	271	156	157	140	876	34	263	16	169	34	16	253
Future Volume (vph)	271	156	157	140	876	34	263	16	169	34	16	253
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	2.7	2.7	4.0	2.7	2.7	4.0	3.0		4.0	4.6	4.6
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.86		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	1770	1607		1770	1863	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	1770	1607		1770	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	295	170	171	152	952	37	286	17	184	37	17	275
RTOR Reduction (vph)	0	0	117	0	0	24	0	122	0	0	0	169
Lane Group Flow (vph)	295	170	54	152	952	13	286	79	0	37	17	106
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA		Prot	NA	Perm
Protected Phases	1	6		5	2		3	8		7	NA	4
Permitted Phases			6			2						4
Actuated Green, G (s)	7.0	23.8	23.8	10.4	27.2	27.2	14.1	25.5		3.4	14.8	14.8
Effective Green, g (s)	7.0	25.1	25.1	10.4	28.5	28.5	14.1	26.5		3.4	14.2	14.2
Actuated g/C Ratio	0.09	0.32	0.32	0.13	0.36	0.36	0.18	0.34		0.04	0.18	0.18
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	303	1122	502	232	1275	570	315	538		76	334	284
v/s Ratio Prot	c0.09	0.05		0.09	c0.27		c0.16	0.05		0.02	0.01	
v/s Ratio Perm			0.03			0.01						c0.07
v/c Ratio	0.97	0.15	0.11	0.66	0.75	0.02	0.91	0.15		0.49	0.05	0.37
Uniform Delay, d1	36.0	19.4	19.1	32.6	22.1	16.3	31.9	18.4		37.0	26.9	28.5
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	44.2	0.1	0.1	6.5	2.4	0.0	28.2	0.1		4.8	0.1	0.8
Delay (s)	80.1	19.4	19.2	39.2	24.6	16.3	60.0	18.5		41.8	26.9	29.4
Level of Service	F	B	B	D	C	B	E	B		D	C	C
Approach Delay (s)		47.5			26.2			42.9			30.6	
Approach LOS		D			C			D			C	

Intersection Summary				
HCM 2000 Control Delay		35.2	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio		0.72		
Actuated Cycle Length (s)		79.1	Sum of lost time (s)	15.3
Intersection Capacity Utilization		70.4%	ICU Level of Service	C
Analysis Period (min)		15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
28: Isabel Ave/Campus Hill Dr & Portola Ave

BART to Livermore Extension Project
2040 DMU + INP + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	1	199	230	722	565	137	494	304	121	74	228	2
Future Volume (vph)	1	199	230	722	565	137	494	304	121	74	228	2
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	5.8	5.8
Lane Util. Factor	1.00	0.95	0.88	0.94	0.95		0.97	0.95	1.00	1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	0.97		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3539	2787	4990	3436		3433	3539	1583	1770	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	3539	2787	4990	3436		3433	3539	1583	1770	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	1	216	250	785	614	149	537	330	132	80	248	2
RTOR Reduction (vph)	0	0	197	0	14	0	0	0	93	0	0	2
Lane Group Flow (vph)	1	216	53	785	749	0	537	330	39	80	248	0
Turn Type	Prot	NA	Perm	Prot	NA		Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4						2			6
Actuated Green, G (s)	1.6	17.0	17.0	19.1	34.5		19.1	24.4	24.4	7.7	13.4	13.4
Effective Green, g (s)	1.6	18.3	18.3	19.1	35.8		19.1	25.7	25.7	7.7	12.5	12.5
Actuated g/C Ratio	0.02	0.21	0.21	0.22	0.41		0.22	0.30	0.30	0.09	0.14	0.14
Clearance Time (s)	4.0	5.3	5.3	4.0	5.3		4.0	5.3	5.3	4.0	4.9	4.9
Vehicle Extension (s)	2.0	3.0	3.0	2.0	3.0		2.0	3.0	3.0	2.0	3.0	3.0
Lane Grp Cap (vph)	32	746	587	1098	1417		755	1047	468	157	509	227
v/s Ratio Prot	0.00	0.06		c0.16	c0.22		c0.16	0.09		0.05	c0.07	
v/s Ratio Perm			0.02						0.02			0.00
v/c Ratio	0.03	0.29	0.09	0.71	0.53		0.71	0.32	0.08	0.51	0.49	0.00
Uniform Delay, d1	41.8	28.8	27.6	31.3	19.2		31.3	23.7	22.0	37.7	34.2	31.8
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.1	0.2	0.1	1.9	0.4		2.6	0.2	0.1	0.9	0.7	0.0
Delay (s)	42.0	29.0	27.6	33.2	19.5		33.9	23.9	22.1	38.7	34.9	31.8
Level of Service	D	C	C	C	B		C	C	C	D	C	C
Approach Delay (s)		28.3			26.5			29.1			35.8	
Approach LOS		C			C			C			D	

Intersection Summary

HCM 2000 Control Delay	28.4	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.64		
Actuated Cycle Length (s)	86.8	Sum of lost time (s)	17.8
Intersection Capacity Utilization	66.4%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 29: Isabel Ave & I-580 WB Ramps

BART to Livermore Extension Project
 2040 DMU + INP + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↔↔		↗		↑↑↑	↗		↑↑↑	↗
Traffic Volume (vph)	0	0	0	1002	0	615	0	780	0	0	901	449
Future Volume (vph)	0	0	0	1002	0	615	0	780	0	0	901	449
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0		4.0		4.8			4.8	4.8
Lane Util. Factor				0.97		1.00		0.91			0.91	1.00
Frt				1.00		0.85		1.00			1.00	0.85
Flt Protected				0.95		1.00		1.00			1.00	1.00
Satd. Flow (prot)				3433		1583		5085			5085	1583
Flt Permitted				0.95		1.00		1.00			1.00	1.00
Satd. Flow (perm)				3433		1583		5085			5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	1089	0	668	0	848	0	0	979	488
RTOR Reduction (vph)	0	0	0	0	0	13	0	0	0	0	0	307
Lane Group Flow (vph)	0	0	0	1089	0	655	0	848	0	0	979	181
Turn Type				Prot		Prot		NA	Free		NA	Prot
Protected Phases				8		8		2			6	6
Permitted Phases									Free			
Actuated Green, G (s)				29.0		29.0		23.0			23.0	23.0
Effective Green, g (s)				29.0		29.0		22.2			22.2	22.2
Actuated g/C Ratio				0.48		0.48		0.37			0.37	0.37
Clearance Time (s)				4.0		4.0		4.0			4.0	4.0
Vehicle Extension (s)				2.0		2.0		4.0			4.0	4.0
Lane Grp Cap (vph)				1659		765		1881			1881	585
v/s Ratio Prot				0.32		c0.41		0.17			c0.19	0.11
v/s Ratio Perm												
v/c Ratio				0.66		0.86		0.45			0.52	0.31
Uniform Delay, d1				11.7		13.7		14.3			14.7	13.4
Progression Factor				1.00		1.00		0.72			1.00	1.00
Incremental Delay, d2				0.7		9.0		0.7			1.0	1.4
Delay (s)				12.5		22.7		11.0			15.8	14.8
Level of Service				B		C		B			B	B
Approach Delay (s)		0.0			16.3			11.0			15.5	
Approach LOS		A			B			B			B	

Intersection Summary			
HCM 2000 Control Delay	14.9	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.71		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.8
Intersection Capacity Utilization	60.5%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 30: Isabel Ave & I-580 EB Ramps

BART to Livermore Extension Project
 2040 DMU + INP + Garage AM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations													
Traffic Volume (vph)	417	0	399	0	0	0	0	801	468	0	1512	474	
Future Volume (vph)	417	0	399	0	0	0	0	801	468	0	1512	474	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)	4.0		4.0					4.0	4.0		4.0	4.0	
Lane Util. Factor	0.97		0.88					0.91	1.00		0.91	1.00	
Frt	1.00		0.85					1.00	0.85		1.00	0.85	
Flt Protected	0.95		1.00					1.00	1.00		1.00	1.00	
Satd. Flow (prot)	3433		2787					5085	1583		5085	1583	
Flt Permitted	0.95		1.00					1.00	1.00		1.00	1.00	
Satd. Flow (perm)	3433		2787					5085	1583		5085	1583	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	
Adj. Flow (vph)	453	0	434	0	0	0	0	871	509	0	1643	515	
RTOR Reduction (vph)	0	0	37	0	0	0	0	0	0	0	0	0	
Lane Group Flow (vph)	453	0	397	0	0	0	0	871	509	0	1643	515	
Turn Type	Prot		Perm					NA	Free		NA	Free	
Protected Phases	4							2			6		
Permitted Phases			4						Free			Free	
Actuated Green, G (s)	12.5		12.5					38.5	60.0		38.5	60.0	
Effective Green, g (s)	12.5		12.5					39.5	60.0		39.5	60.0	
Actuated g/C Ratio	0.21		0.21					0.66	1.00		0.66	1.00	
Clearance Time (s)	4.0		4.0					5.0			5.0		
Vehicle Extension (s)	2.0		2.0					4.0			4.0		
Lane Grp Cap (vph)	715		580					3347	1583		3347	1583	
v/s Ratio Prot	0.13							0.17			c0.32		
v/s Ratio Perm			c0.14						0.32			0.33	
v/c Ratio	0.63		0.68					0.26	0.32		0.49	0.33	
Uniform Delay, d1	21.7		21.9					4.2	0.0		5.2	0.0	
Progression Factor	1.00		1.00					1.00	1.00		0.84	1.00	
Incremental Delay, d2	1.4		2.7					0.2	0.5		0.4	0.5	
Delay (s)	23.0		24.6					4.4	0.5		4.8	0.5	
Level of Service	C		C					A	A		A	A	
Approach Delay (s)		23.8			0.0			3.0			3.8		
Approach LOS		C			A			A			A		
Intersection Summary													
HCM 2000 Control Delay			7.5									HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio			0.54										
Actuated Cycle Length (s)			60.0									Sum of lost time (s)	8.0
Intersection Capacity Utilization			49.8%									ICU Level of Service	A
Analysis Period (min)			15										

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
31: Isabel Ave & Airway Blvd

BART to Livermore Extension Project
2040 DMU + INP + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	1	152	474	272	383	175	318	1075	286	587	1396	15
Future Volume (vph)	1	152	474	272	383	175	318	1075	286	587	1396	15
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.2	5.2	5.6	5.2	5.2	5.6	4.0	4.0	4.0	4.0	4.0	5.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.91	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	1863	1583	1770	1863	1583	1770	5085	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	1863	1583	1770	1863	1583	1770	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	1	165	515	296	416	190	346	1168	311	638	1517	16
RTOR Reduction (vph)	0	0	99	0	0	76	0	0	207	0	0	11
Lane Group Flow (vph)	1	165	416	296	416	114	346	1168	104	638	1517	5
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4	5	3	8	1	5	2		1	NA	6
Permitted Phases			4			8			2			6
Actuated Green, G (s)	0.7	18.5	32.6	13.5	31.3	45.4	14.1	31.5	31.5	14.1	31.5	31.5
Effective Green, g (s)	0.1	17.9	31.4	12.9	30.7	44.2	15.1	32.5	32.5	15.1	32.5	31.5
Actuated g/C Ratio	0.00	0.18	0.32	0.13	0.32	0.46	0.16	0.34	0.34	0.16	0.34	0.33
Clearance Time (s)	4.6	4.6	5.0	4.6	4.6	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	5.0	5.0	3.0	5.0	5.0
Lane Grp Cap (vph)	1	344	513	235	590	722	276	1707	531	535	1707	515
v/s Ratio Prot	0.00	0.09	c0.11	c0.17	0.22	0.02	c0.20	0.23		c0.19	c0.30	
v/s Ratio Perm			0.15			0.05			0.07			0.00
v/c Ratio	1.00	0.48	0.81	1.26	0.71	0.16	1.25	0.68	0.20	1.19	0.89	0.01
Uniform Delay, d1	48.4	35.3	30.0	41.9	29.1	15.4	40.9	27.7	22.9	40.9	30.4	22.1
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	900.0	1.1	9.4	146.5	3.8	0.1	140.3	1.5	0.4	104.0	6.5	0.0
Delay (s)	948.4	36.3	39.4	188.4	32.9	15.5	181.2	29.2	23.2	144.8	37.0	22.1
Level of Service	F	D	D	F	C	B	F	C	C	F	D	C
Approach Delay (s)		40.0			80.3			57.0			68.6	
Approach LOS		D			F			E			E	

Intersection Summary

HCM 2000 Control Delay	63.2	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.06		
Actuated Cycle Length (s)	96.8	Sum of lost time (s)	20.0
Intersection Capacity Utilization	83.7%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
32: Isabel Ave & Jack London Blvd

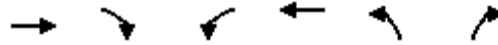
BART to Livermore Extension Project
2040 DMU + INP + Garage AM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	26	54	63	313	939	386	429	1065	122	180	1537	313
Future Volume (vph)	26	54	63	313	939	386	429	1065	122	180	1537	313
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.97	0.91	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	3433	5085	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	3433	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	28	59	68	340	1021	420	466	1158	133	196	1671	340
RTOR Reduction (vph)	0	0	56	0	0	45	0	0	84	0	0	95
Lane Group Flow (vph)	28	59	12	340	1021	375	466	1158	49	196	1671	245
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8	1	5	2		1	NA	6
Permitted Phases			4			8			2			6
Actuated Green, G (s)	3.9	22.1	22.1	25.4	43.6	56.4	18.2	48.3	48.3	12.8	42.9	42.9
Effective Green, g (s)	3.9	22.1	22.1	25.4	43.6	56.4	18.2	48.3	48.3	12.8	42.9	42.9
Actuated g/C Ratio	0.03	0.17	0.17	0.20	0.34	0.43	0.14	0.37	0.37	0.10	0.33	0.33
Clearance Time (s)	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	103	602	269	346	1188	752	481	1892	589	338	1680	523
v/s Ratio Prot	0.01	0.02		c0.19	c0.29	0.05	c0.14	0.23		0.06	c0.33	
v/s Ratio Perm			0.01			0.19			0.03			0.15
v/c Ratio	0.27	0.10	0.04	0.98	0.86	0.50	0.97	0.61	0.08	0.58	0.99	0.47
Uniform Delay, d1	61.6	45.4	45.0	52.0	40.2	26.5	55.5	33.1	26.4	55.9	43.3	34.4
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.4	0.1	0.1	43.4	6.4	0.5	32.7	0.6	0.1	2.4	20.6	0.7
Delay (s)	63.0	45.5	45.1	95.4	46.6	27.0	88.2	33.7	26.5	58.3	63.9	35.1
Level of Service	E	D	D	F	D	C	F	C	C	E	E	D
Approach Delay (s)		48.5			51.3			47.6			59.0	
Approach LOS		D			D			D			E	

Intersection Summary		
HCM 2000 Control Delay	53.0	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.98	
Actuated Cycle Length (s)	129.8	Sum of lost time (s)
Intersection Capacity Utilization	81.1%	ICU Level of Service
Analysis Period (min)	15	

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 33: Isabel Ave Connector & Stanley Blvd



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑	↑	↔	↑↑	↔	↔
Traffic Volume (vph)	366	135	749	2520	521	665
Future Volume (vph)	366	135	749	2520	521	665
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	2.3	2.3	4.0	2.3	2.5	2.5
Lane Util. Factor	0.95	1.00	0.97	0.95	0.97	0.88
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	3539	1583	3433	3539	3433	2787
Flt Permitted	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (perm)	3539	1583	3433	3539	3433	2787
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	398	147	814	2739	566	723
RTOR Reduction (vph)	0	12	0	0	0	213
Lane Group Flow (vph)	398	135	814	2739	566	510
Turn Type	NA	pm+ov	Prot	NA	Prot	pm+ov
Protected Phases	2	8	1	6	8	1
Permitted Phases		2				8
Actuated Green, G (s)	46.7	69.4	31.4	82.1	22.7	54.1
Effective Green, g (s)	48.4	72.8	31.4	83.8	24.2	57.1
Actuated g/C Ratio	0.43	0.65	0.28	0.74	0.21	0.51
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Grp Cap (vph)	1518	1053	955	2629	736	1472
v/s Ratio Prot	0.11	0.03	0.24	c0.77	c0.16	0.10
v/s Ratio Perm		0.06				0.08
v/c Ratio	0.26	0.13	0.85	1.04	0.77	0.35
Uniform Delay, d1	20.7	7.7	38.5	14.5	41.7	16.7
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.0	0.0	7.2	29.7	4.4	0.1
Delay (s)	20.7	7.8	45.7	44.2	46.0	16.7
Level of Service	C	A	D	D	D	B
Approach Delay (s)	17.2			44.5	29.6	
Approach LOS	B			D	C	

Intersection Summary

HCM 2000 Control Delay	38.2	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	1.02		
Actuated Cycle Length (s)	112.8	Sum of lost time (s)	8.8
Intersection Capacity Utilization	91.2%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
34: Murrieta Blvd/Driveway & Portola Ave

BART to Livermore Extension Project
2040 DMU + INP + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗		↖	↗		↖	↗	↗		↗	
Traffic Volume (vph)	0	664	167	292	1102	1	228	6	208	1	3	0
Future Volume (vph)	0	664	167	292	1102	1	228	6	208	1	3	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.8		4.0	5.8		5.2	5.2	5.2		4.0	
Lane Util. Factor		0.95		1.00	0.95		0.95	0.95	1.00		1.00	
Frt		0.97		1.00	1.00		1.00	1.00	0.85		1.00	
Flt Protected		1.00		0.95	1.00		0.95	0.95	1.00		0.99	
Satd. Flow (prot)		3432		1770	3539		1681	1690	1583		1840	
Flt Permitted		1.00		0.95	1.00		0.95	0.95	1.00		0.99	
Satd. Flow (perm)		3432		1770	3539		1681	1690	1583		1840	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	722	182	317	1198	1	248	7	226	1	3	0
RTOR Reduction (vph)	0	24	0	0	0	0	0	0	194	0	0	0
Lane Group Flow (vph)	0	880	0	317	1199	0	129	126	32	0	4	0
Turn Type	Prot	NA		Prot	NA		Split	NA	Perm		Split	NA
Protected Phases	5	2		1	6		8	8		4	4	
Permitted Phases									8			
Actuated Green, G (s)		21.2		14.5	39.7		9.7	9.7	9.7		0.6	
Effective Green, g (s)		20.3		14.5	38.8		9.1	9.1	9.1		0.6	
Actuated g/C Ratio		0.32		0.23	0.61		0.14	0.14	0.14		0.01	
Clearance Time (s)		4.9		4.0	4.9		4.6	4.6	4.6		4.0	
Vehicle Extension (s)		2.0		2.0	2.0		2.0	2.0	2.0		2.0	
Lane Grp Cap (vph)		1097		404	2162		240	242	226		17	
v/s Ratio Prot		c0.26		c0.18	0.34		c0.08	0.07			c0.00	
v/s Ratio Perm									0.02			
v/c Ratio		0.80		0.78	0.55		0.54	0.52	0.14		0.24	
Uniform Delay, d1		19.8		23.0	7.3		25.2	25.2	23.8		31.2	
Progression Factor		1.00		1.00	1.00		1.00	1.00	1.00		1.00	
Incremental Delay, d2		4.1		8.9	0.2		1.2	0.9	0.1		2.6	
Delay (s)		23.8		32.0	7.4		26.4	26.1	23.9		33.8	
Level of Service		C		C	A		C	C	C		C	
Approach Delay (s)		23.8			12.6			25.2			33.8	
Approach LOS		C			B			C			C	

Intersection Summary

HCM 2000 Control Delay	18.2	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.73		
Actuated Cycle Length (s)	63.5	Sum of lost time (s)	19.0
Intersection Capacity Utilization	65.5%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 35: Murrieta Blvd & Jack London Blvd

BART to Livermore Extension Project
 2040 DMU + INP + Garage AM



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	93	311	993	321	252	178
Future Volume (vph)	93	311	993	321	252	178
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00	1.00	0.95	0.91	
Frt	1.00	0.85	1.00	1.00	0.94	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1770	1583	1770	3539	4770	
Flt Permitted	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	1770	1583	1770	3539	4770	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	101	338	1079	349	274	193
RTOR Reduction (vph)	0	301	0	0	120	0
Lane Group Flow (vph)	101	37	1079	349	347	0
Turn Type	Prot	Perm	Prot	NA	NA	
Protected Phases	4		5	2	6	
Permitted Phases		4				
Actuated Green, G (s)	11.1	11.1	66.2	82.8	12.6	
Effective Green, g (s)	11.1	11.1	66.2	82.8	12.6	
Actuated g/C Ratio	0.11	0.11	0.65	0.81	0.12	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	192	172	1149	2875	589	
v/s Ratio Prot	c0.06		c0.61	0.10	c0.07	
v/s Ratio Perm		0.02				
v/c Ratio	0.53	0.21	0.94	0.12	0.59	
Uniform Delay, d1	42.9	41.4	16.0	2.0	42.2	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	2.6	0.6	14.1	0.0	1.5	
Delay (s)	45.5	42.0	30.2	2.0	43.7	
Level of Service	D	D	C	A	D	
Approach Delay (s)	42.8			23.3	43.7	
Approach LOS	D			C	D	

Intersection Summary

HCM 2000 Control Delay	31.1	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.84		
Actuated Cycle Length (s)	101.9	Sum of lost time (s)	12.0
Intersection Capacity Utilization	79.0%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 36: Murrieta Blvd & Stanley Blvd



















BART to Livermore Extension Project
 2040 DMU + INP + Garage AM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	238	804	257	24	1378	155	711	448	18	213	194	468
Future Volume (vph)	238	804	257	24	1378	155	711	448	18	213	194	468
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	5.8	5.8	4.0	5.8	4.9	4.9	5.8		4.9	5.8	4.9
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.97	0.95		1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	3433	3518		1770	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	3433	3518		1770	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	259	874	279	26	1498	168	773	487	20	232	211	509
RTOR Reduction (vph)	0	0	123	0	0	23	0	2	0	0	0	61
Lane Group Flow (vph)	259	874	156	26	1498	145	773	505	0	232	211	448
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Prot	NA		Prot	NA	Perm
Protected Phases	1	6		5	2	3	7	4		3	8	
Permitted Phases			6			2						8
Actuated Green, G (s)	8.0	60.1	60.1	3.6	55.7	78.6	26.0	37.2		22.9	34.1	34.1
Effective Green, g (s)	8.0	59.2	59.2	3.6	54.8	76.8	25.1	36.3		22.0	33.2	34.1
Actuated g/C Ratio	0.06	0.42	0.42	0.03	0.39	0.54	0.18	0.26		0.16	0.23	0.24
Clearance Time (s)	4.0	4.9	4.9	4.0	4.9	4.0	4.0	4.9		4.0	4.9	4.9
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	193	1479	661	45	1369	858	608	901		275	829	381
v/s Ratio Prot	c0.08	0.25		0.01	c0.42	0.03	c0.23	c0.14		0.13	0.06	
v/s Ratio Perm			0.10			0.07						c0.28
v/c Ratio	1.34	0.59	0.24	0.58	1.09	0.17	1.27	0.56		0.84	0.25	1.18
Uniform Delay, d1	66.8	31.8	26.6	68.2	43.4	16.3	58.2	45.7		58.1	44.1	53.8
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	184.4	0.6	0.2	16.7	54.3	0.1	134.7	0.8		20.4	0.2	103.6
Delay (s)	251.2	32.5	26.8	85.0	97.7	16.4	192.9	46.5		78.5	44.3	157.3
Level of Service	F	C	C	F	F	B	F	D		E	D	F
Approach Delay (s)		71.5			89.5			134.9			113.1	
Approach LOS		E			F			F			F	

Intersection Summary		
HCM 2000 Control Delay	99.8	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	1.17	F
Actuated Cycle Length (s)	141.6	Sum of lost time (s)
Intersection Capacity Utilization	100.4%	20.5
Analysis Period (min)	15	ICU Level of Service
		G



















c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 37: Livermore Ave & I-580 WB Ramps

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations													
Traffic Volume (vph)	0	0	0	344	89	27	479	80	0	0	151	0	
Future Volume (vph)	0	0	0	344	89	27	479	80	0	0	151	0	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)					4.0		4.0	4.0			4.0		
Lane Util. Factor					0.95		0.97	1.00			0.95		
Frt					0.99		1.00	1.00			1.00		
Flt Protected					0.96		0.95	1.00			1.00		
Satd. Flow (prot)					1691		3433	1863			3539		
Flt Permitted					0.96		0.95	1.00			1.00		
Satd. Flow (perm)					1691		3433	1863			3539		
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	
Adj. Flow (vph)	0	0	0	374	97	29	521	87	0	0	164	0	
RTOR Reduction (vph)	0	0	0	0	4	0	0	0	0	0	0	0	
Lane Group Flow (vph)	0	0	0	0	496	0	521	87	0	0	164	0	
Turn Type				Split	NA		Prot	NA			NA		
Protected Phases				8	8		5	2			6		
Permitted Phases													
Actuated Green, G (s)					20.8		12.5	29.5			13.5		
Effective Green, g (s)					20.8		12.0	31.2			15.2		
Actuated g/C Ratio					0.35		0.20	0.52			0.25		
Clearance Time (s)					4.0		3.5	5.7			5.7		
Vehicle Extension (s)					2.0		2.0	2.5			2.5		
Lane Grp Cap (vph)					586		686	968			896		
v/s Ratio Prot					c0.29		c0.15	0.05			c0.05		
v/s Ratio Perm													
v/c Ratio					0.85		0.76	0.09			0.18		
Uniform Delay, d1					18.1		22.6	7.3			17.5		
Progression Factor					1.00		0.78	0.53			1.00		
Incremental Delay, d2					10.5		3.5	0.2			0.4		
Delay (s)					28.6		21.2	4.0			18.0		
Level of Service					C		C	A			B		
Approach Delay (s)		0.0			28.6			18.7			18.0		
Approach LOS		A			C			B			B		
Intersection Summary													
HCM 2000 Control Delay			22.5		HCM 2000 Level of Service						C		
HCM 2000 Volume to Capacity ratio			0.61										
Actuated Cycle Length (s)			60.0		Sum of lost time (s)						12.0		
Intersection Capacity Utilization			63.4%		ICU Level of Service						B		
Analysis Period (min)			15										
c Critical Lane Group													





























HCM Signalized Intersection Capacity Analysis
 38: Livermore Ave & I-580 EB Ramps

BART to Livermore Extension Project
 2040 DMU + INP + Garage AM

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations													
Traffic Volume (vph)	11	2	696	0	0	0	0	546	593	27	474	0	
Future Volume (vph)	11	2	696	0	0	0	0	546	593	27	474	0	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)		4.0	4.0					3.0		5.0	3.0		
Lane Util. Factor		0.95	0.95					0.95		1.00	0.95		
Frt		0.86	0.85					0.92		1.00	1.00		
Flt Protected		1.00	1.00					1.00		0.95	1.00		
Satd. Flow (prot)		1511	1504					3263		1770	3539		
Flt Permitted		1.00	1.00					1.00		0.95	1.00		
Satd. Flow (perm)		1511	1504					3263		1770	3539		
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	
Adj. Flow (vph)	12	2	757	0	0	0	0	593	645	29	515	0	
RTOR Reduction (vph)	0	254	254	0	0	0	0	262	0	0	0	0	
Lane Group Flow (vph)	0	131	132	0	0	0	0	976	0	29	515	0	
Turn Type	Prot	NA	Perm					NA		Prot	NA		
Protected Phases	7	4						2		1	6		
Permitted Phases			4										
Actuated Green, G (s)		14.6	14.6					31.8		1.6	37.4		
Effective Green, g (s)		14.6	14.6					32.8		0.6	38.4		
Actuated g/C Ratio		0.24	0.24					0.55		0.01	0.64		
Clearance Time (s)		4.0	4.0					4.0		4.0	4.0		
Vehicle Extension (s)		2.0	2.0					2.5		2.0	2.5		
Lane Grp Cap (vph)		367	365					1783		17	2264		
v/s Ratio Prot								c0.30		c0.02	0.15		
v/s Ratio Perm		0.09	c0.09										
v/c Ratio		0.36	0.36					0.55		1.71	0.23		
Uniform Delay, d1		18.8	18.8					8.8		29.7	4.6		
Progression Factor		1.00	1.00					1.00		1.13	0.24		
Incremental Delay, d2		0.2	0.2					1.2		464.0	0.2		
Delay (s)		19.0	19.1					10.0		497.5	1.3		
Level of Service		B	B					B		F	A		
Approach Delay (s)		19.0			0.0			10.0			27.7		
Approach LOS		B			A			B			C		
Intersection Summary													
HCM 2000 Control Delay			16.5									HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio			0.50										
Actuated Cycle Length (s)			60.0									Sum of lost time (s)	12.0
Intersection Capacity Utilization			63.4%									ICU Level of Service	B
Analysis Period (min)			15										
c Critical Lane Group													

HCM Signalized Intersection Capacity Analysis
 39: Livermore Ave & Portola Ave

BART to Livermore Extension Project
 2040 DMU + INP + Garage AM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 	 			 			 			 	
Traffic Volume (vph)	442	297	121	26	587	91	233	550	60	128	764	448
Future Volume (vph)	442	297	121	26	587	91	233	550	60	128	764	448
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	2.7	4.0	4.0	2.7	4.0	4.0	4.9		4.0	4.9	4.9
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	1.00	0.95		1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	1770	3487		1770	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	1770	3487		1770	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	480	323	132	28	638	99	253	598	65	139	830	487
RTOR Reduction (vph)	0	0	81	0	0	74	0	7	0	0	0	46
Lane Group Flow (vph)	480	323	51	28	638	25	253	656	0	139	830	441
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA		Prot	NA	pm+ov
Protected Phases	3	8		7	4		1	6		5	2	3
Permitted Phases			8			4						2
Actuated Green, G (s)	17.8	42.7	42.7	3.4	28.3	28.3	18.0	35.4		13.3	30.7	48.5
Effective Green, g (s)	17.8	44.0	42.7	3.4	29.6	28.3	18.0	34.5		13.3	29.8	46.7
Actuated g/C Ratio	0.16	0.40	0.39	0.03	0.27	0.26	0.16	0.31		0.12	0.27	0.42
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	551	1405	610	54	945	404	287	1085		212	951	737
v/s Ratio Prot	c0.14	0.09		0.02	c0.18		c0.14	0.19		0.08	c0.23	c0.09
v/s Ratio Perm			0.03			0.02						0.19
v/c Ratio	0.87	0.23	0.08	0.52	0.68	0.06	0.88	0.60		0.66	0.87	0.60
Uniform Delay, d1	45.4	22.2	21.6	52.9	36.3	31.2	45.4	32.4		46.6	38.7	24.8
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	14.1	0.1	0.1	8.2	1.9	0.1	25.5	1.0		7.1	8.9	1.3
Delay (s)	59.5	22.2	21.7	61.1	38.2	31.3	70.9	33.3		53.7	47.6	26.1
Level of Service	E	C	C	E	D	C	E	C		D	D	C
Approach Delay (s)		41.3			38.2			43.7			41.0	
Approach LOS		D			D			D			D	

Intersection Summary

HCM 2000 Control Delay	41.1	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.82		
Actuated Cycle Length (s)	110.8	Sum of lost time (s)	16.5
Intersection Capacity Utilization	76.9%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
40: First St/Springtown Blvd & I-580 WB Ramps

BART to Livermore Extension Project
2040 DMU + INP + Garage AM
























Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations			↗↘			↗	↗↘	↑			↗↘	↗
Traffic Volume (vph)	0	0	443	0	0	0	341	375	0	0	881	533
Future Volume (vph)	0	0	443	0	0	0	341	375	0	0	881	533
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)			4.5				4.5	4.0			4.5	4.5
Lane Util. Factor			0.88				0.97	1.00			0.95	1.00
Frt			0.85				1.00	1.00			1.00	0.85
Flt Protected			1.00				0.95	1.00			1.00	1.00
Satd. Flow (prot)			2787				3433	1863			3539	1583
Flt Permitted			1.00				0.95	1.00			1.00	1.00
Satd. Flow (perm)			2787				3433	1863			3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	482	0	0	0	371	408	0	0	958	579
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	70
Lane Group Flow (vph)	0	0	482	0	0	0	371	408	0	0	958	509
Turn Type			Over			Free	Prot	NA			NA	Perm
Protected Phases			5				5	2			6	
Permitted Phases						Free						6
Actuated Green, G (s)			14.2				14.2	60.0			37.8	37.8
Effective Green, g (s)			13.7				13.7	60.0			37.3	37.3
Actuated g/C Ratio			0.23				0.23	1.00			0.62	0.62
Clearance Time (s)			4.0				4.0	4.0			4.0	4.0
Vehicle Extension (s)			2.0				2.0	0.2			4.0	4.0
Lane Grp Cap (vph)			636				783	1863			2200	984
v/s Ratio Prot			c0.17				0.11	0.22			0.27	
v/s Ratio Perm												c0.32
v/c Ratio			0.76				0.47	0.22			0.44	0.52
Uniform Delay, d1			21.6				20.0	0.0			5.9	6.3
Progression Factor			1.00				0.65	1.00			1.00	1.00
Incremental Delay, d2			4.6				0.1	0.2			0.6	1.9
Delay (s)			26.2				13.1	0.2			6.5	8.3
Level of Service			C				B	A			A	A
Approach Delay (s)		26.2			0.0			6.4			7.2	
Approach LOS		C			A			A			A	

Intersection Summary		
HCM 2000 Control Delay	10.2	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.58	B
Actuated Cycle Length (s)	60.0	Sum of lost time (s)
Intersection Capacity Utilization	50.2%	9.0
Analysis Period (min)	15	ICU Level of Service
		A

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
41: First St & I-580 EB Ramps

BART to Livermore Extension Project
2040 DMU + INP + Garage AM

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations			 					 			 		
Traffic Volume (vph)	74	2	384	0	0	0	0	918	887	90	1208	0	
Future Volume (vph)	74	2	384	0	0	0	0	918	887	90	1208	0	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)		4.0	4.0					5.0	5.0	5.0	5.0		
Lane Util. Factor		1.00	0.88					0.95	1.00	1.00	0.95		
Frt		1.00	0.85					1.00	0.85	1.00	1.00		
Flt Protected		0.95	1.00					1.00	1.00	0.95	1.00		
Satd. Flow (prot)		1776	2787					3539	1583	1770	3539		
Flt Permitted		0.95	1.00					1.00	1.00	0.95	1.00		
Satd. Flow (perm)		1776	2787					3539	1583	1770	3539		
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	
Adj. Flow (vph)	80	2	417	0	0	0	0	998	964	98	1313	0	
RTOR Reduction (vph)	0	0	137	0	0	0	0	0	334	0	0	0	
Lane Group Flow (vph)	0	82	280	0	0	0	0	998	630	98	1313	0	
Turn Type	Perm	NA	Perm					NA	Perm	Prot	NA		
Protected Phases		4						2		1	6		
Permitted Phases	4		4						2				
Actuated Green, G (s)		8.8	8.8					33.7	33.7	5.5	43.2		
Effective Green, g (s)		8.3	8.3					33.2	33.2	4.5	42.7		
Actuated g/C Ratio		0.14	0.14					0.55	0.55	0.08	0.71		
Clearance Time (s)		3.5	3.5					4.5	4.5	4.0	4.5		
Vehicle Extension (s)		2.5	2.5					4.0	4.0	2.0	4.0		
Lane Grp Cap (vph)		245	385					1958	875	132	2518		
v/s Ratio Prot								0.28		0.06	c0.37		
v/s Ratio Perm		0.05	c0.10						c0.40				
v/c Ratio		0.33	0.73					0.51	0.72	0.74	0.52		
Uniform Delay, d1		23.4	24.8					8.3	9.9	27.2	4.0		
Progression Factor		1.00	1.00					1.00	1.00	1.16	0.51		
Incremental Delay, d2		0.6	6.3					1.0	5.1	15.8	0.7		
Delay (s)		23.9	31.1					9.3	15.0	47.3	2.7		
Level of Service		C	C					A	B	D	A		
Approach Delay (s)		29.9			0.0			12.1			5.8		
Approach LOS		C			A			B			A		
Intersection Summary													
HCM 2000 Control Delay			12.1									HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio			0.73										
Actuated Cycle Length (s)			60.0									Sum of lost time (s)	14.0
Intersection Capacity Utilization			75.8%									ICU Level of Service	D
Analysis Period (min)			15										

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
42: 1st St & Mines Rd

BART to Livermore Extension Project
2040 DMU + INP + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	43	59	45	478	97	353	26	1437	339	179	1342	22
Future Volume (vph)	43	59	45	478	97	353	26	1437	339	179	1342	22
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		0.97	1.00	1.00	1.00	0.91		0.97	0.91	
Frt	1.00	0.93		1.00	1.00	0.85	1.00	0.97		1.00	1.00	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1742		3433	1863	1583	1770	4940		3433	5073	
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	1742		3433	1863	1583	1770	4940		3433	5073	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	47	64	49	520	105	384	28	1562	368	195	1459	24
RTOR Reduction (vph)	0	33	0	0	0	46	0	39	0	0	1	0
Lane Group Flow (vph)	47	80	0	520	105	338	28	1891	0	195	1482	0
Turn Type	Prot	NA		Prot	NA	pm+ov	Prot	NA		Prot	NA	
Protected Phases	7	4		3	8	1	5	2		1	6	
Permitted Phases						8						
Actuated Green, G (s)	3.4	8.5		14.7	19.8	25.8	1.9	39.9		6.0	44.0	
Effective Green, g (s)	3.4	8.5		14.7	19.8	25.8	1.9	39.9		6.0	44.0	
Actuated g/C Ratio	0.04	0.10		0.17	0.23	0.30	0.02	0.47		0.07	0.52	
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	70	173		593	433	554	39	2316		242	2622	
v/s Ratio Prot	0.03	0.05		c0.15	0.06	c0.04	0.02	c0.38		c0.06	0.29	
v/s Ratio Perm						0.17						
v/c Ratio	0.67	0.46		0.88	0.24	0.61	0.72	0.82		0.81	0.57	
Uniform Delay, d1	40.3	36.1		34.3	26.6	25.4	41.3	19.4		39.0	14.0	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	22.4	1.9		13.7	0.3	2.0	47.4	2.3		17.5	0.3	
Delay (s)	62.7	38.1		48.0	26.8	27.3	88.7	21.8		56.5	14.3	
Level of Service	E	D		D	C	C	F	C		E	B	
Approach Delay (s)		45.3			38.0			22.7			19.2	
Approach LOS		D			D			C			B	

Intersection Summary

HCM 2000 Control Delay	25.5	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.85		
Actuated Cycle Length (s)	85.1	Sum of lost time (s)	16.0
Intersection Capacity Utilization	70.7%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Unsignalized Intersection Capacity Analysis
 43: Vasco Rd & I-580 WB Ramps























BART to Livermore Extension Project
 2040 DMU + INP + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations			↗			↗		↑↑↑	↗		↑↑↑	↗
Traffic Volume (veh/h)	0	0	0	0	0	150	0	1042	0	0	1881	0
Future Volume (Veh/h)	0	0	0	0	0	150	0	1042	0	0	1881	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	0	0	0	163	0	1133	0	0	2045	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage (veh)												
Upstream signal (ft)											524	
pX, platoon unblocked												
vC, conflicting volume	2586	3178	682	1815	3178	378	2045			1133		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	2586	3178	682	1815	3178	378	2045			1133		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	100	100	74	100			100		
cM capacity (veh/h)	9	10	392	49	10	620	272			612		
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	NB 4	SB 1	SB 2	SB 3	SB 4		
Volume Total	0	163	378	378	378	0	682	682	682	0		
Volume Left	0	0	0	0	0	0	0	0	0	0		
Volume Right	0	163	0	0	0	0	0	0	0	0		
cSH	1700	620	1700	1700	1700	1700	1700	1700	1700	1700		
Volume to Capacity	0.00	0.26	0.22	0.22	0.22	0.00	0.40	0.40	0.40	0.00		
Queue Length 95th (ft)	0	26	0	0	0	0	0	0	0	0		
Control Delay (s)	0.0	12.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
Lane LOS	A	B										
Approach Delay (s)	0.0	12.9	0.0				0.0					
Approach LOS	A	B										
Intersection Summary												
Average Delay			0.6									
Intersection Capacity Utilization			39.7%			ICU Level of Service				A		
Analysis Period (min)			15									

HCM Unsignalized Intersection Capacity Analysis
44: Vasco Rd & I-580 EB Ramps

BART to Livermore Extension Project
2040 DMU + INP + Garage AM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations								  			  	
Traffic Volume (veh/h)	0	0	0	0	0	0	0	988	0	73	2008	0
Future Volume (Veh/h)	0	0	0	0	0	0	0	988	0	73	2008	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	0	0	0	0	0	1074	0	79	2183	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	2699	3415	728	1960	3415	358	2183			1074		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	2699	3415	728	1960	3415	358	2183			1074		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	100	100	100	100			88		
cM capacity (veh/h)	9	6	366	34	6	638	240			645		
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	NB 4	SB 1	SB 2	SB 3	SB 4		
Volume Total	0	0	358	358	358	0	79	728	728	728		
Volume Left	0	0	0	0	0	0	79	0	0	0		
Volume Right	0	0	0	0	0	0	0	0	0	0		
cSH	1700	1700	1700	1700	1700	1700	645	1700	1700	1700		
Volume to Capacity	0.00	0.00	0.21	0.21	0.21	0.00	0.12	0.43	0.43	0.43		
Queue Length 95th (ft)	0	0	0	0	0	0	10	0	0	0		
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	11.4	0.0	0.0	0.0		
Lane LOS	A	A					B					
Approach Delay (s)	0.0	0.0	0.0				0.4					
Approach LOS	A	A										
Intersection Summary												
Average Delay			0.3									
Intersection Capacity Utilization			42.1%	ICU Level of Service	A							
Analysis Period (min)			15									

HCM Signalized Intersection Capacity Analysis
45: Vasco Rd & East Ave

BART to Livermore Extension Project
2040 DMU + INP + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	298	360	50	5	13	10	62	259	194	266	295	294
Future Volume (vph)	298	360	50	5	13	10	62	259	194	266	295	294
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	0.95		0.97	1.00	1.00
Frt	1.00	0.98		1.00	0.93		1.00	0.94		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	3475		1770	3306		1770	3312		3433	1863	1583
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1770	3475		1770	3306		1770	3312		3433	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	324	391	54	5	14	11	67	282	211	289	321	320
RTOR Reduction (vph)	0	19	0	0	11	0	0	153	0	0	0	212
Lane Group Flow (vph)	324	426	0	5	14	0	67	340	0	289	321	108
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												6
Actuated Green, G (s)	12.5	13.2		0.6	1.3		2.2	13.4		5.2	16.4	16.4
Effective Green, g (s)	12.5	13.2		0.6	1.3		2.2	13.4		5.2	16.4	16.4
Actuated g/C Ratio	0.26	0.27		0.01	0.03		0.05	0.28		0.11	0.34	0.34
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	457	947		21	88		80	916		368	631	536
v/s Ratio Prot	c0.18	c0.12		0.00	0.00		0.04	0.10		c0.08	c0.17	
v/s Ratio Perm												0.07
v/c Ratio	0.71	0.45		0.24	0.16		0.84	0.37		0.79	0.51	0.20
Uniform Delay, d1	16.3	14.6		23.7	23.0		22.9	14.1		21.1	12.8	11.4
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	5.0	0.3		5.8	0.9		50.1	0.3		10.5	0.6	0.2
Delay (s)	21.3	14.9		29.5	23.9		73.0	14.4		31.6	13.4	11.5
Level of Service	C	B		C	C		E	B		C	B	B
Approach Delay (s)		17.6			24.8			21.4			18.4	
Approach LOS		B			C			C			B	

Intersection Summary

HCM 2000 Control Delay	19.0	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.67		
Actuated Cycle Length (s)	48.4	Sum of lost time (s)	16.0
Intersection Capacity Utilization	54.1%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
46: Greenville Rd & I-580 WB Ramps

BART to Livermore Extension Project
2040 DMU + INP + Garage AM
























Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↔↔		↗		↕↕	↗		↕↕	
Traffic Volume (vph)	0	0	0	262	0	64	0	302	320	0	936	68
Future Volume (vph)	0	0	0	262	0	64	0	302	320	0	936	68
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0		4.0		4.0	4.0		4.0	
Lane Util. Factor				0.97		1.00		0.95	1.00		0.95	
Frt				1.00		0.85		1.00	0.85		0.99	
Flt Protected				0.95		1.00		1.00	1.00		1.00	
Satd. Flow (prot)				3433		1583		3539	1583		3503	
Flt Permitted				0.95		1.00		1.00	1.00		1.00	
Satd. Flow (perm)				3433		1583		3539	1583		3503	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	285	0	70	0	328	348	0	1017	74
RTOR Reduction (vph)	0	0	0	0	0	58	0	0	106	0	8	0
Lane Group Flow (vph)	0	0	0	285	0	12	0	328	242	0	1083	0
Turn Type				Prot		Prot		NA	Perm		NA	
Protected Phases				3		3		2			6	
Permitted Phases									2			
Actuated Green, G (s)				10.2		10.2		41.8	41.8		41.8	
Effective Green, g (s)				10.2		10.2		41.8	41.8		41.8	
Actuated g/C Ratio				0.17		0.17		0.70	0.70		0.70	
Clearance Time (s)				4.0		4.0		4.0	4.0		4.0	
Vehicle Extension (s)				3.0		3.0		3.0	3.0		3.0	
Lane Grp Cap (vph)				583		269		2465	1102		2440	
v/s Ratio Prot				c0.08		0.01		0.09			c0.31	
v/s Ratio Perm									0.15			
v/c Ratio				0.49		0.04		0.13	0.22		0.44	
Uniform Delay, d1				22.5		20.8		3.0	3.3		4.0	
Progression Factor				1.00		1.00		0.72	0.37		1.00	
Incremental Delay, d2				0.6		0.1		0.1	0.5		0.6	
Delay (s)				23.2		20.9		2.3	1.7		4.6	
Level of Service				C		C		A	A		A	
Approach Delay (s)		0.0			22.7			2.0			4.6	
Approach LOS		A			C			A			A	

Intersection Summary			
HCM 2000 Control Delay	6.8	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.45		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	42.2%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
47: Greenville Rd & I-580 EB Ramps

BART to Livermore Extension Project
2040 DMU + INP + Garage AM

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations	 							 			 		
Traffic Volume (vph)	16	0	22	0	0	0	0	617	73	0	874	30	
Future Volume (vph)	16	0	22	0	0	0	0	617	73	0	874	30	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)	4.0		4.0					4.0	4.0		4.0	4.0	
Lane Util. Factor	0.97		1.00					0.95	1.00		0.95	1.00	
Frt	1.00		0.85					1.00	0.85		1.00	0.85	
Flt Protected	0.95		1.00					1.00	1.00		1.00	1.00	
Satd. Flow (prot)	3433		1583					3539	1583		3539	1583	
Flt Permitted	0.95		1.00					1.00	1.00		1.00	1.00	
Satd. Flow (perm)	3433		1583					3539	1583		3539	1583	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	
Adj. Flow (vph)	17	0	24	0	0	0	0	671	79	0	950	33	
RTOR Reduction (vph)	0	0	23	0	0	0	0	0	14	0	0	6	
Lane Group Flow (vph)	17	0	1	0	0	0	0	671	65	0	950	27	
Turn Type	Prot		Prot					NA	Perm		NA	Perm	
Protected Phases	7		7					2			6		
Permitted Phases									2			6	
Actuated Green, G (s)	2.7		2.7					49.3	49.3		49.3	49.3	
Effective Green, g (s)	2.7		2.7					49.3	49.3		49.3	49.3	
Actuated g/C Ratio	0.05		0.05					0.82	0.82		0.82	0.82	
Clearance Time (s)	4.0		4.0					4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0		3.0					3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	154		71					2907	1300		2907	1300	
v/s Ratio Prot	c0.00		0.00					0.19			c0.27		
v/s Ratio Perm									0.04			0.02	
v/c Ratio	0.11		0.02					0.23	0.05		0.33	0.02	
Uniform Delay, d1	27.5		27.4					1.2	1.0		1.3	1.0	
Progression Factor	1.00		1.00					1.00	1.00		0.71	0.61	
Incremental Delay, d2	0.3		0.1					0.2	0.1		0.3	0.0	
Delay (s)	27.8		27.5					1.4	1.1		1.2	0.6	
Level of Service	C		C					A	A		A	A	
Approach Delay (s)		27.6			0.0			1.3			1.2		
Approach LOS		C			A			A			A		
Intersection Summary													
HCM 2000 Control Delay			1.9									HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio			0.32										
Actuated Cycle Length (s)			60.0									Sum of lost time (s)	8.0
Intersection Capacity Utilization			34.2%									ICU Level of Service	A
Analysis Period (min)			15										
c Critical Lane Group													

HCM Signalized Intersection Capacity Analysis
 48: Greenville Rd & Northfront Road/Altamont Pass Road

BART to Livermore Extension Project
 2040 DMU + INP + Garage AM



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↗	↖	↑	↘	↗
Traffic Volume (vph)	8	648	274	974	306	59
Future Volume (vph)	8	648	274	974	306	59
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	1863	1583	1770	1863	1770	1583
Flt Permitted	1.00	1.00	0.75	1.00	0.95	1.00
Satd. Flow (perm)	1863	1583	1400	1863	1770	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	9	704	298	1059	333	64
RTOR Reduction (vph)	0	262	0	0	0	49
Lane Group Flow (vph)	9	442	298	1059	333	15
Turn Type	NA	Perm	Perm	NA	Prot	Perm
Protected Phases	4			8	2	
Permitted Phases		4	8			2
Actuated Green, G (s)	38.1	38.1	38.1	38.1	14.6	14.6
Effective Green, g (s)	38.1	38.1	38.1	38.1	14.6	14.6
Actuated g/C Ratio	0.63	0.63	0.63	0.63	0.24	0.24
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	1169	993	878	1169	425	380
v/s Ratio Prot	0.00			c0.57	c0.19	
v/s Ratio Perm		0.28	0.21			0.01
v/c Ratio	0.01	0.44	0.34	0.91	0.78	0.04
Uniform Delay, d1	4.2	5.8	5.3	9.8	21.6	17.7
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.0	0.3	0.2	10.1	9.1	0.0
Delay (s)	4.2	6.2	5.6	19.8	30.7	17.7
Level of Service	A	A	A	B	C	B
Approach Delay (s)	6.1			16.7	28.6	
Approach LOS	A			B	C	

Intersection Summary

HCM 2000 Control Delay	15.6	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.87		
Actuated Cycle Length (s)	60.7	Sum of lost time (s)	8.0
Intersection Capacity Utilization	74.9%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
49: Greenville Rd & Southfront Rd

BART to Livermore Extension Project
2040 DMU + INP + Garage AM



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	110	180	118	586	754	123
Future Volume (vph)	110	180	118	586	754	123
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.2	5.2	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.88	0.97	0.95	0.95	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	3433	2787	3433	3539	3539	1583
Flt Permitted	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (perm)	3433	2787	3433	3539	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	120	196	128	637	820	134
RTOR Reduction (vph)	0	174	0	0	0	68
Lane Group Flow (vph)	120	22	128	637	820	66
Turn Type	Prot	Perm	Prot	NA	NA	Perm
Protected Phases	8		1	6	2	
Permitted Phases		8				2
Actuated Green, G (s)	5.4	5.4	3.2	26.3	19.1	19.1
Effective Green, g (s)	4.8	4.8	3.2	28.0	20.8	20.8
Actuated g/C Ratio	0.11	0.11	0.08	0.67	0.50	0.50
Clearance Time (s)	4.6	4.6	4.0	5.7	5.7	5.7
Vehicle Extension (s)	5.0	5.0	6.0	2.5	2.5	2.5
Lane Grp Cap (vph)	392	318	261	2359	1752	783
v/s Ratio Prot	c0.03		c0.04	0.18	c0.23	
v/s Ratio Perm		0.01				0.04
v/c Ratio	0.31	0.07	0.49	0.27	0.47	0.08
Uniform Delay, d1	17.1	16.6	18.6	2.8	7.0	5.6
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.9	0.2	4.0	0.0	0.1	0.0
Delay (s)	18.0	16.8	22.7	2.9	7.1	5.6
Level of Service	B	B	C	A	A	A
Approach Delay (s)	17.3			6.2	6.9	
Approach LOS	B			A	A	

Intersection Summary

HCM 2000 Control Delay	8.2	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.44		
Actuated Cycle Length (s)	42.0	Sum of lost time (s)	13.2
Intersection Capacity Utilization	38.5%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
50: Greenville Rd & Patterson Pass Rd

BART to Livermore Extension Project
2040 DMU + INP + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗		↖	↗		↖	↗		↖	↗	
Traffic Volume (vph)	50	5	61	253	405	474	12	150	1	7	340	48
Future Volume (vph)	50	5	61	253	405	474	12	150	1	7	340	48
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.86		1.00	0.92		1.00	1.00		1.00	0.98	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1603		1770	1712		1770	1861		1770	1828	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	1603		1770	1712		1770	1861		1770	1828	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	54	5	66	275	440	515	13	163	1	8	370	52
RTOR Reduction (vph)	0	53	0	0	44	0	0	0	0	0	5	0
Lane Group Flow (vph)	54	18	0	275	911	0	13	164	0	8	417	0
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												
Actuated Green, G (s)	3.1	16.8		32.3	46.0		0.7	21.1		0.7	21.1	
Effective Green, g (s)	3.1	16.8		32.3	46.0		0.7	21.1		0.7	21.1	
Actuated g/C Ratio	0.04	0.19		0.37	0.53		0.01	0.24		0.01	0.24	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	63	309		657	906		14	451		14	443	
v/s Ratio Prot	c0.03	0.01		0.16	c0.53		c0.01	0.09		0.00	c0.23	
v/s Ratio Perm												
v/c Ratio	0.86	0.06		0.42	1.01		0.93	0.36		0.57	0.94	
Uniform Delay, d1	41.7	28.6		20.3	20.5		43.1	27.3		43.0	32.3	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	64.9	0.1		0.4	31.2		201.0	2.3		46.0	30.2	
Delay (s)	106.5	28.7		20.7	51.6		244.0	29.6		88.9	62.5	
Level of Service	F	C		C	D		F	C		F	E	
Approach Delay (s)		62.3			44.7			45.3			63.0	
Approach LOS		E			D			D			E	

Intersection Summary

HCM 2000 Control Delay	49.9	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.98		
Actuated Cycle Length (s)	86.9	Sum of lost time (s)	16.0
Intersection Capacity Utilization	77.8%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
1: Dougherty Rd & Amador Valley Rd

BART to Livermore Extension Project
2040 DMU + INP + Garage PM



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	399	462	916	2205	1130	345
Future Volume (vph)	399	462	916	2205	1130	345
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00	0.97	0.91	0.91	
Frt	1.00	0.85	1.00	1.00	0.96	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1770	1583	3433	5085	4907	
Flt Permitted	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	1770	1583	3433	5085	4907	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	434	502	996	2397	1228	375
RTOR Reduction (vph)	0	371	0	0	46	0
Lane Group Flow (vph)	434	131	996	2397	1557	0
Turn Type	Perm	Perm	Prot	NA	NA	
Protected Phases			5	2	6	
Permitted Phases	4	4				
Actuated Green, G (s)	30.9	30.9	35.8	79.8	40.0	
Effective Green, g (s)	30.9	30.9	35.8	79.8	40.0	
Actuated g/C Ratio	0.26	0.26	0.30	0.67	0.34	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	460	412	1035	3418	1653	
v/s Ratio Prot			c0.29	0.47	c0.32	
v/s Ratio Perm	c0.25	0.08				
v/c Ratio	0.94	0.32	0.96	0.70	0.94	
Uniform Delay, d1	43.0	35.4	40.8	12.1	38.2	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	28.1	0.4	19.4	0.7	11.2	
Delay (s)	71.1	35.8	60.2	12.7	49.4	
Level of Service	E	D	E	B	D	
Approach Delay (s)	52.2			26.7	49.4	
Approach LOS	D			C	D	

Intersection Summary

HCM 2000 Control Delay	36.8	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.95		
Actuated Cycle Length (s)	118.7	Sum of lost time (s)	12.0
Intersection Capacity Utilization	87.8%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
2: Hopyard Road/Dougherty Rd & Dublin Blvd

BART to Livermore Extension Project
2040 DMU + INP + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↑↑↑	↖↗	↖↗↘	↑↑↑	↖	↖↗↘	↑↑↑	↖↗	↖↗	↑↑↑	↖↗
Traffic Volume (vph)	100	1200	870	676	1157	1077	816	2043	325	733	1186	38
Future Volume (vph)	100	1200	870	676	1157	1077	816	2043	325	733	1186	38
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	6.0	5.0	5.0	5.5	5.0	5.0	5.5	5.0	5.0	5.5	
Lane Util. Factor	0.97	0.91	0.88	0.94	0.91	1.00	0.94	0.91	0.88	0.97	0.86	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	3433	5085	2787	4990	5085	1583	4990	5085	2787	3433	6378	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	3433	5085	2787	4990	5085	1583	4990	5085	2787	3433	6378	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	109	1304	946	735	1258	1171	887	2221	353	797	1289	41
RTOR Reduction (vph)	0	0	56	0	0	65	0	0	56	0	4	0
Lane Group Flow (vph)	109	1304	890	735	1258	1106	887	2221	297	797	1326	0
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	
Protected Phases	5	2	3	1	6	7	3	8	1	7	4	
Permitted Phases			2			6			8			
Actuated Green, G (s)	16.0	37.0	59.8	19.0	40.5	56.5	22.8	46.5	65.5	16.0	39.7	
Effective Green, g (s)	16.0	37.0	59.8	19.0	40.5	56.5	22.8	46.5	65.5	16.0	39.7	
Actuated g/C Ratio	0.11	0.26	0.43	0.14	0.29	0.40	0.16	0.33	0.47	0.11	0.28	
Clearance Time (s)	5.0	6.0	5.0	5.0	5.5	5.0	5.0	5.5	5.0	5.0	5.5	
Vehicle Extension (s)	2.0	4.5	2.0	2.0	4.5	2.0	2.0	4.5	2.0	2.0	4.5	
Lane Grp Cap (vph)	392	1343	1190	677	1471	638	812	1688	1303	392	1808	
v/s Ratio Prot	0.03	c0.26	0.12	0.15	0.25	c0.20	0.18	c0.44	0.03	c0.23	0.21	
v/s Ratio Perm			0.20			0.50			0.08			
v/c Ratio	0.28	0.97	0.75	1.09	0.86	1.73	1.09	1.32	0.23	2.03	0.73	
Uniform Delay, d1	56.7	51.0	33.8	60.5	47.0	41.8	58.6	46.8	22.2	62.0	45.4	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.1	18.1	2.3	60.1	5.5	336.6	59.8	146.4	0.0	473.8	1.8	
Delay (s)	56.9	69.1	36.1	120.6	52.4	378.4	118.4	193.2	22.2	535.8	47.2	
Level of Service	E	E	D	F	D	F	F	F	C	F	D	
Approach Delay (s)		55.3			188.9			156.6			230.3	
Approach LOS		E			F			F			F	

Intersection Summary

HCM 2000 Control Delay	158.4	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.53		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	21.5
Intersection Capacity Utilization	131.6%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

3: Dougherty Rd/Hopyard Road & I-580 WB Ramps

BART to Livermore Extension Project
2040 DMU + INP + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↔↔		↔↔		↑↑↑			↑↑↑	↔
Traffic Volume (vph)	0	0	0	322	0	591	0	2631	0	0	1680	0
Future Volume (vph)	0	0	0	322	0	591	0	2631	0	0	1680	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0		4.0		4.0			4.0	
Lane Util. Factor				0.97		0.88		0.91			0.86	
Frt				1.00		0.85		1.00			1.00	
Flt Protected				0.95		1.00		1.00			1.00	
Satd. Flow (prot)				3433		2787		5085			4806	
Flt Permitted				0.95		1.00		1.00			1.00	
Satd. Flow (perm)				3433		2787		5085			4806	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	350	0	642	0	2860	0	0	1826	0
RTOR Reduction (vph)	0	0	0	0	0	18	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	350	0	624	0	2860	0	0	1826	0
Turn Type				Prot		Prot		NA			NA	Perm
Protected Phases				4		4		2			6	
Permitted Phases												6
Actuated Green, G (s)				27.3		27.3		71.9			71.9	
Effective Green, g (s)				28.7		28.7		73.3			73.3	
Actuated g/C Ratio				0.26		0.26		0.67			0.67	
Clearance Time (s)				5.4		5.4		5.4			5.4	
Vehicle Extension (s)				3.0		3.0		3.0			3.0	
Lane Grp Cap (vph)				895		727		3388			3202	
v/s Ratio Prot				0.10		c0.22		c0.56			0.38	
v/s Ratio Perm												
v/c Ratio				0.39		0.86		0.84			0.57	
Uniform Delay, d1				33.5		38.7		14.0			9.9	
Progression Factor				1.00		1.00		1.05			1.00	
Incremental Delay, d2				0.3		9.9		0.3			0.7	
Delay (s)				33.7		48.6		14.9			10.6	
Level of Service				C		D		B			B	
Approach Delay (s)		0.0			43.4			14.9			10.6	
Approach LOS		A			D			B			B	

Intersection Summary

HCM 2000 Control Delay	18.5	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.85		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	78.2%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 4: Hopyard Rd/Dougherty Rd & I-580 EB Ramps

BART to Livermore Extension Project
 2040 DMU + INP + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗		↖↗					↑↑↑	↖		↑↑↑	↖
Traffic Volume (vph)	1281	0	984	0	0	0	0	2652	0	0	1320	0
Future Volume (vph)	1281	0	984	0	0	0	0	2652	0	0	1320	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0					4.0			4.0	
Lane Util. Factor	0.97		0.88					0.91			0.86	
Frt	1.00		0.85					1.00			1.00	
Flt Protected	0.95		1.00					1.00			1.00	
Satd. Flow (prot)	3433		2787					5085			4806	
Flt Permitted	0.95		1.00					1.00			1.00	
Satd. Flow (perm)	3433		2787					5085			4806	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	1392	0	1070	0	0	0	0	2883	0	0	1435	0
RTOR Reduction (vph)	0	0	34	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	1392	0	1036	0	0	0	0	2883	0	0	1435	0
Turn Type	Prot		Prot					NA	Free		NA	Perm
Protected Phases	4		4					2			6	
Permitted Phases									Free			6
Actuated Green, G (s)	40.6		40.6					58.6			58.6	
Effective Green, g (s)	42.0		42.0					60.0			60.0	
Actuated g/C Ratio	0.38		0.38					0.55			0.55	
Clearance Time (s)	5.4		5.4					5.4			5.4	
Vehicle Extension (s)	3.0		3.0					3.0			3.0	
Lane Grp Cap (vph)	1310		1064					2773			2621	
v/s Ratio Prot	c0.41		0.37					c0.57			0.30	
v/s Ratio Perm												
v/c Ratio	1.06		0.97					1.04			0.55	
Uniform Delay, d1	34.0		33.5					25.0			16.2	
Progression Factor	1.00		1.00					1.00			0.73	
Incremental Delay, d2	43.3		21.3					28.5			0.7	
Delay (s)	77.3		54.8					53.5			12.6	
Level of Service	E		D					D			B	
Approach Delay (s)		67.5			0.0			53.5			12.6	
Approach LOS		E			A			D			B	

Intersection Summary

HCM 2000 Control Delay	49.9	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	1.05		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	94.5%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
5: Hopyard Rd & Owens Rd

BART to Livermore Extension Project
2040 DMU + INP + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	387	279	247	590	319	412	224	944	294	500	1591	259
Future Volume (vph)	387	279	247	590	319	412	224	944	294	500	1591	259
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	2.7	2.7		2.7	2.7	2.7	4.0	2.3	2.3	4.0	2.3	
Lane Util. Factor	0.91	0.91		1.00	0.95	0.95	1.00	0.91	1.00	0.97	0.91	
Frt	1.00	0.95		1.00	0.96	0.85	1.00	1.00	0.85	1.00	0.98	
Flt Protected	0.95	0.99		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1610	3171		1770	1694	1504	1770	5085	1583	3433	4978	
Flt Permitted	0.95	0.99		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1610	3171		1770	1694	1504	1770	5085	1583	3433	4978	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	421	303	268	641	347	448	243	1026	320	543	1729	282
RTOR Reduction (vph)	0	54	0	0	12	24	0	0	231	0	18	0
Lane Group Flow (vph)	232	706	0	641	474	285	243	1026	89	543	1993	0
Turn Type	Split	NA		Split	NA	pm+ov	Prot	NA	Perm	Prot	NA	
Protected Phases	8	8		4	4	1	5	2		1	6	
Permitted Phases						4			2			
Actuated Green, G (s)	18.0	18.0		31.0	31.0	54.2	13.0	31.8	31.8	23.2	42.0	
Effective Green, g (s)	19.3	19.3		32.3	32.3	56.8	13.0	33.5	33.5	23.2	43.7	
Actuated g/C Ratio	0.16	0.16		0.27	0.27	0.47	0.11	0.28	0.28	0.19	0.36	
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	258	510		476	455	745	191	1419	441	663	1812	
v/s Ratio Prot	0.14	c0.22		c0.36	0.28	0.08	c0.14	0.20		0.16	c0.40	
v/s Ratio Perm						0.11			0.06			
v/c Ratio	0.90	1.38		1.35	1.04	0.38	1.27	0.72	0.20	0.82	1.10	
Uniform Delay, d1	49.4	50.4		43.9	43.9	20.3	53.5	39.1	33.0	46.4	38.1	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	30.6	185.1		169.5	53.7	0.3	156.9	3.2	1.0	7.8	54.0	
Delay (s)	80.0	235.4		213.4	97.5	20.7	210.4	42.3	34.1	54.2	92.1	
Level of Service	F	F		F	F	C	F	D	C	D	F	
Approach Delay (s)		199.1			132.7			66.3			84.0	
Approach LOS		F			F			E			F	

Intersection Summary

HCM 2000 Control Delay	107.8	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.24		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	11.7
Intersection Capacity Utilization	112.9%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

6: Hopyard Rd & Stoneridge Dr

BART to Livermore Extension Project
2040 DMU + INP + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	258	1141	695	123	1346	191	615	844	89	275	971	211
Future Volume (vph)	258	1141	695	123	1346	191	615	844	89	275	971	211
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.91	1.00	0.97	0.91	1.00	0.94	0.95	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5085	1583	3433	5085	1583	4990	3539	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5085	1583	3433	5085	1583	4990	3539	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	280	1240	755	134	1463	208	668	917	97	299	1055	229
RTOR Reduction (vph)	0	0	178	0	0	147	0	0	70	0	0	118
Lane Group Flow (vph)	280	1240	577	134	1463	61	668	917	27	299	1055	111
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8			2			6
Actuated Green, G (s)	4.0	18.6	18.6	3.2	17.8	17.8	6.0	17.0	17.0	6.0	17.0	17.0
Effective Green, g (s)	4.0	18.6	18.6	3.2	17.8	17.8	6.0	17.0	17.0	6.0	17.0	17.0
Actuated g/C Ratio	0.07	0.31	0.31	0.05	0.29	0.29	0.10	0.28	0.28	0.10	0.28	0.28
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	225	1555	484	180	1488	463	492	989	442	338	1421	442
v/s Ratio Prot	c0.08	0.24		0.04	0.29		c0.13	c0.26		0.09	0.21	
v/s Ratio Perm			c0.36			0.04			0.02			0.07
v/c Ratio	1.24	0.80	1.19	0.74	0.98	0.13	1.36	0.93	0.06	0.88	0.74	0.25
Uniform Delay, d1	28.4	19.4	21.1	28.4	21.4	15.8	27.4	21.3	16.1	27.1	19.9	17.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	141.6	2.9	105.1	15.3	19.3	0.1	173.8	14.1	0.1	22.9	2.1	0.3
Delay (s)	170.0	22.3	126.2	43.7	40.6	15.9	201.2	35.4	16.1	50.0	22.0	17.3
Level of Service	F	C	F	D	D	B	F	D	B	D	C	B
Approach Delay (s)		75.0			38.0			100.2			26.6	
Approach LOS		E			D			F			C	

Intersection Summary

HCM 2000 Control Delay	61.2	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.14		
Actuated Cycle Length (s)	60.8	Sum of lost time (s)	16.0
Intersection Capacity Utilization	77.9%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
7: Hopyard Rd & Las Positas Blvd



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↖↖	↖	↖↗	↖↖	↖	↖↗	↖↖↖	↖	↖↗	↖↖↖	↖
Traffic Volume (vph)	99	253	462	591	432	50	382	982	262	76	1574	80
Future Volume (vph)	99	253	462	591	432	50	382	982	262	76	1574	80
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.95	1.00	0.97	0.95	1.00	0.97	0.91	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	3433	3539	1583	3433	5085	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	3433	3539	1583	3433	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	108	275	502	642	470	54	415	1067	285	83	1711	87
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	56
Lane Group Flow (vph)	108	275	502	642	470	54	415	1067	285	83	1711	31
Turn Type	Prot	NA	Free	Prot	NA	Free	Prot	NA	Free	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1		6
Permitted Phases			Free			Free			Free			6
Actuated Green, G (s)	4.8	12.8	87.7	17.0	25.0	87.7	11.0	37.9	87.7	4.0	30.9	30.9
Effective Green, g (s)	4.8	12.8	87.7	17.0	25.0	87.7	11.0	37.9	87.7	4.0	30.9	30.9
Actuated g/C Ratio	0.05	0.15	1.00	0.19	0.29	1.00	0.13	0.43	1.00	0.05	0.35	0.35
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	187	516	1583	665	1008	1583	430	2197	1583	156	1791	557
v/s Ratio Prot	0.03	0.08		c0.19	c0.13		c0.12	0.21		0.02	c0.34	
v/s Ratio Perm			0.32			0.03			0.18			0.02
v/c Ratio	0.58	0.53	0.32	0.97	0.47	0.03	0.97	0.49	0.18	0.53	0.96	0.06
Uniform Delay, d1	40.5	34.7	0.0	35.1	25.8	0.0	38.2	17.9	0.0	40.9	27.7	18.8
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	4.3	1.1	0.5	26.3	0.3	0.0	34.1	0.2	0.2	3.5	12.3	0.0
Delay (s)	44.7	35.7	0.5	61.4	26.2	0.0	72.3	18.1	0.2	44.4	40.0	18.8
Level of Service	D	D	A	E	C	A	E	B	A	D	D	B
Approach Delay (s)		16.9			44.3			27.9			39.2	
Approach LOS		B			D			C			D	

Intersection Summary

HCM 2000 Control Delay	33.3	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.89		
Actuated Cycle Length (s)	87.7	Sum of lost time (s)	16.0
Intersection Capacity Utilization	78.5%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
8: Willow Rd & Owens Rd

BART to Livermore Extension Project
2040 DMU + INP + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔↔	↕↕↔		↔↔	↕↕↕	↔	↔	↕↕	↔	↔	↕	↔
Traffic Volume (vph)	109	805	202	96	721	73	193	71	0	217	82	201
Future Volume (vph)	109	805	202	96	721	73	193	71	0	217	82	201
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	5.3	4.0		5.3	4.0	4.0
Lane Util. Factor	0.97	0.91		0.97	0.91	1.00	1.00	0.95		1.00	1.00	1.00
Frt	1.00	0.97		1.00	1.00	0.85	1.00	1.00		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	4932		3433	5085	1583	1770	3539		1770	1863	1583
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.69	1.00		0.70	1.00	1.00
Satd. Flow (perm)	3433	4932		3433	5085	1583	1289	3539		1312	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	118	875	220	104	784	79	210	77	0	236	89	218
RTOR Reduction (vph)	0	29	0	0	0	35	0	0	0	0	0	163
Lane Group Flow (vph)	118	1066	0	104	784	44	210	77	0	236	89	55
Turn Type	Prot	NA		Prot	NA	Perm	Perm	NA	Perm	Perm	NA	Perm
Protected Phases	1	6		5	2			4				8
Permitted Phases						2	4		4	8		8
Actuated Green, G (s)	9.1	59.9		8.7	59.5	59.5	26.4	26.4		26.4	26.4	26.4
Effective Green, g (s)	9.1	61.6		8.7	61.2	61.2	26.4	27.7		26.4	27.7	27.7
Actuated g/C Ratio	0.08	0.56		0.08	0.56	0.56	0.24	0.25		0.24	0.25	0.25
Clearance Time (s)	4.0	5.7		4.0	5.7	5.7	5.3	5.3		5.3	5.3	5.3
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	284	2761		271	2829	880	309	891		314	469	398
v/s Ratio Prot	0.03	c0.22		c0.03	0.15			0.02				0.05
v/s Ratio Perm						0.03	0.16			c0.18		0.03
v/c Ratio	0.42	0.39		0.38	0.28	0.05	0.68	0.09		0.75	0.19	0.14
Uniform Delay, d1	47.9	13.6		48.1	12.8	11.1	38.0	31.5		38.8	32.3	31.9
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	1.0	0.4		0.9	0.2	0.1	5.8	0.0		9.7	0.2	0.2
Delay (s)	48.9	14.0		49.0	13.0	11.2	43.8	31.5		48.5	32.5	32.1
Level of Service	D	B		D	B	B	D	C		D	C	C
Approach Delay (s)		17.4			16.8			40.5			39.3	
Approach LOS		B			B			D			D	

Intersection Summary

HCM 2000 Control Delay	23.3	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.48		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	52.1%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
9: Hacienda Dr & Dublin Blvd

BART to Livermore Extension Project
2040 DMU + INP + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↑↑↑	↖↗	↖↗	↑↑↑		↖↗	↑↑	↖↗	↖↗	↑↑↑	↖↗
Traffic Volume (vph)	49	1014	205	246	627	22	511	676	555	30	704	222
Future Volume (vph)	49	1014	205	246	627	22	511	676	555	30	704	222
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	6.0	5.0	4.5	6.0		5.0	6.0	6.0	4.5	5.5	5.5
Lane Util. Factor	0.97	0.91	0.88	0.97	0.91		0.94	0.95	0.88	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5085	2787	3433	5059		4990	3539	2787	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5085	2787	3433	5059		4990	3539	2787	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	53	1102	223	267	682	24	555	735	603	33	765	241
RTOR Reduction (vph)	0	0	63	0	3	0	0	0	194	0	0	152
Lane Group Flow (vph)	53	1102	160	267	703	0	555	735	409	33	765	89
Turn Type	Prot	NA	pm+ov	Prot	NA		Prot	NA	Perm	Prot	NA	Perm
Protected Phases	5	2	3	1	6		3	8		7		4
Permitted Phases			2						8			4
Actuated Green, G (s)	4.1	30.7	43.1	9.5	36.1		12.4	34.2	34.2	2.1	23.9	23.9
Effective Green, g (s)	4.1	30.7	43.1	9.5	36.1		12.4	34.2	34.2	2.1	23.9	23.9
Actuated g/C Ratio	0.04	0.31	0.44	0.10	0.37		0.13	0.35	0.35	0.02	0.25	0.25
Clearance Time (s)	4.5	6.0	5.0	4.5	6.0		5.0	6.0	6.0	4.5	5.5	5.5
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	144	1601	1374	334	1873		634	1241	977	73	1246	388
v/s Ratio Prot	0.02	c0.22	0.01	c0.08	0.14		c0.11	0.21		0.01	c0.15	
v/s Ratio Perm			0.04						0.15			0.06
v/c Ratio	0.37	0.69	0.12	0.80	0.38		0.88	0.59	0.42	0.45	0.61	0.23
Uniform Delay, d1	45.4	29.2	16.0	43.1	22.5		41.8	25.9	24.1	47.1	32.7	29.4
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.6	1.3	0.0	12.6	0.1		12.9	0.8	0.3	4.4	0.9	0.3
Delay (s)	47.0	30.5	16.0	55.6	22.6		54.6	26.7	24.4	51.5	33.6	29.7
Level of Service	D	C	B	E	C		D	C	C	D	C	C
Approach Delay (s)		28.8			31.6			34.2			33.3	
Approach LOS		C			C			C			C	

Intersection Summary

HCM 2000 Control Delay	32.1	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.71		
Actuated Cycle Length (s)	97.5	Sum of lost time (s)	21.0
Intersection Capacity Utilization	67.4%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 10: Hacienda Dr & Martinelli Blvd/Hacienda Crossings

BART to Livermore Extension Project
 2040 DMU + INP + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗	↖↗	↖↗	↗		↖↗↘	↖↗↘	↖	↖↗	↖↗↘	
Traffic Volume (vph)	35	54	477	289	32	26	413	1713	461	62	1070	74
Future Volume (vph)	35	54	477	289	32	26	413	1713	461	62	1070	74
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	2.0	2.0	4.5	2.0		3.0	2.0	2.0	4.5	2.5	
Lane Util. Factor	1.00	0.91	0.91	0.97	1.00		0.94	0.91	1.00	0.97	0.86	
Frt	1.00	0.93	0.85	1.00	0.93		1.00	1.00	0.85	1.00	0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1770	1576	2882	3433	1739		4990	5085	1583	3433	6346	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1770	1576	2882	3433	1739		4990	5085	1583	3433	6346	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	38	59	518	314	35	28	449	1862	501	67	1163	80
RTOR Reduction (vph)	0	37	264	0	21	0	0	0	159	0	7	0
Lane Group Flow (vph)	38	74	202	314	42	0	449	1862	342	67	1236	0
Turn Type	Prot	NA	Perm	Prot	NA		Prot	NA	pm+ov	Prot	NA	
Protected Phases	5	2		1	6		3	8	1	7	4	
Permitted Phases			2						8			
Actuated Green, G (s)	3.6	16.6	16.6	14.1	27.1		12.7	56.9	71.0	6.4	50.6	
Effective Green, g (s)	3.1	18.6	18.6	13.6	29.1		13.7	58.9	75.0	5.9	52.1	
Actuated g/C Ratio	0.03	0.17	0.17	0.12	0.26		0.12	0.54	0.68	0.05	0.47	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	4.0	4.0	2.0	4.0		3.0	4.0	2.0	3.0	4.0	
Lane Grp Cap (vph)	49	266	487	424	460		621	2722	1108	184	3005	
v/s Ratio Prot	0.02	0.05		c0.09	0.02		0.09	c0.37	0.05	0.02	c0.19	
v/s Ratio Perm			c0.07						0.17			
v/c Ratio	0.78	0.28	0.41	0.74	0.09		0.72	0.68	0.31	0.36	0.41	
Uniform Delay, d1	53.1	39.9	40.8	46.5	30.5		46.3	18.7	7.1	50.2	18.9	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.03	1.06	2.02	1.00	1.00	
Incremental Delay, d2	53.1	0.8	0.8	6.0	0.1		2.8	0.9	0.0	1.2	0.4	
Delay (s)	106.2	40.6	41.6	52.5	30.6		50.6	20.8	14.3	51.5	19.3	
Level of Service	F	D	D	D	C		D	C	B	D	B	
Approach Delay (s)		45.4			48.8			24.4			21.0	
Approach LOS		D			D			C			C	

Intersection Summary		
HCM 2000 Control Delay	27.8	HCM 2000 Level of Service C
HCM 2000 Volume to Capacity ratio	0.63	
Actuated Cycle Length (s)	110.0	Sum of lost time (s) 13.0
Intersection Capacity Utilization	70.5%	ICU Level of Service C
Analysis Period (min)	15	

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 11: Hacienda Dr & I-580 WB Ramps

BART to Livermore Extension Project
 2040 DMU + INP + Garage PM


























Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↔↔		↔↔		↑↑↑			↑↑↑	↔
Traffic Volume (vph)	0	0	0	420	0	468	0	1856	807	0	1002	803
Future Volume (vph)	0	0	0	420	0	468	0	1856	807	0	1002	803
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				2.6		2.6		2.1			2.1	2.1
Lane Util. Factor				0.97		0.88		0.91			0.86	0.86
Frt				1.00		0.85		0.95			0.96	0.85
Flt Protected				0.95		1.00		1.00			1.00	1.00
Satd. Flow (prot)				3433		2787		4854			4599	1362
Flt Permitted				0.95		1.00		1.00			1.00	1.00
Satd. Flow (perm)				3433		2787		4854			4599	1362
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	457	0	509	0	2017	877	0	1089	873
RTOR Reduction (vph)	0	0	0	0	0	24	0	140	0	0	130	141
Lane Group Flow (vph)	0	0	0	457	0	485	0	2754	0	0	1396	295
Turn Type				Prot		Prot		NA			NA	Perm
Protected Phases				4		4		2			6	
Permitted Phases												6
Actuated Green, G (s)				11.7		11.7		35.3			35.3	35.3
Effective Green, g (s)				13.1		13.1		37.2			37.2	37.2
Actuated g/C Ratio				0.24		0.24		0.68			0.68	0.68
Clearance Time (s)				4.0		4.0		4.0			4.0	4.0
Vehicle Extension (s)				3.0		3.0		3.0			3.0	3.0
Lane Grp Cap (vph)				817		663		3283			3110	921
v/s Ratio Prot				0.13		c0.17		c0.57			0.30	
v/s Ratio Perm												0.22
v/c Ratio				0.56		0.73		0.84			0.45	0.32
Uniform Delay, d1				18.4		19.3		6.7			4.1	3.7
Progression Factor				1.00		1.00		0.85			0.61	1.27
Incremental Delay, d2				0.8		4.2		1.6			0.4	0.8
Delay (s)				19.2		23.5		7.2			3.0	5.5
Level of Service				B		C		A			A	A
Approach Delay (s)		0.0			21.5			7.2			3.5	
Approach LOS		A			C			A			A	

Intersection Summary		
HCM 2000 Control Delay	8.3	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.80	A
Actuated Cycle Length (s)	55.0	Sum of lost time (s)
Intersection Capacity Utilization	76.9%	4.7
Analysis Period (min)	15	ICU Level of Service
		D

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
12: Hacienda Dr & I-580 EB Ramps

BART to Livermore Extension Project
2040 DMU + INP + Garage PM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 		 					  			  	
Traffic Volume (vph)	932	0	555	0	0	0	0	1897	582	0	995	313
Future Volume (vph)	932	0	555	0	0	0	0	1897	582	0	995	313
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0					4.0	4.0		4.0	
Lane Util. Factor	0.97		0.88					0.86	0.86		0.91	
Frt	1.00		0.85					0.99	0.85		0.96	
Flt Protected	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (prot)	3433		2787					4743	1362		4903	
Flt Permitted	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (perm)	3433		2787					4743	1362		4903	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	1013	0	603	0	0	0	0	2062	633	0	1082	340
RTOR Reduction (vph)	0	0	93	0	0	0	0	9	183	0	49	0
Lane Group Flow (vph)	1013	0	510	0	0	0	0	2249	254	0	1373	0
Turn Type	Prot		Prot					NA	Perm		NA	
Protected Phases	4		4					2			6	
Permitted Phases									2			
Actuated Green, G (s)	36.7		36.7					62.0	62.0		62.0	
Effective Green, g (s)	38.1		38.1					63.9	63.9		63.9	
Actuated g/C Ratio	0.35		0.35					0.58	0.58		0.58	
Clearance Time (s)	5.4		5.4					5.9	5.9		5.9	
Vehicle Extension (s)	2.0		2.0					2.0	2.0		2.0	
Lane Grp Cap (vph)	1189		965					2755	791		2848	
v/s Ratio Prot	c0.30		0.18					c0.47			0.28	
v/s Ratio Perm									0.19			
v/c Ratio	0.85		0.53					0.82	0.32		0.48	
Uniform Delay, d1	33.3		28.8					18.4	11.9		13.4	
Progression Factor	1.00		1.00					1.00	1.00		0.67	
Incremental Delay, d2	5.8		0.2					2.8	1.1		0.5	
Delay (s)	39.2		29.0					21.2	12.9		9.5	
Level of Service	D		C					C	B		A	
Approach Delay (s)		35.4			0.0			19.8			9.5	
Approach LOS		D			A			B			A	
Intersection Summary												
HCM 2000 Control Delay			21.7					HCM 2000 Level of Service			C	
HCM 2000 Volume to Capacity ratio			0.83									
Actuated Cycle Length (s)			110.0					Sum of lost time (s)			8.0	
Intersection Capacity Utilization			74.2%					ICU Level of Service			D	
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis
13: Hacienda Dr & Owens Rd

BART to Livermore Extension Project
2040 DMU + INP + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↑↑↑	↖	↖↗	↑↑↑	↖	↖↗	↑↑↑	↖	↖↗	↑↑↑	↖
Traffic Volume (vph)	644	927	48	143	360	931	25	735	274	704	537	294
Future Volume (vph)	644	927	48	143	360	931	25	735	274	704	537	294
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	2.3	4.0	4.0	2.3	4.0	4.0	2.7	4.0	4.0	2.7
Lane Util. Factor	0.97	0.91	1.00	0.97	0.91	1.00	0.97	0.91	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5085	1583	3433	5085	1583	3433	5085	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5085	1583	3433	5085	1583	3433	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	700	1008	52	155	391	1012	27	799	298	765	584	320
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	700	1008	52	155	391	1012	27	799	298	765	584	320
Turn Type	Prot	NA	Free	Prot	NA	Free	Prot	NA	Free	Prot	NA	Free
Protected Phases	1	6		5	2		7	4		3	8	
Permitted Phases			Free			Free			Free			Free
Actuated Green, G (s)	31.6	37.3	115.0	8.7	14.4	115.0	2.4	24.1	115.0	25.9	47.6	115.0
Effective Green, g (s)	31.6	39.0	115.0	8.7	16.1	115.0	2.4	25.4	115.0	25.9	48.9	115.0
Actuated g/C Ratio	0.27	0.34	1.00	0.08	0.14	1.00	0.02	0.22	1.00	0.23	0.43	1.00
Clearance Time (s)	4.0	5.7		4.0	5.7		4.0	5.3		4.0	5.3	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	943	1724	1583	259	711	1583	71	1123	1583	773	2162	1583
v/s Ratio Prot	c0.20	0.20		0.05	0.08		0.01	c0.16		c0.22	0.11	
v/s Ratio Perm			0.03			c0.64			0.19			0.20
v/c Ratio	0.74	0.58	0.03	0.60	0.55	0.64	0.38	0.71	0.19	0.99	0.27	0.20
Uniform Delay, d1	38.0	31.3	0.0	51.5	46.1	0.0	55.6	41.4	0.0	44.4	21.5	0.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	3.2	0.5	0.0	3.7	0.9	2.0	3.4	3.8	0.3	29.4	0.3	0.3
Delay (s)	41.2	31.8	0.0	55.2	46.9	2.0	58.9	45.3	0.3	73.9	21.8	0.3
Level of Service	D	C	A	E	D	A	E	D	A	E	C	A
Approach Delay (s)		34.6			18.6			33.7			41.5	
Approach LOS		C			B			C			D	

Intersection Summary

HCM 2000 Control Delay	32.2	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.82		
Actuated Cycle Length (s)	115.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	72.9%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 14: Tassajara Rd & Dublin Blvd

BART to Livermore Extension Project
 2040 DMU + INP + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔↔	↑↑↑	↔↔	↔↔↔	↑↑↑		↔↔↔	↑↑↑	↔	↔↔	↑↑↑	↔↔
Traffic Volume (vph)	263	985	453	292	366	24	422	966	639	37	803	148
Future Volume (vph)	263	985	453	292	366	24	422	966	639	37	803	148
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	6.0	6.0	5.0	6.0		5.0	6.0	6.0	5.0	5.7	5.7
Lane Util. Factor	0.97	0.86	0.88	0.94	0.91		0.94	0.86	1.00	0.97	0.86	0.88
Frt	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	6408	2787	4990	5039		4990	6408	1583	3433	6408	2787
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	6408	2787	4990	5039		4990	6408	1583	3433	6408	2787
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	286	1071	492	317	398	26	459	1050	695	40	873	161
RTOR Reduction (vph)	0	0	290	0	5	0	0	0	231	0	0	128
Lane Group Flow (vph)	286	1071	202	317	419	0	459	1050	464	40	873	33
Turn Type	Prot	NA	Perm	Prot	NA		Prot	NA	Perm	Prot	NA	Perm
Protected Phases	5	2		1	6		3	8		7		4
Permitted Phases			2						8			4
Actuated Green, G (s)	16.5	37.8	37.8	16.5	37.8		31.7	48.4	48.4	11.2	28.2	28.2
Effective Green, g (s)	16.5	37.8	37.8	16.5	37.8		31.7	48.4	48.4	11.2	28.2	28.2
Actuated g/C Ratio	0.12	0.28	0.28	0.12	0.28		0.23	0.36	0.36	0.08	0.21	0.21
Clearance Time (s)	5.0	6.0	6.0	5.0	6.0		5.0	6.0	6.0	5.0	5.7	5.7
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	416	1782	775	605	1401		1163	2282	563	282	1329	578
v/s Ratio Prot	c0.08	c0.17		0.06	0.08		c0.09	0.16		0.01	0.14	
v/s Ratio Perm			0.07						c0.29			0.01
v/c Ratio	0.69	0.60	0.26	0.52	0.30		0.39	0.46	0.82	0.14	0.66	0.06
Uniform Delay, d1	57.2	42.5	38.2	56.0	38.6		44.0	33.7	39.9	57.9	49.4	43.2
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	4.7	0.6	0.2	0.8	0.1		0.2	0.1	9.5	0.2	1.2	0.0
Delay (s)	61.9	43.1	38.4	56.8	38.7		44.2	33.8	49.4	58.1	50.6	43.2
Level of Service	E	D	D	E	D		D	C	D	E	D	D
Approach Delay (s)		44.7			46.5			40.9			49.8	
Approach LOS		D			D			D			D	

Intersection Summary			
HCM 2000 Control Delay	44.4	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.70		
Actuated Cycle Length (s)	135.9	Sum of lost time (s)	22.0
Intersection Capacity Utilization	80.5%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 15: Tassajara Rd & I-580 WB Ramps

BART to Livermore Extension Project
 2040 DMU + INP + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↔↔		↔↔		↑↑	↔		↑↑↔	↔
Traffic Volume (vph)	0	0	0	601	0	229	0	1701	712	0	1339	629
Future Volume (vph)	0	0	0	601	0	229	0	1701	712	0	1339	629
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0		4.0		4.0	4.0		4.0	4.0
Lane Util. Factor				0.97		0.88		0.95	1.00		0.86	0.86
Frt				1.00		0.85		1.00	0.85		0.98	0.85
Flt Protected				0.95		1.00		1.00	1.00		1.00	1.00
Satd. Flow (prot)				3433		2787		3539	1583		4717	1362
Flt Permitted				0.95		1.00		1.00	1.00		1.00	1.00
Satd. Flow (perm)				3433		2787		3539	1583		4717	1362
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	653	0	249	0	1849	774	0	1455	684
RTOR Reduction (vph)	0	0	0	0	0	15	0	0	321	0	29	199
Lane Group Flow (vph)	0	0	0	653	0	234	0	1849	453	0	1631	280
Turn Type				Perm		Perm		NA	Perm		NA	Perm
Protected Phases								2			6	
Permitted Phases				8		8			2			6
Actuated Green, G (s)				14.8		14.8		32.2	32.2		32.2	32.2
Effective Green, g (s)				14.8		14.8		32.2	32.2		32.2	32.2
Actuated g/C Ratio				0.27		0.27		0.59	0.59		0.59	0.59
Clearance Time (s)				4.0		4.0		4.0	4.0		4.0	4.0
Vehicle Extension (s)				3.0		3.0		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)				923		749		2071	926		2761	797
v/s Ratio Prot								c0.52			0.35	
v/s Ratio Perm				c0.19		0.08			0.29			0.21
v/c Ratio				0.71		0.31		0.89	0.49		0.59	0.35
Uniform Delay, d1				18.1		16.0		9.9	6.6		7.2	6.0
Progression Factor				1.00		1.00		1.00	1.00		1.00	1.00
Incremental Delay, d2				2.5		0.2		6.4	1.8		0.9	1.2
Delay (s)				20.6		16.3		16.3	8.5		8.2	7.2
Level of Service				C		B		B	A		A	A
Approach Delay (s)		0.0			19.4			14.0			7.9	
Approach LOS		A			B			B			A	

Intersection Summary			
HCM 2000 Control Delay	12.6	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.83		
Actuated Cycle Length (s)	55.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	70.8%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 16: Santa Rita Rd & I-580 EB Ramps/Pimilco Dr

BART to Livermore Extension Project
 2040 DMU + INP + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	441	83	264	142	0	316	0	1616	200	318	1152	0
Future Volume (vph)	441	83	264	142	0	316	0	1616	200	318	1152	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0		4.0		4.0		4.0	4.0	
Lane Util. Factor	0.97	1.00	1.00	0.97		0.88		0.86		1.00	0.95	
Frt	1.00	1.00	0.85	1.00		0.85		0.98		1.00	1.00	
Flt Protected	0.95	1.00	1.00	0.95		1.00		1.00		0.95	1.00	
Satd. Flow (prot)	3433	1863	1583	3433		2787		6302		1770	3539	
Flt Permitted	0.95	1.00	1.00	0.95		1.00		1.00		0.95	1.00	
Satd. Flow (perm)	3433	1863	1583	3433		2787		6302		1770	3539	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	479	90	287	154	0	343	0	1757	217	346	1252	0
RTOR Reduction (vph)	0	0	73	0	0	35	0	19	0	0	0	0
Lane Group Flow (vph)	479	90	214	154	0	308	0	1955	0	346	1252	0
Turn Type	Perm	NA	Perm	Prot		pm+ov		NA		Prot	NA	Perm
Protected Phases		4		3		1		2		1	6	
Permitted Phases	4		4			3						6
Actuated Green, G (s)	19.3	19.3	19.3	7.6		32.4		42.3		24.8	71.1	
Effective Green, g (s)	19.3	19.3	19.3	7.6		32.4		42.3		24.8	71.1	
Actuated g/C Ratio	0.18	0.18	0.18	0.07		0.29		0.38		0.23	0.65	
Clearance Time (s)	4.0	4.0	4.0	4.0		4.0		4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0		3.0		3.0		3.0	3.0	
Lane Grp Cap (vph)	602	326	277	237		820		2423		399	2287	
v/s Ratio Prot		0.05		c0.04		0.08		c0.31		c0.20	0.35	
v/s Ratio Perm	c0.14		0.13			0.03						
v/c Ratio	0.80	0.28	0.77	0.65		0.38		0.81		0.87	0.55	
Uniform Delay, d1	43.5	39.3	43.2	49.9		30.8		30.2		41.0	10.6	
Progression Factor	1.00	1.00	1.00	1.00		1.00		1.00		1.00	1.00	
Incremental Delay, d2	7.2	0.5	12.5	6.0		0.3		3.0		17.6	0.9	
Delay (s)	50.7	39.8	55.7	55.9		31.1		33.2		58.7	11.6	
Level of Service	D	D	E	E		C		C		E	B	
Approach Delay (s)		51.2			38.8			33.2			21.8	
Approach LOS		D			D			C			C	

Intersection Summary

HCM 2000 Control Delay	33.2	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.81		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	67.0%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 17: Santa Rita Rd & Valley Ave

BART to Livermore Extension Project
 2040 DMU + INP + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	368	714	125	139	379	793	146	628	155	1386	1103	276
Future Volume (vph)	368	714	125	139	379	793	146	628	155	1386	1103	276
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.97	0.95		0.97	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.97		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	3433	3434		3433	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	3433	3434		3433	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	400	776	136	151	412	862	159	683	168	1507	1199	300
RTOR Reduction (vph)	0	0	96	0	0	0	0	18	0	0	0	127
Lane Group Flow (vph)	400	776	40	151	412	862	159	833	0	1507	1199	173
Turn Type	Prot	NA	Perm	Prot	NA	Free	Prot	NA		Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1		6
Permitted Phases			4			Free						6
Actuated Green, G (s)	14.0	22.0	22.0	8.0	16.0	120.0	9.5	30.0		44.0	64.5	64.5
Effective Green, g (s)	14.0	22.0	22.0	8.0	16.0	120.0	9.5	30.0		44.0	64.5	64.5
Actuated g/C Ratio	0.12	0.18	0.18	0.07	0.13	1.00	0.08	0.25		0.37	0.54	0.54
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	400	648	290	118	471	1583	271	858		1258	1902	850
v/s Ratio Prot	c0.12	c0.22		c0.09	0.12		0.05	c0.24		c0.44	0.34	
v/s Ratio Perm			0.03			0.54						0.11
v/c Ratio	1.00	1.20	0.14	1.28	0.87	0.54	0.59	0.97		1.20	0.63	0.20
Uniform Delay, d1	53.0	49.0	41.0	56.0	51.0	0.0	53.4	44.6		38.0	19.4	14.4
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	45.0	103.4	0.2	175.8	16.4	1.4	3.2	23.7		97.0	0.7	0.1
Delay (s)	98.0	152.4	41.3	231.8	67.4	1.4	56.6	68.3		135.0	20.1	14.5
Level of Service	F	F	D	F	E	A	E	E		F	C	B
Approach Delay (s)		124.3			44.9			66.4			77.2	
Approach LOS		F			D			E			E	

Intersection Summary

HCM 2000 Control Delay	77.9	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.14		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	102.6%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
18: Bernal Ave/Valley Ave & Stanley Blvd

BART to Livermore Extension Project
2040 DMU + INP + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	223	830	58	93	235	349	96	367	308	824	551	131
Future Volume (vph)	223	830	58	93	235	349	96	367	308	824	551	131
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.95	1.00	0.97	0.91	0.91	1.00	0.95	1.00	0.97	0.95	0.95
Frt	1.00	1.00	0.85	1.00	0.94	0.85	1.00	1.00	0.85	1.00	0.97	0.97
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	3433	3178	1441	1770	3539	1583	3433	3437	3437
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	3433	3178	1441	1770	3539	1583	3433	3437	3437
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	242	902	63	101	255	379	104	399	335	896	599	142
RTOR Reduction (vph)	0	0	39	0	126	54	0	0	167	0	22	0
Lane Group Flow (vph)	242	902	24	101	311	143	104	399	168	896	719	0
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	NA
Protected Phases	7	4	5	3	8	1	5	2		1	6	
Permitted Phases			4			8			2			
Actuated Green, G (s)	10.2	24.9	32.6	3.0	17.7	43.0	7.7	16.0	16.0	25.3	33.6	
Effective Green, g (s)	10.2	24.9	32.6	3.0	17.7	43.0	7.7	16.0	16.0	25.3	33.6	
Actuated g/C Ratio	0.12	0.29	0.38	0.04	0.21	0.50	0.09	0.19	0.19	0.30	0.39	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	410	1034	680	120	660	794	159	664	297	1019	1355	
v/s Ratio Prot	c0.07	c0.25	0.00	0.03	0.10	0.05	0.06	0.11		c0.26	c0.21	
v/s Ratio Perm			0.01			0.05			0.11			
v/c Ratio	0.59	0.87	0.04	0.84	0.47	0.18	0.65	0.60	0.56	0.88	0.53	
Uniform Delay, d1	35.5	28.6	16.5	40.9	29.6	11.5	37.5	31.7	31.4	28.5	19.8	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	2.3	8.2	0.0	38.5	0.5	0.1	9.3	1.5	2.5	8.8	0.4	
Delay (s)	37.8	36.9	16.5	79.4	30.2	11.6	46.8	33.2	33.9	37.3	20.2	
Level of Service	D	D	B	E	C	B	D	C	C	D	C	
Approach Delay (s)		36.0			32.0			35.2			29.5	
Approach LOS		D			C			D			C	

Intersection Summary		
HCM 2000 Control Delay	32.8	HCM 2000 Level of Service C
HCM 2000 Volume to Capacity ratio	0.82	
Actuated Cycle Length (s)	85.2	Sum of lost time (s) 16.0
Intersection Capacity Utilization	75.5%	ICU Level of Service D
Analysis Period (min)	15	

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
19: Fallon Rd & Dublin Blvd/Croak Rd

BART to Livermore Extension Project
2040 DMU + INP + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↑↑↑	↖↗	↖↗↘	↑↑↑	↖	↖↗↘	↑↑↑	↖↗	↖↗	↑↑↑	↖
Traffic Volume (vph)	169	669	422	107	29	96	260	879	333	133	641	22
Future Volume (vph)	169	669	422	107	29	96	260	879	333	133	641	22
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.91	0.88	0.94	0.91	1.00	0.94	0.91	0.88	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5085	2787	4990	5085	1583	4990	5085	2787	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5085	2787	4990	5085	1583	4990	5085	2787	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	184	727	459	116	32	104	283	955	362	145	697	24
RTOR Reduction (vph)	0	0	73	0	0	93	0	0	186	0	0	13
Lane Group Flow (vph)	184	727	386	116	32	11	283	955	176	145	697	11
Turn Type	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4	5	3	8		5	2		1	6	
Permitted Phases			4			8			2			6
Actuated Green, G (s)	18.7	23.3	35.6	7.4	12.0	12.0	12.3	53.6	53.6	9.7	51.0	51.0
Effective Green, g (s)	18.7	23.3	35.6	7.4	12.0	12.0	12.3	53.6	53.6	9.7	51.0	51.0
Actuated g/C Ratio	0.17	0.21	0.32	0.07	0.11	0.11	0.11	0.49	0.49	0.09	0.46	0.46
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	583	1077	1003	335	554	172	557	2477	1358	302	2357	733
v/s Ratio Prot	0.05	c0.14	0.04	c0.02	0.01		c0.06	c0.19		c0.04	0.14	
v/s Ratio Perm			0.10			0.01			0.06			0.01
v/c Ratio	0.32	0.68	0.38	0.35	0.06	0.07	0.51	0.39	0.13	0.48	0.30	0.02
Uniform Delay, d1	40.0	39.9	28.7	49.0	43.9	44.0	46.0	17.8	15.4	47.7	18.3	15.9
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.02	0.90	1.70	1.00	1.00	1.00
Incremental Delay, d2	0.3	1.7	0.2	0.6	0.0	0.2	0.7	0.4	0.2	1.2	0.3	0.0
Delay (s)	40.4	41.6	29.0	49.6	44.0	44.1	47.6	16.4	26.5	49.0	18.7	16.0
Level of Service	D	D	C	D	D	D	D	B	C	D	B	B
Approach Delay (s)		37.2			46.6			24.2			23.7	
Approach LOS		D			D			C			C	

Intersection Summary

HCM 2000 Control Delay	29.8	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.47		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	50.4%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 20: El Charro Rd/Fallon Rd & I-580 WB Ramps

BART to Livermore Extension Project
 2040 DMU + INP + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↖	↖	↖↖		↑↑↑	↖		↑↑↑	↖
Traffic Volume (vph)	0	0	0	724	0	535	0	1025	245	0	876	397
Future Volume (vph)	0	0	0	724	0	535	0	1025	245	0	876	397
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0	4.0	4.0		4.0	4.0		4.0	4.0
Lane Util. Factor				0.95	0.95	0.88		0.91	1.00		0.91	1.00
Frt				1.00	1.00	0.85		1.00	0.85		1.00	0.85
Flt Protected				0.95	0.95	1.00		1.00	1.00		1.00	1.00
Satd. Flow (prot)				1681	1681	2787		5085	1583		5085	1583
Flt Permitted				0.95	0.95	1.00		1.00	1.00		1.00	1.00
Satd. Flow (perm)				1681	1681	2787		5085	1583		5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	787	0	582	0	1114	266	0	952	432
RTOR Reduction (vph)	0	0	0	0	0	41	0	0	126	0	0	205
Lane Group Flow (vph)	0	0	0	401	386	541	0	1114	140	0	952	227
Turn Type				Perm	NA	Perm		NA	Perm		NA	Perm
Protected Phases					8			2			6	
Permitted Phases				8		8			2			6
Actuated Green, G (s)				18.6	18.6	18.6		28.9	28.9		28.9	28.9
Effective Green, g (s)				18.1	18.1	18.1		28.9	28.9		28.9	28.9
Actuated g/C Ratio				0.33	0.33	0.33		0.53	0.53		0.53	0.53
Clearance Time (s)				3.5	3.5	3.5		4.0	4.0		4.0	4.0
Vehicle Extension (s)				2.0	2.0	2.0		2.0	2.0		2.0	2.0
Lane Grp Cap (vph)				553	553	917		2671	831		2671	831
v/s Ratio Prot								c0.22			0.19	
v/s Ratio Perm				c0.24	0.23	0.19			0.09			0.14
v/c Ratio				0.73	0.70	0.59		0.42	0.17		0.36	0.27
Uniform Delay, d1				16.3	16.1	15.4		7.9	6.8		7.6	7.2
Progression Factor				1.00	1.00	1.00		0.87	1.06		0.56	0.56
Incremental Delay, d2				4.0	3.1	0.7		0.3	0.3		0.4	0.8
Delay (s)				20.3	19.2	16.0		7.2	7.4		4.7	4.8
Level of Service				C	B	B		A	A		A	A
Approach Delay (s)		0.0			18.2			7.2			4.7	
Approach LOS		A			B			A			A	

Intersection Summary			
HCM 2000 Control Delay	10.0	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.54		
Actuated Cycle Length (s)	55.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	51.3%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 21: El Charro Rd & I-580 EB Ramps

BART to Livermore Extension Project
 2040 DMU + INP + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗		↖↗					↕↔	↖		↕↔	↖
Traffic Volume (vph)	337	0	428	0	0	0	0	1702	281	0	1840	0
Future Volume (vph)	337	0	428	0	0	0	0	1702	281	0	1840	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0					4.0	4.0		4.0	
Lane Util. Factor	0.97		0.88					0.91	0.91		0.91	
Frt	1.00		0.85					1.00	0.85		1.00	
Flt Protected	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (prot)	3433		2787					3380	1441		3390	
Flt Permitted	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (perm)	3433		2787					3380	1441		3390	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	366	0	465	0	0	0	0	1850	305	0	2000	0
RTOR Reduction (vph)	0	0	27	0	0	0	0	2	87	0	0	0
Lane Group Flow (vph)	366	0	438	0	0	0	0	1885	181	0	2000	0
Turn Type	Prot		Perm					NA	Perm		NA	Perm
Protected Phases	4							2			6	
Permitted Phases			4						2			6
Actuated Green, G (s)	9.9		9.9					37.1	37.1		37.1	
Effective Green, g (s)	9.9		9.9					37.1	37.1		37.1	
Actuated g/C Ratio	0.18		0.18					0.67	0.67		0.67	
Clearance Time (s)	4.0		4.0					4.0	4.0		4.0	
Vehicle Extension (s)	2.0		2.0					3.0	3.0		3.0	
Lane Grp Cap (vph)	617		501					2279	972		2286	
v/s Ratio Prot	0.11							0.56			c0.59	
v/s Ratio Perm			c0.16						0.13			
v/c Ratio	0.59		0.87					0.83	0.19		0.87	
Uniform Delay, d1	20.7		21.9					6.6	3.3		7.1	
Progression Factor	1.00		1.00					1.00	1.00		1.22	
Incremental Delay, d2	1.0		15.1					3.6	0.4		4.8	
Delay (s)	21.7		37.0					10.2	3.8		13.4	
Level of Service	C		D					B	A		B	
Approach Delay (s)		30.3			0.0			9.4			13.4	
Approach LOS		C			A			A			B	

Intersection Summary

HCM 2000 Control Delay	14.5	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.87		
Actuated Cycle Length (s)	55.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	72.5%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 22: El Charro Rd & Stoneridge Dr/Jack London Blvd

BART to Livermore Extension Project
 2040 DMU + INP + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔↔↔	↑↑	↗	↖	↑↑	↗↗	↖	↑↑		↖↖↖	↑	↗↗
Traffic Volume (vph)	196	581	59	108	332	746	18	552	60	875	483	78
Future Volume (vph)	196	581	59	108	332	746	18	552	60	875	483	78
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	0.94	0.95	1.00	1.00	0.95	0.88	1.00	0.95		0.94	1.00	0.88
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	4491	3185	1425	1593	3185	2508	1593	3139		4491	1676	2508
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	4491	3185	1425	1593	3185	2508	1593	3139		4491	1676	2508
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	213	632	64	117	361	811	20	600	65	951	525	85
RTOR Reduction (vph)	0	0	49	0	0	84	0	13	0	0	0	46
Lane Group Flow (vph)	213	632	15	117	361	727	20	652	0	951	525	39
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Prot	NA		Prot	NA	Perm
Protected Phases	7	4		3	8	1	5	2		1	6	
Permitted Phases			4			8						6
Actuated Green, G (s)	6.0	15.4	15.4	4.0	13.4	29.6	0.8	15.5		16.2	30.9	30.9
Effective Green, g (s)	6.0	15.4	15.4	4.0	13.4	29.6	0.8	15.5		16.2	30.9	30.9
Actuated g/C Ratio	0.09	0.23	0.23	0.06	0.20	0.44	0.01	0.23		0.24	0.46	0.46
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	401	730	327	94	636	1106	18	725		1084	771	1154
v/s Ratio Prot	0.05	c0.20		c0.07	0.11	0.16	0.01	c0.21		c0.21	0.31	
v/s Ratio Perm			0.01			0.13						0.02
v/c Ratio	0.53	0.87	0.04	1.24	0.57	0.66	1.11	0.90		0.88	0.68	0.03
Uniform Delay, d1	29.2	24.9	20.1	31.5	24.2	14.8	33.1	25.0		24.5	14.2	9.9
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	1.4	10.5	0.1	172.3	1.2	1.4	250.0	14.0		8.2	2.5	0.0
Delay (s)	30.6	35.4	20.2	203.9	25.4	16.2	283.2	39.0		32.7	16.7	9.9
Level of Service	C	D	C	F	C	B	F	D		C	B	A
Approach Delay (s)		33.2			35.8			46.1			26.1	
Approach LOS		C			D			D			C	

Intersection Summary

HCM 2000 Control Delay	33.4	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.91		
Actuated Cycle Length (s)	67.1	Sum of lost time (s)	16.0
Intersection Capacity Utilization	75.4%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 23: Stanley Blvd & El Charro Rd

BART to Livermore Extension Project
 2040 DMU + INP + Garage PM



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	↖	↗↗	↖↖↖	↗	↖↖	↗↗
Traffic Volume (vph)	506	2537	819	13	167	450
Future Volume (vph)	506	2537	819	13	167	450
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95	0.91	1.00	0.97	0.88
Frt	1.00	1.00	1.00	0.85	1.00	0.85
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1770	3539	5085	1583	3433	2787
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1770	3539	5085	1583	3433	2787
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	550	2758	890	14	182	489
RTOR Reduction (vph)	0	0	0	8	0	434
Lane Group Flow (vph)	550	2758	890	6	182	55
Turn Type	Prot	NA	NA	Perm	Prot	Perm
Protected Phases	7	4	8		6	
Permitted Phases				8		6
Actuated Green, G (s)	34.5	76.0	37.5	37.5	10.7	10.7
Effective Green, g (s)	34.5	76.0	37.5	37.5	10.7	10.7
Actuated g/C Ratio	0.36	0.80	0.40	0.40	0.11	0.11
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	644	2840	2013	626	387	314
v/s Ratio Prot	0.31	c0.78	0.18		c0.05	
v/s Ratio Perm				0.00		0.02
v/c Ratio	0.85	0.97	0.44	0.01	0.47	0.18
Uniform Delay, d1	27.8	8.4	20.9	17.3	39.3	38.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	10.7	11.0	0.2	0.0	0.9	0.3
Delay (s)	38.5	19.4	21.1	17.3	40.3	38.3
Level of Service	D	B	C	B	D	D
Approach Delay (s)		22.5	21.0		38.8	
Approach LOS		C	C		D	

Intersection Summary

HCM 2000 Control Delay	24.5	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.95		
Actuated Cycle Length (s)	94.7	Sum of lost time (s)	12.0
Intersection Capacity Utilization	81.6%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
24: Airway Blvd/Driveway & N Canyons Pkwy

BART to Livermore Extension Project
2040 DMU + INP + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑	↑	↑↑	↑	↑		↑	↑↑		↑	
Traffic Volume (vph)	0	734	354	1189	121	0	55	0	866	0	0	0
Future Volume (vph)	0	734	354	1189	121	0	55	0	866	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		2.0	2.0	2.0	2.0			4.2	2.0			
Lane Util. Factor		0.95	1.00	0.97	1.00			1.00	0.88			
Frt		1.00	0.85	1.00	1.00			1.00	0.85			
Flt Protected		1.00	1.00	0.95	1.00			0.95	1.00			
Satd. Flow (prot)		3539	1583	3433	1863			1770	2787			
Flt Permitted		1.00	1.00	0.95	1.00			0.95	1.00			
Satd. Flow (perm)		3539	1583	3433	1863			1770	2787			
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	798	385	1292	132	0	60	0	941	0	0	0
RTOR Reduction (vph)	0	0	274	0	0	0	0	0	318	0	0	0
Lane Group Flow (vph)	0	798	111	1292	132	0	0	60	623	0	0	0
Turn Type		NA	Perm	Prot	NA	Perm	Split	NA	pm+ov			
Protected Phases		2		1	6		8	8	1	4	4	
Permitted Phases			2			6			8			
Actuated Green, G (s)		32.6	32.6	63.9	100.5			11.5	75.4			
Effective Green, g (s)		34.6	34.6	65.9	102.5			11.3	79.4			
Actuated g/C Ratio		0.29	0.29	0.55	0.85			0.09	0.66			
Clearance Time (s)		4.0	4.0	4.0	4.0			4.0	4.0			
Vehicle Extension (s)		3.0	3.0	3.0	3.0			3.0	3.0			
Lane Grp Cap (vph)		1020	456	1885	1591			166	1890			
v/s Ratio Prot		c0.23		c0.38	0.07			0.03	c0.18			
v/s Ratio Perm			0.07						0.04			
v/c Ratio		0.78	0.24	0.69	0.08			0.36	0.33			
Uniform Delay, d1		39.2	32.7	19.6	1.4			51.0	8.8			
Progression Factor		1.00	1.00	1.00	1.00			1.00	1.00			
Incremental Delay, d2		6.0	1.3	1.0	0.1			1.3	0.1			
Delay (s)		45.2	33.9	20.6	1.5			52.3	8.9			
Level of Service		D	C	C	A			D	A			
Approach Delay (s)		41.6			18.8			11.5			0.0	
Approach LOS		D			B			B			A	

Intersection Summary

HCM 2000 Control Delay	24.2	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.70		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	12.2
Intersection Capacity Utilization	67.7%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 25: Airway Blvd & I-580 WB Ramps

BART to Livermore Extension Project
 2040 DMU + INP + Garage PM




























Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↙	↖	↗		↑↑	↗		↑↑↑	
Traffic Volume (vph)	0	0	0	311	86	238	0	762	295	0	911	735
Future Volume (vph)	0	0	0	311	86	238	0	762	295	0	911	735
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0	4.0	4.0		4.0	4.0		4.0	
Lane Util. Factor				0.95	0.95	0.88		0.95	1.00		0.91	
Frt				1.00	1.00	0.85		1.00	0.85		0.93	
Flt Protected				0.95	0.97	1.00		1.00	1.00		1.00	
Satd. Flow (prot)				1681	1715	2787		3539	1583		4745	
Flt Permitted				0.95	0.97	1.00		1.00	1.00		1.00	
Satd. Flow (perm)				1681	1715	2787		3539	1583		4745	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	338	93	259	0	828	321	0	990	799
RTOR Reduction (vph)	0	0	0	0	0	201	0	0	111	0	180	0
Lane Group Flow (vph)	0	0	0	179	252	58	0	828	210	0	1609	0
Turn Type				Split	NA	Perm		NA	Perm		NA	
Protected Phases				8	8			2			6	
Permitted Phases						8			2			
Actuated Green, G (s)				14.5	14.5	14.5		41.2	41.2		41.2	
Effective Green, g (s)				14.5	14.5	14.5		42.5	42.5		42.5	
Actuated g/C Ratio				0.22	0.22	0.22		0.65	0.65		0.65	
Clearance Time (s)				4.0	4.0	4.0		5.3	5.3		5.3	
Vehicle Extension (s)				2.0	2.0	2.0		4.0	4.0		4.0	
Lane Grp Cap (vph)				374	382	621		2313	1035		3102	
v/s Ratio Prot				0.11	c0.15			0.23			c0.34	
v/s Ratio Perm						0.02			0.13			
v/c Ratio				0.48	0.66	0.09		0.36	0.20		0.52	
Uniform Delay, d1				22.0	23.0	20.0		5.1	4.5		5.9	
Progression Factor				1.00	1.00	1.00		1.00	1.00		1.00	
Incremental Delay, d2				0.4	3.1	0.0		0.4	0.4		0.6	
Delay (s)				22.3	26.1	20.1		5.5	4.9		6.5	
Level of Service				C	C	C		A	A		A	
Approach Delay (s)		0.0			22.9			5.4			6.5	
Approach LOS		A			C			A			A	

Intersection Summary			
HCM 2000 Control Delay	9.3	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.55		
Actuated Cycle Length (s)	65.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	51.6%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
26: Airway Blvd & I-580 EB Ramps/Kitty Hawk Rd

BART to Livermore Extension Project
2040 DMU + INP + Garage PM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 							 			 	
Traffic Volume (vph)	525	174	403	79	82	121	48	456	158	135	521	457
Future Volume (vph)	525	174	403	79	82	121	48	456	158	135	521	457
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.4	4.4	4.4	4.5	2.7		4.0	2.7	
Lane Util. Factor	0.97	1.00	1.00	1.00	1.00	1.00	1.00	0.95		1.00	0.95	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.96		1.00	0.93	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	3433	1863	1583	1770	1863	1583	1770	3403		1770	3291	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	3433	1863	1583	1770	1863	1583	1770	3403		1770	3291	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	571	189	438	86	89	132	52	496	172	147	566	497
RTOR Reduction (vph)	0	0	312	0	0	102	0	42	0	0	180	0
Lane Group Flow (vph)	571	189	126	86	89	30	52	626	0	147	883	0
Turn Type	Split	NA	Perm	Split	NA	pm+ov	Prot	NA		Prot	NA	
Protected Phases	7	7		8	8	1	5	2		1	6	
Permitted Phases			7			8						
Actuated Green, G (s)	17.2	17.2	17.2	11.2	11.2	20.0	4.8	31.8		8.8	35.8	
Effective Green, g (s)	17.2	17.2	17.2	10.8	10.8	19.2	4.3	33.1		8.8	37.1	
Actuated g/C Ratio	0.20	0.20	0.20	0.13	0.13	0.23	0.05	0.39		0.10	0.44	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Vehicle Extension (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	3.5		2.0	4.0	
Lane Grp Cap (vph)	694	376	320	224	236	357	89	1325		183	1436	
v/s Ratio Prot	c0.17	0.10		c0.05	0.05	0.01	0.03	c0.18		c0.08	c0.27	
v/s Ratio Perm			0.08			0.01						
v/c Ratio	0.82	0.50	0.39	0.38	0.38	0.08	0.58	0.47		0.80	0.62	
Uniform Delay, d1	32.4	30.1	29.4	34.0	34.0	26.0	39.5	19.4		37.3	18.4	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	7.4	0.4	0.3	0.4	0.4	0.0	6.2	1.2		20.8	2.0	
Delay (s)	39.9	30.5	29.7	34.4	34.4	26.0	45.6	20.6		58.1	20.4	
Level of Service	D	C	C	C	C	C	D	C		E	C	
Approach Delay (s)		34.7			30.8			22.4			25.0	
Approach LOS		C			C			C			C	

Intersection Summary

HCM 2000 Control Delay	28.4	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.66		
Actuated Cycle Length (s)	85.0	Sum of lost time (s)	15.6
Intersection Capacity Utilization	76.0%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
27: Collier Canyon Rd & N Canyons Pkwy/Portola Ave

BART to Livermore Extension Project
2040 DMU + INP + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↕	↖	↖	↕	↖	↖	↕		↖	↕	↖
Traffic Volume (vph)	466	589	538	75	215	9	157	10	243	73	31	223
Future Volume (vph)	466	589	538	75	215	9	157	10	243	73	31	223
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	2.7	2.7	4.0	2.7	2.7	4.0	3.0		4.0	4.6	4.6
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.86		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	1770	1595		1770	1863	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	1770	1595		1770	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	507	640	585	82	234	10	171	11	264	79	34	242
RTOR Reduction (vph)	0	0	360	0	0	7	0	201	0	0	0	200
Lane Group Flow (vph)	507	640	225	82	234	3	171	74	0	79	34	42
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA		Prot	NA	Perm
Protected Phases	1	6		5	2		3	8		7	NA	4
Permitted Phases			6			2						4
Actuated Green, G (s)	15.2	27.0	27.0	7.0	18.8	18.8	10.1	16.7		6.9	13.5	13.5
Effective Green, g (s)	15.2	28.3	28.3	7.0	20.1	20.1	10.1	17.7		6.9	12.9	12.9
Actuated g/C Ratio	0.21	0.38	0.38	0.10	0.27	0.27	0.14	0.24		0.09	0.18	0.18
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	708	1360	608	168	966	432	242	383		165	326	277
v/s Ratio Prot	c0.15	c0.18		0.05	0.07		c0.10	c0.05		0.04	0.02	
v/s Ratio Perm			0.14			0.00						0.03
v/c Ratio	0.72	0.47	0.37	0.49	0.24	0.01	0.71	0.19		0.48	0.10	0.15
Uniform Delay, d1	27.2	17.0	16.3	31.6	20.8	19.5	30.3	22.3		31.6	25.5	25.7
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	3.5	0.3	0.4	2.2	0.1	0.0	9.1	0.2		2.2	0.1	0.3
Delay (s)	30.6	17.3	16.6	33.8	21.0	19.5	39.4	22.5		33.8	25.6	26.0
Level of Service	C	B	B	C	C	B	D	C		C	C	C
Approach Delay (s)		21.0			24.1			29.0			27.7	
Approach LOS		C			C			C			C	

Intersection Summary

HCM 2000 Control Delay	23.4	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.53		
Actuated Cycle Length (s)	73.6	Sum of lost time (s)	15.3
Intersection Capacity Utilization	58.0%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
28: Isabel Ave/Campus Hill Dr & Portola Ave

BART to Livermore Extension Project
2040 DMU + INP + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗↗	↖↖	↖↖↖	↗↗		↖↖	↗↗	↖	↖	↗↗	↖
Traffic Volume (vph)	1	619	371	864	139	99	241	433	553	127	203	0
Future Volume (vph)	1	619	371	864	139	99	241	433	553	127	203	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	5.8	
Lane Util. Factor	1.00	0.95	0.88	0.94	0.95		0.97	0.95	1.00	1.00	0.95	
Frt	1.00	1.00	0.85	1.00	0.94		1.00	1.00	0.85	1.00	1.00	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1770	3539	2787	4990	3318		3433	3539	1583	1770	3539	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1770	3539	2787	4990	3318		3433	3539	1583	1770	3539	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	1	673	403	939	151	108	262	471	601	138	221	0
RTOR Reduction (vph)	0	0	284	0	54	0	0	0	294	0	0	0
Lane Group Flow (vph)	1	673	119	939	205	0	262	471	307	138	221	0
Turn Type	Prot	NA	Perm	Prot	NA		Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4						2			6
Actuated Green, G (s)	1.5	33.6	33.6	25.9	58.0		11.4	27.7	27.7	12.6	29.3	
Effective Green, g (s)	1.5	34.9	34.9	25.9	59.3		11.4	29.0	29.0	12.6	28.4	
Actuated g/C Ratio	0.01	0.29	0.29	0.22	0.50		0.10	0.24	0.24	0.11	0.24	
Clearance Time (s)	4.0	5.3	5.3	4.0	5.3		4.0	5.3	5.3	4.0	4.9	
Vehicle Extension (s)	2.0	3.0	3.0	2.0	3.0		2.0	3.0	3.0	2.0	3.0	
Lane Grp Cap (vph)	22	1043	821	1091	1661		330	866	387	188	848	
v/s Ratio Prot	0.00	c0.19		c0.19	0.06		0.08	0.13		c0.08	0.06	
v/s Ratio Perm			0.04						c0.19			
v/c Ratio	0.05	0.65	0.14	0.86	0.12		0.79	0.54	0.79	0.73	0.26	
Uniform Delay, d1	57.7	36.4	30.8	44.5	15.7		52.4	38.9	41.9	51.3	36.5	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.3	1.4	0.1	6.9	0.0		11.6	0.7	10.7	12.0	0.2	
Delay (s)	58.1	37.7	30.8	51.4	15.8		63.9	39.6	52.6	63.3	36.7	
Level of Service	E	D	C	D	B		E	D	D	E	D	
Approach Delay (s)		35.2			43.7			50.3			46.9	
Approach LOS		D			D			D			D	

Intersection Summary

HCM 2000 Control Delay	43.9	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.77		
Actuated Cycle Length (s)	118.4	Sum of lost time (s)	17.8
Intersection Capacity Utilization	68.9%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
29: Isabel Ave & I-580 WB Ramps

BART to Livermore Extension Project
2040 DMU + INP + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↖↗		↖		↖↖↖	↖		↖↖↖	↖
Traffic Volume (vph)	0	0	0	682	0	542	0	633	0	0	927	897
Future Volume (vph)	0	0	0	682	0	542	0	633	0	0	927	897
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0		4.0		4.8			4.8	4.8
Lane Util. Factor				0.97		1.00		0.91			0.91	1.00
Frt				1.00		0.85		1.00			1.00	0.85
Flt Protected				0.95		1.00		1.00			1.00	1.00
Satd. Flow (prot)				3433		1583		5085			5085	1583
Flt Permitted				0.95		1.00		1.00			1.00	1.00
Satd. Flow (perm)				3433		1583		5085			5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	741	0	589	0	688	0	0	1008	975
RTOR Reduction (vph)	0	0	0	0	0	118	0	0	0	0	0	454
Lane Group Flow (vph)	0	0	0	741	0	471	0	688	0	0	1008	521
Turn Type				Prot		Prot		NA	Free		NA	Prot
Protected Phases				8		8		2			6	6
Permitted Phases									Free			
Actuated Green, G (s)				21.5		21.5		35.5			35.5	35.5
Effective Green, g (s)				21.5		21.5		34.7			34.7	34.7
Actuated g/C Ratio				0.33		0.33		0.53			0.53	0.53
Clearance Time (s)				4.0		4.0		4.0			4.0	4.0
Vehicle Extension (s)				2.0		2.0		4.0			4.0	4.0
Lane Grp Cap (vph)				1135		523		2714			2714	845
v/s Ratio Prot				0.22		c0.30		0.14			0.20	c0.33
v/s Ratio Perm												
v/c Ratio				0.65		0.90		0.25			0.37	0.62
Uniform Delay, d1				18.6		20.7		8.2			8.8	10.5
Progression Factor				1.00		1.00		0.82			1.00	1.00
Incremental Delay, d2				1.0		18.2		0.2			0.4	3.4
Delay (s)				19.6		39.0		7.0			9.2	13.9
Level of Service				B		D		A			A	B
Approach Delay (s)		0.0			28.2			7.0			11.5	
Approach LOS		A			C			A			B	

























Intersection Summary

HCM 2000 Control Delay	16.3	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.72		
Actuated Cycle Length (s)	65.0	Sum of lost time (s)	8.8
Intersection Capacity Utilization	59.5%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 30: Isabel Ave & I-580 EB Ramps

BART to Livermore Extension Project
 2040 DMU + INP + Garage PM

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations	 		 					  			  		
Traffic Volume (vph)	194	0	494	0	0	0	0	880	1432	0	919	743	
Future Volume (vph)	194	0	494	0	0	0	0	880	1432	0	919	743	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)	4.0		4.0					4.0	4.0		4.0	4.0	
Lane Util. Factor	0.97		0.88					0.91	1.00		0.91	1.00	
Frt	1.00		0.85					1.00	0.85		1.00	0.85	
Flt Protected	0.95		1.00					1.00	1.00		1.00	1.00	
Satd. Flow (prot)	3433		2787					5085	1583		5085	1583	
Flt Permitted	0.95		1.00					1.00	1.00		1.00	1.00	
Satd. Flow (perm)	3433		2787					5085	1583		5085	1583	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	
Adj. Flow (vph)	211	0	537	0	0	0	0	957	1557	0	999	808	
RTOR Reduction (vph)	0	0	99	0	0	0	0	0	0	0	0	0	
Lane Group Flow (vph)	211	0	438	0	0	0	0	957	1557	0	999	808	
Turn Type	Prot		Perm					NA	Free		NA	Free	
Protected Phases	4							2			6		
Permitted Phases			4						Free			Free	
Actuated Green, G (s)	25.5		25.5					95.5	130.0		95.5	130.0	
Effective Green, g (s)	25.5		25.5					96.5	130.0		96.5	130.0	
Actuated g/C Ratio	0.20		0.20					0.74	1.00		0.74	1.00	
Clearance Time (s)	4.0		4.0					5.0			5.0		
Vehicle Extension (s)	2.0		2.0					4.0			4.0		
Lane Grp Cap (vph)	673		546					3774	1583		3774	1583	
v/s Ratio Prot	0.06							0.19			0.20		
v/s Ratio Perm			0.16						c0.98			0.51	
v/c Ratio	0.31		0.80					0.25	0.98		0.26	0.51	
Uniform Delay, d1	44.8		49.8					5.3	0.0		5.4	0.0	
Progression Factor	1.00		1.00					1.00	1.00		0.65	1.00	
Incremental Delay, d2	0.1		7.9					0.2	19.0		0.2	1.1	
Delay (s)	44.9		57.7					5.5	19.0		3.6	1.1	
Level of Service	D		E					A	B		A	A	
Approach Delay (s)		54.1			0.0			13.9			2.5		
Approach LOS		D			A			B			A		
Intersection Summary													
HCM 2000 Control Delay			15.7									HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio			1.05										
Actuated Cycle Length (s)			130.0									Sum of lost time (s)	8.0
Intersection Capacity Utilization			41.7%									ICU Level of Service	A
Analysis Period (min)			15										
c Critical Lane Group													

HCM Signalized Intersection Capacity Analysis
31: Isabel Ave & Airway Blvd

BART to Livermore Extension Project
2040 DMU + INP + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	8	110	495	327	130	542	469	1467	328	395	1352	21
Future Volume (vph)	8	110	495	327	130	542	469	1467	328	395	1352	21
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.2	5.2	5.6	5.2	5.2	5.6	4.0	4.0	4.0	4.0	4.0	5.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.91	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	1863	1583	1770	1863	1583	1770	5085	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	1863	1583	1770	1863	1583	1770	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	9	120	538	355	141	589	510	1595	357	429	1470	23
RTOR Reduction (vph)	0	0	60	0	0	57	0	0	167	0	0	14
Lane Group Flow (vph)	9	120	478	355	141	532	510	1595	190	429	1470	9
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4	5	3	8	1	5	2		1	NA	6
Permitted Phases			4			8			2			6
Actuated Green, G (s)	0.8	18.1	44.1	19.4	36.7	52.7	26.0	67.3	67.3	16.0	57.3	57.3
Effective Green, g (s)	0.2	17.5	42.9	18.8	36.1	51.5	27.0	68.3	68.3	17.0	58.3	57.3
Actuated g/C Ratio	0.00	0.12	0.31	0.13	0.26	0.37	0.19	0.49	0.49	0.12	0.42	0.41
Clearance Time (s)	4.6	4.6	5.0	4.6	4.6	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	5.0	5.0	3.0	5.0	5.0
Lane Grp Cap (vph)	2	232	485	237	480	582	341	2480	772	416	2117	647
v/s Ratio Prot	0.01	0.06	0.18	c0.20	0.08	c0.10	c0.29	0.31		0.12	c0.29	
v/s Ratio Perm			0.12			0.24			0.12			0.01
v/c Ratio	4.50	0.52	0.98	1.50	0.29	0.91	1.50	0.64	0.25	1.03	0.69	0.01
Uniform Delay, d1	69.9	57.3	48.2	60.6	41.7	42.1	56.5	26.8	20.9	61.5	33.5	24.6
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	2350.4	1.9	36.6	245.0	0.3	18.9	238.0	1.3	0.8	52.4	1.9	0.0
Delay (s)	2420.3	59.2	84.9	305.6	42.1	61.1	294.5	28.1	21.6	113.9	35.4	24.6
Level of Service	F	E	F	F	D	E	F	C	C	F	D	C
Approach Delay (s)		111.8			138.6			82.3			52.8	
Approach LOS		F			F			F			D	


































Intersection Summary

HCM 2000 Control Delay	86.2	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.06		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	87.9%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 32: Isabel Ave & Jack London Blvd

BART to Livermore Extension Project
 2040 DMU + INP + Garage PM

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations	 	 			 		 	  		 	  		
Traffic Volume (vph)	212	893	412	246	235	372	182	1743	411	461	1558	101	
Future Volume (vph)	212	893	412	246	235	372	182	1743	411	461	1558	101	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.97	0.91	1.00	0.97	0.91	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	3433	5085	1583	3433	5085	1583	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	3433	5085	1583	3433	5085	1583	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	
Adj. Flow (vph)	230	971	448	267	255	404	198	1895	447	501	1693	110	
RTOR Reduction (vph)	0	0	127	0	0	35	0	0	177	0	0	66	
Lane Group Flow (vph)	230	971	321	267	255	369	198	1895	270	501	1693	44	
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	Perm	
Protected Phases	7	4		3	8	1	5	2		1	6		
Permitted Phases			4			8			2			6	
Actuated Green, G (s)	13.8	34.7	34.7	17.7	38.6	56.3	10.6	48.7	48.7	17.7	55.8	55.8	
Effective Green, g (s)	13.8	34.7	34.7	17.7	38.6	56.3	10.6	48.7	48.7	17.7	55.8	55.8	
Actuated g/C Ratio	0.10	0.25	0.25	0.13	0.28	0.40	0.08	0.35	0.35	0.13	0.40	0.40	
Clearance Time (s)	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	338	877	392	223	975	696	259	1768	550	434	2026	630	
v/s Ratio Prot	0.07	c0.27		c0.15	0.07	c0.07	0.06	c0.37		c0.15	0.33		
v/s Ratio Perm			0.20			0.17			0.17			0.03	
v/c Ratio	0.68	1.11	0.82	1.20	0.26	0.53	0.76	1.07	0.49	1.15	0.84	0.07	
Uniform Delay, d1	61.0	52.6	49.7	61.1	39.6	31.8	63.5	45.6	35.9	61.1	38.0	26.0	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	5.5	64.2	12.5	123.9	0.1	0.7	12.6	43.6	0.7	92.7	3.2	0.0	
Delay (s)	66.5	116.8	62.2	185.0	39.7	32.5	76.1	89.2	36.6	153.9	41.1	26.1	
Level of Service	E	F	E	F	D	C	E	F	D	F	D	C	
Approach Delay (s)		95.0			78.5			78.9			64.9		
Approach LOS		F			E			E			E		
Intersection Summary													
HCM 2000 Control Delay			78.1		HCM 2000 Level of Service				E				
HCM 2000 Volume to Capacity ratio			1.11										
Actuated Cycle Length (s)			140.0		Sum of lost time (s)				21.2				
Intersection Capacity Utilization			102.8%		ICU Level of Service				G				
Analysis Period (min)			15										

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
33: Isabel Ave Connector & Stanley Blvd

BART to Livermore Extension Project
2040 DMU + INP + Garage PM



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑	↑	↑↓	↑↑	↑↓	↑↓
Traffic Volume (vph)	2030	750	842	569	175	1104
Future Volume (vph)	2030	750	842	569	175	1104
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	2.3	2.3	4.0	2.3	2.5	2.5
Lane Util. Factor	0.95	1.00	0.97	0.95	0.97	0.88
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	3539	1583	3433	3539	3433	2787
Flt Permitted	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (perm)	3539	1583	3433	3539	3433	2787
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	2207	815	915	618	190	1200
RTOR Reduction (vph)	0	0	0	0	0	2
Lane Group Flow (vph)	2207	815	915	618	190	1198
Turn Type	NA	pm+ov	Prot	NA	Prot	pm+ov
Protected Phases	2	8	1	6	8	1
Permitted Phases		2				8
Actuated Green, G (s)	57.0	67.7	21.0	82.0	10.7	31.7
Effective Green, g (s)	58.7	71.1	21.0	83.7	12.2	34.7
Actuated g/C Ratio	0.58	0.71	0.21	0.83	0.12	0.34
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Grp Cap (vph)	2062	1153	715	2941	415	1029
v/s Ratio Prot	c0.62	0.09	0.27	0.17	0.06	c0.26
v/s Ratio Perm		0.43				0.17
v/c Ratio	1.07	0.71	1.28	0.21	0.46	1.16
Uniform Delay, d1	21.0	8.7	39.9	1.7	41.2	33.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	41.7	1.6	136.5	0.0	0.3	84.7
Delay (s)	62.7	10.3	176.3	1.8	41.5	117.7
Level of Service	E	B	F	A	D	F
Approach Delay (s)	48.6			106.0	107.3	
Approach LOS	D			F	F	

Intersection Summary

HCM 2000 Control Delay	77.1	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.15		
Actuated Cycle Length (s)	100.7	Sum of lost time (s)	8.8
Intersection Capacity Utilization	101.4%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 34: Murrieta Blvd/Driveway & Portola Ave

BART to Livermore Extension Project
 2040 DMU + INP + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗		↖	↗		↖	↗	↗		↗	
Traffic Volume (vph)	0	981	221	388	1049	0	314	6	444	3	8	0
Future Volume (vph)	0	981	221	388	1049	0	314	6	444	3	8	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.8		4.0	5.8		5.2	5.2	5.2		4.0	
Lane Util. Factor		0.95		1.00	0.95		0.95	0.95	1.00		1.00	
Frt		0.97		1.00	1.00		1.00	1.00	0.85		1.00	
Flt Protected		1.00		0.95	1.00		0.95	0.95	1.00		0.99	
Satd. Flow (prot)		3442		1770	3539		1681	1689	1583		1840	
Flt Permitted		1.00		0.95	1.00		0.95	0.95	1.00		0.99	
Satd. Flow (perm)		3442		1770	3539		1681	1689	1583		1840	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	1066	240	422	1140	0	341	7	483	3	9	0
RTOR Reduction (vph)	0	15	0	0	0	0	0	0	361	0	0	0
Lane Group Flow (vph)	0	1291	0	422	1140	0	177	171	122	0	12	0
Turn Type	Prot	NA		Prot	NA		Split	NA	Perm		Split	NA
Protected Phases	5	2		1	6		8	8			4	4
Permitted Phases									8			
Actuated Green, G (s)		45.7		28.2	77.9		16.9	16.9	16.9		1.5	
Effective Green, g (s)		44.8		28.2	77.0		16.3	16.3	16.3		1.5	
Actuated g/C Ratio		0.41		0.26	0.70		0.15	0.15	0.15		0.01	
Clearance Time (s)		4.9		4.0	4.9		4.6	4.6	4.6		4.0	
Vehicle Extension (s)		2.0		2.0	2.0		2.0	2.0	2.0		2.0	
Lane Grp Cap (vph)		1404		454	2481		249	250	234		25	
v/s Ratio Prot		c0.37		c0.24	0.32		c0.11	0.10			c0.01	
v/s Ratio Perm									0.08			
v/c Ratio		0.92		0.93	0.46		0.71	0.68	0.52		0.48	
Uniform Delay, d1		30.8		39.8	7.2		44.5	44.3	43.1		53.8	
Progression Factor		1.00		1.00	1.00		1.00	1.00	1.00		1.00	
Incremental Delay, d2		9.7		25.0	0.0		7.7	6.0	1.0		5.2	
Delay (s)		40.4		64.8	7.3		52.2	50.3	44.1		59.0	
Level of Service		D		E	A		D	D	D		E	
Approach Delay (s)		40.4			22.8			47.1			59.0	
Approach LOS		D			C			D			E	

Intersection Summary		
HCM 2000 Control Delay	34.6	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.88	C
Actuated Cycle Length (s)	109.8	Sum of lost time (s)
Intersection Capacity Utilization	83.7%	19.0
Analysis Period (min)	15	ICU Level of Service
		E

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
35: Murrieta Blvd & Jack London Blvd

BART to Livermore Extension Project
2040 DMU + INP + Garage PM



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	344	1125	566	290	629	286
Future Volume (vph)	344	1125	566	290	629	286
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00	1.00	0.95	0.91	
Frt	1.00	0.85	1.00	1.00	0.95	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1770	1583	1770	3539	4847	
Flt Permitted	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	1770	1583	1770	3539	4847	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	374	1223	615	315	684	311
RTOR Reduction (vph)	0	418	0	0	92	0
Lane Group Flow (vph)	374	805	615	315	903	0
Turn Type	Prot	Perm	Prot	NA	NA	
Protected Phases	4		5	2	6	
Permitted Phases		4				
Actuated Green, G (s)	34.0	34.0	27.0	48.0	17.0	
Effective Green, g (s)	34.0	34.0	27.0	48.0	17.0	
Actuated g/C Ratio	0.38	0.38	0.30	0.53	0.19	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	668	598	531	1887	915	
v/s Ratio Prot	0.21		c0.35	0.09	c0.19	
v/s Ratio Perm		c0.51				
v/c Ratio	0.56	1.35	1.16	0.17	0.99	
Uniform Delay, d1	22.1	28.0	31.5	10.8	36.4	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	1.0	166.6	90.7	0.0	26.4	
Delay (s)	23.1	194.6	122.2	10.8	62.8	
Level of Service	C	F	F	B	E	
Approach Delay (s)	154.4			84.4	62.8	
Approach LOS	F			F	E	

Intersection Summary

HCM 2000 Control Delay	110.1	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.20		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	94.9%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 36: Murrieta Blvd & Stanley Blvd

BART to Livermore Extension Project
 2040 DMU + INP + Garage PM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	357	1470	894	87	1050	238	281	357	18	275	478	246
Future Volume (vph)	357	1470	894	87	1050	238	281	357	18	275	478	246
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	5.8	5.8	4.0	5.8	4.9	4.9	5.8		4.9	5.8	4.9
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.97	0.95		1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	3433	3513		1770	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	3433	3513		1770	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	388	1598	972	95	1141	259	305	388	20	299	520	267
RTOR Reduction (vph)	0	0	225	0	0	50	0	3	0	0	0	129
Lane Group Flow (vph)	388	1598	747	95	1141	209	305	405	0	299	520	138
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Prot	NA		Prot	NA	Perm
Protected Phases	1	6		5	2	3	7	4		3	8	
Permitted Phases			6			2						8
Actuated Green, G (s)	13.0	50.4	50.4	4.0	41.4	59.5	14.5	20.9		18.1	24.5	24.5
Effective Green, g (s)	13.0	49.5	49.5	4.0	40.5	57.7	13.6	20.0		17.2	23.6	24.5
Actuated g/C Ratio	0.12	0.45	0.45	0.04	0.36	0.52	0.12	0.18		0.15	0.21	0.22
Clearance Time (s)	4.0	4.9	4.9	4.0	4.9	4.0	4.0	4.9		4.0	4.9	4.9
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	401	1575	704	63	1288	821	419	631		273	751	348
v/s Ratio Prot	c0.11	0.45		c0.05	0.32	0.04	0.09	0.12		c0.17	c0.15	
v/s Ratio Perm			c0.47			0.09						0.09
v/c Ratio	0.97	1.01	1.06	1.51	0.89	0.26	0.73	0.64		1.10	0.69	0.40
Uniform Delay, d1	48.9	30.9	30.9	53.6	33.2	14.8	47.0	42.3		47.0	40.4	37.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	36.1	26.4	51.2	294.4	7.6	0.2	6.2	2.2		82.3	2.8	0.7
Delay (s)	85.0	57.2	82.0	348.0	40.8	15.0	53.2	44.5		129.3	43.2	37.8
Level of Service	F	E	F	F	D	B	D	D		F	D	D
Approach Delay (s)		69.0			55.9			48.2			65.6	
Approach LOS		E			E			D			E	

Intersection Summary

HCM 2000 Control Delay	62.9	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.02		
Actuated Cycle Length (s)	111.2	Sum of lost time (s)	20.5
Intersection Capacity Utilization	88.2%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
37: Livermore Ave & I-580 WB Ramps

BART to Livermore Extension Project
2040 DMU + INP + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↖	↔		↗	↑			↕	↘
Traffic Volume (vph)	0	0	0	734	24	33	579	450	0	0	118	0
Future Volume (vph)	0	0	0	734	24	33	579	450	0	0	118	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)					4.0		4.0	4.0			4.0	
Lane Util. Factor					0.95		0.97	1.00			0.95	
Frt					0.99		1.00	1.00			1.00	
Flt Protected					0.96		0.95	1.00			1.00	
Satd. Flow (prot)					1681		3433	1863			3539	
Flt Permitted					0.96		0.95	1.00			1.00	
Satd. Flow (perm)					1681		3433	1863			3539	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	798	26	36	629	489	0	0	128	0
RTOR Reduction (vph)	0	0	0	0	1	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	0	859	0	629	489	0	0	128	0
Turn Type				Split	NA		Prot	NA			NA	
Protected Phases				8	8		5	2			6	
Permitted Phases												
Actuated Green, G (s)					73.2		27.2	47.1			16.4	
Effective Green, g (s)					73.2		26.7	48.8			18.1	
Actuated g/C Ratio					0.56		0.21	0.38			0.14	
Clearance Time (s)					4.0		3.5	5.7			5.7	
Vehicle Extension (s)					2.0		2.0	2.5			2.5	
Lane Grp Cap (vph)					946		705	699			492	
v/s Ratio Prot					c0.51		c0.18	c0.26			0.04	
v/s Ratio Perm												
v/c Ratio					0.91		0.89	0.70			0.26	
Uniform Delay, d1					25.4		50.2	34.4			50.0	
Progression Factor					1.00		0.38	0.25			1.00	
Incremental Delay, d2					11.9		1.5	0.5			1.3	
Delay (s)					37.3		20.8	9.0			51.3	
Level of Service					D		C	A			D	
Approach Delay (s)		0.0			37.3			15.6			51.3	
Approach LOS		A			D			B			D	

Intersection Summary

HCM 2000 Control Delay	26.6	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.88		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	111.9%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
38: Livermore Ave & I-580 EB Ramps



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕	↗					↕		↗	↕	
Traffic Volume (vph)	238	11	1366	0	0	0	0	810	210	115	736	0
Future Volume (vph)	238	11	1366	0	0	0	0	810	210	115	736	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0					3.0		5.0	3.0	
Lane Util. Factor		0.95	0.95					0.95		1.00	0.95	
Frt		0.89	0.85					0.97		1.00	1.00	
Flt Protected		0.99	1.00					1.00		0.95	1.00	
Satd. Flow (prot)		1556	1504					3430		1770	3539	
Flt Permitted		0.99	1.00					1.00		0.95	1.00	
Satd. Flow (perm)		1556	1504					3430		1770	3539	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	259	12	1485	0	0	0	0	880	228	125	800	0
RTOR Reduction (vph)	0	56	56	0	0	0	0	18	0	0	0	0
Lane Group Flow (vph)	0	943	701	0	0	0	0	1090	0	125	800	0
Turn Type	Prot	NA	Perm					NA		Prot	NA	
Protected Phases	7	4						2		1	6	
Permitted Phases			4									
Actuated Green, G (s)		63.7	63.7					42.8		11.5	58.3	
Effective Green, g (s)		63.7	63.7					43.8		10.5	59.3	
Actuated g/C Ratio		0.49	0.49					0.34		0.08	0.46	
Clearance Time (s)		4.0	4.0					4.0		4.0	4.0	
Vehicle Extension (s)		2.0	2.0					2.5		2.0	2.5	
Lane Grp Cap (vph)		762	736					1155		142	1614	
v/s Ratio Prot								c0.32		c0.07	0.23	
v/s Ratio Perm		0.61	0.47									
v/c Ratio		1.24	0.95					0.94		0.88	0.50	
Uniform Delay, d1		33.1	31.7					41.9		59.1	24.8	
Progression Factor		1.00	1.00					1.00		0.82	1.05	
Incremental Delay, d2		118.0	22.0					16.0		28.3	0.6	
Delay (s)		151.1	53.7					57.9		77.1	26.6	
Level of Service		F	D					E		E	C	
Approach Delay (s)		109.1			0.0			57.9			33.4	
Approach LOS		F			A			E			C	

Intersection Summary

HCM 2000 Control Delay	75.7	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.10		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	111.9%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 39: Livermore Ave & Portola Ave

BART to Livermore Extension Project
 2040 DMU + INP + Garage PM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	587	659	176	23	506	75	336	766	139	259	1019	565
Future Volume (vph)	587	659	176	23	506	75	336	766	139	259	1019	565
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	2.7	4.0	4.0	2.7	4.0	4.0	4.9		4.0	4.9	4.9
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	1.00	0.95		1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.98		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	1770	3458		1770	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	1770	3458		1770	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	638	716	191	25	550	82	365	833	151	282	1108	614
RTOR Reduction (vph)	0	0	119	0	0	65	0	10	0	0	0	36
Lane Group Flow (vph)	638	716	72	25	550	17	365	974	0	282	1108	578
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA		Prot	NA	pm+ov
Protected Phases	3	8		7	4		1	6		5	2	3
Permitted Phases			8			4						2
Actuated Green, G (s)	23.0	47.7	47.7	3.5	28.2	28.2	26.0	41.9		25.2	41.1	64.1
Effective Green, g (s)	23.0	49.0	47.7	3.5	29.5	28.2	26.0	41.0		25.2	40.2	62.3
Actuated g/C Ratio	0.17	0.36	0.36	0.03	0.22	0.21	0.19	0.31		0.19	0.30	0.46
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	587	1291	562	46	777	332	342	1055		332	1059	734
v/s Ratio Prot	c0.19	0.20		0.01	c0.16		c0.21	0.28		0.16	c0.31	0.13
v/s Ratio Perm			0.05			0.01						0.24
v/c Ratio	1.09	0.55	0.13	0.54	0.71	0.05	1.07	0.92		0.85	1.05	0.79
Uniform Delay, d1	55.7	34.0	29.3	64.6	48.4	42.4	54.2	45.1		52.7	47.1	30.4
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	62.9	0.5	0.1	12.5	3.0	0.1	67.6	13.0		18.0	40.6	5.6
Delay (s)	118.6	34.5	29.4	77.1	51.4	42.4	121.8	58.1		70.7	87.6	36.0
Level of Service	F	C	C	E	D	D	F	E		E	F	D
Approach Delay (s)		68.6			51.2			75.3			69.4	
Approach LOS		E			D			E			E	

Intersection Summary		
HCM 2000 Control Delay	68.5	HCM 2000 Level of Service E
HCM 2000 Volume to Capacity ratio	0.98	
Actuated Cycle Length (s)	134.3	Sum of lost time (s) 16.5
Intersection Capacity Utilization	91.6%	ICU Level of Service F
Analysis Period (min)	15	

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
40: First St/Springtown Blvd & I-580 WB Ramps

BART to Livermore Extension Project
2040 DMU + INP + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations			TT			T	TT	T			TT	T
Traffic Volume (vph)	0	0	262	0	0	0	386	1439	0	0	421	209
Future Volume (vph)	0	0	262	0	0	0	386	1439	0	0	421	209
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)			4.5				4.5	4.0			4.5	4.5
Lane Util. Factor			0.88				0.97	1.00			0.95	1.00
Frt			0.85				1.00	1.00			1.00	0.85
Flt Protected			1.00				0.95	1.00			1.00	1.00
Satd. Flow (prot)			2787				3433	1863			3539	1583
Flt Permitted			1.00				0.95	1.00			1.00	1.00
Satd. Flow (perm)			2787				3433	1863			3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	285	0	0	0	420	1564	0	0	458	227
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	10
Lane Group Flow (vph)	0	0	285	0	0	0	420	1564	0	0	458	217
Turn Type			Over			Free	Prot	NA			NA	Perm
Protected Phases			5				5	2			6	
Permitted Phases						Free						6
Actuated Green, G (s)			19.9				19.9	130.0			102.1	102.1
Effective Green, g (s)			19.4				19.4	130.0			101.6	101.6
Actuated g/C Ratio			0.15				0.15	1.00			0.78	0.78
Clearance Time (s)			4.0				4.0	4.0			4.0	4.0
Vehicle Extension (s)			2.0				2.0	0.2			4.0	4.0
Lane Grp Cap (vph)			415				512	1863			2765	1237
v/s Ratio Prot			0.10				0.12	c0.84			0.13	
v/s Ratio Perm												0.14
v/c Ratio			0.69				0.82	0.84			0.17	0.18
Uniform Delay, d1			52.4				53.6	0.0			3.6	3.6
Progression Factor			1.00				0.83	1.00			1.00	1.00
Incremental Delay, d2			3.7				1.0	0.5			0.1	0.3
Delay (s)			56.2				45.6	0.5			3.7	3.9
Level of Service			E				D	A			A	A
Approach Delay (s)		56.2			0.0			10.0			3.8	
Approach LOS		E			A			B			A	




















Intersection Summary

HCM 2000 Control Delay	13.0	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.90		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	79.1%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 41: First St & I-580 EB Ramps

BART to Livermore Extension Project
 2040 DMU + INP + Garage PM

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations													
Traffic Volume (vph)	536	4	772	0	0	0	0	1663	446	97	1312	0	
Future Volume (vph)	536	4	772	0	0	0	0	1663	446	97	1312	0	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)		4.0	4.0					5.0	5.0	5.0	5.0		
Lane Util. Factor		1.00	0.88					0.95	1.00	1.00	0.95		
Frt		1.00	0.85					1.00	0.85	1.00	1.00		
Flt Protected		0.95	1.00					1.00	1.00	0.95	1.00		
Satd. Flow (prot)		1775	2787					3539	1583	1770	3539		
Flt Permitted		0.95	1.00					1.00	1.00	0.95	1.00		
Satd. Flow (perm)		1775	2787					3539	1583	1770	3539		
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	
Adj. Flow (vph)	583	4	839	0	0	0	0	1808	485	105	1426	0	
RTOR Reduction (vph)	0	0	56	0	0	0	0	0	155	0	0	0	
Lane Group Flow (vph)	0	587	783	0	0	0	0	1808	330	105	1426	0	
Turn Type	Perm	NA	Perm					NA	Perm	Prot	NA		
Protected Phases		4						2		1	6		
Permitted Phases	4		4						2				
Actuated Green, G (s)		42.5	42.5					66.5	66.5	9.0	79.5		
Effective Green, g (s)		42.0	42.0					66.0	66.0	8.0	79.0		
Actuated g/C Ratio		0.32	0.32					0.51	0.51	0.06	0.61		
Clearance Time (s)		3.5	3.5					4.5	4.5	4.0	4.5		
Vehicle Extension (s)		2.5	2.5					4.0	4.0	2.0	4.0		
Lane Grp Cap (vph)		573	900					1796	803	108	2150		
v/s Ratio Prot								c0.51		c0.06	0.40		
v/s Ratio Perm		0.33	0.28						0.21				
v/c Ratio		1.02	0.87					1.01	0.41	0.97	0.66		
Uniform Delay, d1		44.0	41.4					32.0	19.9	60.9	16.8		
Progression Factor		1.00	1.00					1.00	1.00	0.93	0.94		
Incremental Delay, d2		43.9	9.1					22.9	1.6	76.8	1.6		
Delay (s)		87.9	50.6					54.9	21.5	133.7	17.4		
Level of Service		F	D					D	C	F	B		
Approach Delay (s)		66.0			0.0			47.8			25.4		
Approach LOS		E			A			D			C		
Intersection Summary													
HCM 2000 Control Delay			46.2									HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio			1.01										
Actuated Cycle Length (s)			130.0									Sum of lost time (s)	14.0
Intersection Capacity Utilization			92.9%									ICU Level of Service	F
Analysis Period (min)			15										
c Critical Lane Group													

HCM Signalized Intersection Capacity Analysis
42: 1st St & Mines Rd

BART to Livermore Extension Project
2040 DMU + INP + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	70	286	102	482	276	258	109	1528	1069	361	1260	59
Future Volume (vph)	70	286	102	482	276	258	109	1528	1069	361	1260	59
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	0.97	1.00	1.00	1.00	0.91	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	1863	1583	3433	1863	1583	1770	5085	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	1863	1583	3433	1863	1583	1770	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	76	311	111	524	300	280	118	1661	1162	392	1370	64
RTOR Reduction (vph)	0	0	95	0	0	32	0	0	164	0	0	32
Lane Group Flow (vph)	76	311	16	524	300	249	118	1661	998	392	1370	32
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8	1	5	2		1	NA	6
Permitted Phases			4			8			2			6
Actuated Green, G (s)	7.0	17.0	17.0	15.0	25.0	36.0	12.5	61.0	61.0	11.0	59.5	59.5
Effective Green, g (s)	7.0	17.0	17.0	15.0	25.0	36.0	12.5	61.0	61.0	11.0	59.5	59.5
Actuated g/C Ratio	0.06	0.14	0.14	0.12	0.21	0.30	0.10	0.51	0.51	0.09	0.50	0.50
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	103	263	224	429	388	527	184	2584	804	314	2521	784
v/s Ratio Prot	0.04	c0.17		c0.15	0.16	0.04	0.07	0.33		c0.11	0.27	
v/s Ratio Perm			0.01			0.11			c0.63			0.02
v/c Ratio	0.74	1.18	0.07	1.22	0.77	0.47	0.64	0.64	1.24	1.25	0.54	0.04
Uniform Delay, d1	55.6	51.5	44.6	52.5	44.8	34.2	51.6	21.5	29.5	54.5	20.9	15.6
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	23.8	114.1	0.1	119.0	9.3	0.7	7.4	0.6	119.2	135.5	0.2	0.0
Delay (s)	79.4	165.6	44.8	171.5	54.1	34.9	59.0	22.1	148.7	190.0	21.1	15.6
Level of Service	E	F	D	F	D	C	E	C	F	F	C	B
Approach Delay (s)		125.5			105.0			73.6			57.2	
Approach LOS		F			F			E			E	























Intersection Summary

HCM 2000 Control Delay	78.4	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.23		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	101.5%	ICU Level of Service	G
Analysis Period (min)	15		























c Critical Lane Group

HCM Unsignalized Intersection Capacity Analysis
 43: Vasco Rd & I-580 WB Ramps

BART to Livermore Extension Project
 2040 DMU + INP + Garage PM


























													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations								  			  		
Traffic Volume (veh/h)	0	0	0	0	0	158	0	2414	0	0	658	0	
Future Volume (Veh/h)	0	0	0	0	0	158	0	2414	0	0	658	0	
Sign Control		Stop			Stop			Free			Free		
Grade		0%			0%			0%			0%		
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	
Hourly flow rate (vph)	0	0	0	0	0	172	0	2624	0	0	715	0	
Pedestrians													
Lane Width (ft)													
Walking Speed (ft/s)													
Percent Blockage													
Right turn flare (veh)													
Median type							None			None			
Median storage (veh)													
Upstream signal (ft)											524		
pX, platoon unblocked													
vC, conflicting volume	1762	3339	238	2862	3339	875	715				2624		
vC1, stage 1 conf vol													
vC2, stage 2 conf vol													
vCu, unblocked vol	1762	3339	238	2862	3339	875	715				2624		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1				4.1		
tC, 2 stage (s)													
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2				2.2		
p0 queue free %	100	100	100	100	100	41	100				100		
cM capacity (veh/h)	22	8	763	8	8	293	881				160		
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	NB 4	SB 1	SB 2	SB 3	SB 4			
Volume Total	0	172	875	875	875	0	238	238	238	0			
Volume Left	0	0	0	0	0	0	0	0	0	0			
Volume Right	0	172	0	0	0	0	0	0	0	0			
cSH	1700	293	1700	1700	1700	1700	1700	1700	1700	1700			
Volume to Capacity	0.00	0.59	0.51	0.51	0.51	0.00	0.14	0.14	0.14	0.00			
Queue Length 95th (ft)	0	87	0	0	0	0	0	0	0	0			
Control Delay (s)	0.0	33.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
Lane LOS	A	D											
Approach Delay (s)	0.0	33.4	0.0					0.0					
Approach LOS	A	D											
Intersection Summary													
Average Delay			1.6										
Intersection Capacity Utilization			63.1%		ICU Level of Service				B				
Analysis Period (min)			15										

HCM Unsignalized Intersection Capacity Analysis
 44: Vasco Rd & I-580 EB Ramps

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations								  			  	
Traffic Volume (veh/h)	0	0	0	0	0	0	0	2832	0	64	793	0
Future Volume (Veh/h)	0	0	0	0	0	0	0	2832	0	64	793	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	0	0	0	0	0	3078	0	70	862	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	2028	4080	287	3505	4080	1026	862			3078		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	2028	4080	287	3505	4080	1026	862			3078		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	100	100	100	100			33		
cM capacity (veh/h)	16	1	709	1	1	232	776			105		
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	NB 4	SB 1	SB 2	SB 3	SB 4		
Volume Total	0	0	1026	1026	1026	0	70	287	287	287		
Volume Left	0	0	0	0	0	0	70	0	0	0		
Volume Right	0	0	0	0	0	0	0	0	0	0		
cSH	1700	1700	1700	1700	1700	1700	105	1700	1700	1700		
Volume to Capacity	0.00	0.00	0.60	0.60	0.60	0.00	0.67	0.17	0.17	0.17		
Queue Length 95th (ft)	0	0	0	0	0	0	85	0	0	0		
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	90.3	0.0	0.0	0.0		
Lane LOS	A	A					F					
Approach Delay (s)	0.0	0.0	0.0				6.8					
Approach LOS	A	A										
Intersection Summary												
Average Delay			1.6									
Intersection Capacity Utilization			58.1%		ICU Level of Service					B		
Analysis Period (min)			15									

HCM Signalized Intersection Capacity Analysis
45: Vasco Rd & East Ave

BART to Livermore Extension Project
2040 DMU + INP + Garage PM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		 			 			 		 		
Traffic Volume (vph)	741	37	112	129	395	289	114	429	13	17	404	499
Future Volume (vph)	741	37	112	129	395	289	114	429	13	17	404	499
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	0.95		0.97	1.00	1.00
Frt	1.00	0.89		1.00	0.94		1.00	1.00		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	3139		1770	3315		1770	3524		3433	1863	1583
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1770	3139		1770	3315		1770	3524		3433	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	805	40	122	140	429	314	124	466	14	18	439	542
RTOR Reduction (vph)	0	66	0	0	111	0	0	1	0	0	0	399
Lane Group Flow (vph)	805	96	0	140	632	0	124	479	0	18	439	143
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												6
Actuated Green, G (s)	50.0	55.9		14.1	20.0		8.0	34.8		1.6	28.4	28.4
Effective Green, g (s)	50.0	55.9		14.1	20.0		8.0	34.8		1.6	28.4	28.4
Actuated g/C Ratio	0.41	0.46		0.12	0.16		0.07	0.28		0.01	0.23	0.23
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	723	1433		203	541		115	1001		44	432	367
v/s Ratio Prot	c0.45	0.03		0.08	c0.19		c0.07	0.14		0.01	c0.24	
v/s Ratio Perm												0.09
v/c Ratio	1.11	0.07		0.69	1.17		1.08	0.48		0.41	1.02	0.39
Uniform Delay, d1	36.2	18.6		52.0	51.2		57.2	36.3		59.9	47.0	39.7
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	69.1	0.0		9.4	94.1		106.5	0.4		6.1	47.4	0.7
Delay (s)	105.3	18.7		61.4	145.3		163.7	36.6		66.0	94.4	40.4
Level of Service	F	B		E	F		F	D		E	F	D
Approach Delay (s)		90.8			132.0			62.7			64.6	
Approach LOS		F			F			E			E	

Intersection Summary

HCM 2000 Control Delay	88.8	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.09		
Actuated Cycle Length (s)	122.4	Sum of lost time (s)	16.0
Intersection Capacity Utilization	102.2%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
46: Greenville Rd & I-580 WB Ramps

BART to Livermore Extension Project
2040 DMU + INP + Garage PM
























Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↖↗		↖		↕↕	↖		↕↔	
Traffic Volume (vph)	0	0	0	101	0	19	0	1309	770	0	145	24
Future Volume (vph)	0	0	0	101	0	19	0	1309	770	0	145	24
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0		4.0		4.0	4.0		4.0	
Lane Util. Factor				0.97		1.00		0.95	1.00		0.95	
Frt				1.00		0.85		1.00	0.85		0.98	
Flt Protected				0.95		1.00		1.00	1.00		1.00	
Satd. Flow (prot)				3433		1583		3539	1583		3464	
Flt Permitted				0.95		1.00		1.00	1.00		1.00	
Satd. Flow (perm)				3433		1583		3539	1583		3464	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	110	0	21	0	1423	837	0	158	26
RTOR Reduction (vph)	0	0	0	0	0	19	0	0	113	0	4	0
Lane Group Flow (vph)	0	0	0	110	0	2	0	1423	724	0	181	0
Turn Type				Prot		Prot		NA	Perm		NA	
Protected Phases				3		3		2			6	
Permitted Phases									2			
Actuated Green, G (s)				9.5		9.5		112.5	112.5		112.5	
Effective Green, g (s)				9.5		9.5		112.5	112.5		112.5	
Actuated g/C Ratio				0.07		0.07		0.87	0.87		0.87	
Clearance Time (s)				4.0		4.0		4.0	4.0		4.0	
Vehicle Extension (s)				3.0		3.0		3.0	3.0		3.0	
Lane Grp Cap (vph)				250		115		3062	1369		2997	
v/s Ratio Prot				c0.03		0.00		0.40			0.05	
v/s Ratio Perm									c0.46			
v/c Ratio				0.44		0.01		0.46	0.53		0.06	
Uniform Delay, d1				57.7		55.9		2.0	2.2		1.2	
Progression Factor				1.00		1.00		0.86	1.30		1.00	
Incremental Delay, d2				1.2		0.0		0.5	1.4		0.0	
Delay (s)				58.9		55.9		2.2	4.2		1.3	
Level of Service				E		E		A	A		A	
Approach Delay (s)		0.0			58.5			2.9			1.3	
Approach LOS		A			E			A			A	

Intersection Summary		
HCM 2000 Control Delay	5.6	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.52	A
Actuated Cycle Length (s)	130.0	Sum of lost time (s)
Intersection Capacity Utilization	51.0%	8.0
Analysis Period (min)	15	ICU Level of Service
		A

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
47: Greenville Rd & I-580 EB Ramps

BART to Livermore Extension Project
2040 DMU + INP + Garage PM

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations	 							 			 		
Traffic Volume (vph)	133	0	67	0	0	0	0	1378	398	0	196	43	
Future Volume (vph)	133	0	67	0	0	0	0	1378	398	0	196	43	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)	4.0		4.0					4.0	4.0		4.0	4.0	
Lane Util. Factor	0.97		1.00					0.95	1.00		0.95	1.00	
Frt	1.00		0.85					1.00	0.85		1.00	0.85	
Flt Protected	0.95		1.00					1.00	1.00		1.00	1.00	
Satd. Flow (prot)	3433		1583					3539	1583		3539	1583	
Flt Permitted	0.95		1.00					1.00	1.00		1.00	1.00	
Satd. Flow (perm)	3433		1583					3539	1583		3539	1583	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	
Adj. Flow (vph)	145	0	73	0	0	0	0	1498	433	0	213	47	
RTOR Reduction (vph)	0	0	67	0	0	0	0	0	63	0	0	7	
Lane Group Flow (vph)	145	0	6	0	0	0	0	1498	370	0	213	40	
Turn Type	Prot		Prot					NA	Perm		NA	Perm	
Protected Phases	7		7					2			6		
Permitted Phases									2			6	
Actuated Green, G (s)	10.8		10.8					111.2	111.2		111.2	111.2	
Effective Green, g (s)	10.8		10.8					111.2	111.2		111.2	111.2	
Actuated g/C Ratio	0.08		0.08					0.86	0.86		0.86	0.86	
Clearance Time (s)	4.0		4.0					4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0		3.0					3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	285		131					3027	1354		3027	1354	
v/s Ratio Prot	c0.04		0.00					c0.42			0.06		
v/s Ratio Perm									0.23			0.03	
v/c Ratio	0.51		0.05					0.49	0.27		0.07	0.03	
Uniform Delay, d1	57.1		54.9					2.4	1.8		1.4	1.4	
Progression Factor	1.00		1.00					0.80	1.90		0.58	0.13	
Incremental Delay, d2	1.4		0.1					0.5	0.4		0.0	0.0	
Delay (s)	58.5		55.0					2.4	3.8		0.9	0.2	
Level of Service	E		E					A	A		A	A	
Approach Delay (s)		57.3			0.0			2.7			0.8		
Approach LOS		E			A			A			A		
Intersection Summary													
HCM 2000 Control Delay			7.4									HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio			0.50										
Actuated Cycle Length (s)			130.0									Sum of lost time (s)	8.0
Intersection Capacity Utilization			48.6%									ICU Level of Service	A
Analysis Period (min)			15										
c Critical Lane Group													

HCM Signalized Intersection Capacity Analysis
 48: Greenville Rd & Northfront Road/Altamont Pass Road

BART to Livermore Extension Project
 2040 DMU + INP + Garage PM



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↗	↖	↑	↘	↗
Traffic Volume (vph)	555	153	2	73	267	1182
Future Volume (vph)	555	153	2	73	267	1182
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	1863	1583	1770	1863	1770	1583
Flt Permitted	1.00	1.00	0.12	1.00	0.95	1.00
Satd. Flow (perm)	1863	1583	219	1863	1770	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	603	166	2	79	290	1285
RTOR Reduction (vph)	0	75	0	0	0	22
Lane Group Flow (vph)	603	91	2	79	290	1263
Turn Type	NA	Perm	Perm	NA	Prot	Perm
Protected Phases	4			8	2	
Permitted Phases		4	8			2
Actuated Green, G (s)	34.0	34.0	34.0	34.0	78.0	78.0
Effective Green, g (s)	34.0	34.0	34.0	34.0	78.0	78.0
Actuated g/C Ratio	0.28	0.28	0.28	0.28	0.65	0.65
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	527	448	62	527	1150	1028
v/s Ratio Prot	c0.32			0.04	0.16	
v/s Ratio Perm		0.06	0.01			c0.80
v/c Ratio	1.14	0.20	0.03	0.15	0.25	1.23
Uniform Delay, d1	43.0	32.7	31.1	32.2	8.8	21.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	85.5	0.2	0.2	0.1	0.1	111.5
Delay (s)	128.5	32.9	31.3	32.3	8.9	132.5
Level of Service	F	C	C	C	A	F
Approach Delay (s)	107.8			32.3	109.8	
Approach LOS	F			C	F	

Intersection Summary

HCM 2000 Control Delay	106.6	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.20		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	109.1%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
49: Greenville Rd & Southfront Rd

BART to Livermore Extension Project
2040 DMU + INP + Garage PM



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	392	121	218	1415	157	106
Future Volume (vph)	392	121	218	1415	157	106
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.2	5.2	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.88	0.97	0.95	0.95	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	3433	2787	3433	3539	3539	1583
Flt Permitted	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (perm)	3433	2787	3433	3539	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	426	132	237	1538	171	115
RTOR Reduction (vph)	0	104	0	0	0	54
Lane Group Flow (vph)	426	28	237	1538	171	61
Turn Type	Prot	Perm	Prot	NA	NA	Perm
Protected Phases	8		1	6	2	
Permitted Phases		8				2
Actuated Green, G (s)	14.3	14.3	3.5	40.4	32.9	32.9
Effective Green, g (s)	13.7	13.7	3.5	42.1	34.6	34.6
Actuated g/C Ratio	0.21	0.21	0.05	0.65	0.53	0.53
Clearance Time (s)	4.6	4.6	4.0	5.7	5.7	5.7
Vehicle Extension (s)	5.0	5.0	6.0	2.5	2.5	2.5
Lane Grp Cap (vph)	723	587	184	2292	1883	842
v/s Ratio Prot	c0.12		c0.07	c0.43	0.05	
v/s Ratio Perm		0.01				0.04
v/c Ratio	0.59	0.05	1.29	0.67	0.09	0.07
Uniform Delay, d1	23.1	20.4	30.8	7.1	7.5	7.4
Progression Factor	1.00	1.00	1.00	1.00	0.97	2.56
Incremental Delay, d2	1.9	0.1	164.2	1.6	0.1	0.2
Delay (s)	25.0	20.5	194.9	8.7	7.3	19.1
Level of Service	C	C	F	A	A	B
Approach Delay (s)	24.0			33.6	12.1	
Approach LOS	C			C	B	

Intersection Summary

HCM 2000 Control Delay	29.2	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.72		
Actuated Cycle Length (s)	65.0	Sum of lost time (s)	13.2
Intersection Capacity Utilization	58.0%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

50: Greenville Rd & Patterson Pass Rd

BART to Livermore Extension Project
2040 DMU + INP + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	43	530	64	5	13	8	71	483	323	415	217	45
Future Volume (vph)	43	530	64	5	13	8	71	483	323	415	217	45
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.98		1.00	0.94		1.00	0.94		1.00	0.97	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1832		1770	1753		1770	1751		1770	1815	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	1832		1770	1753		1770	1751		1770	1815	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	47	576	70	5	14	9	77	525	351	451	236	49
RTOR Reduction (vph)	0	5	0	0	7	0	0	26	0	0	7	0
Lane Group Flow (vph)	47	641	0	5	16	0	77	850	0	451	278	0
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												
Actuated Green, G (s)	7.0	23.0		0.7	16.7		6.9	33.9		14.0	41.0	
Effective Green, g (s)	7.0	23.0		0.7	16.7		6.9	33.9		14.0	41.0	
Actuated g/C Ratio	0.08	0.26		0.01	0.19		0.08	0.39		0.16	0.47	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	141	481		14	334		139	677		282	849	
v/s Ratio Prot	c0.03	c0.35		0.00	0.01		0.04	c0.49		c0.25	0.15	
v/s Ratio Perm												
v/c Ratio	0.33	1.33		0.36	0.05		0.55	1.26		1.60	0.33	
Uniform Delay, d1	38.1	32.3		43.2	29.0		38.9	26.8		36.8	14.6	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	1.4	163.3		14.9	0.1		4.7	127.0		285.8	1.0	
Delay (s)	39.5	195.6		58.2	29.0		43.6	153.8		322.6	15.7	
Level of Service	D	F		E	C		D	F		F	B	
Approach Delay (s)		185.0			34.2			144.9			203.7	
Approach LOS		F			C			F			F	

Intersection Summary

HCM 2000 Control Delay	173.1	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.34		
Actuated Cycle Length (s)	87.6	Sum of lost time (s)	16.0
Intersection Capacity Utilization	109.9%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
1: Dougherty Rd & Amador Valley Rd

BART to Livermore Extension Project
2040 Express Bus + Garage AM



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	99	779	466	827	2169	133
Future Volume (vph)	99	779	466	827	2169	133
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00	0.97	0.91	0.91	
Frt	1.00	0.85	1.00	1.00	0.99	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1770	1583	3433	5085	5041	
Flt Permitted	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	1770	1583	3433	5085	5041	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	108	847	507	899	2358	145
RTOR Reduction (vph)	0	161	0	0	6	0
Lane Group Flow (vph)	108	686	507	899	2497	0
Turn Type	Perm	Perm	Prot	NA	NA	
Protected Phases			5	2	6	
Permitted Phases	4	4				
Actuated Green, G (s)	41.0	41.0	15.0	71.0	52.0	
Effective Green, g (s)	41.0	41.0	15.0	71.0	52.0	
Actuated g/C Ratio	0.34	0.34	0.12	0.59	0.43	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	604	540	429	3008	2184	
v/s Ratio Prot			c0.15	0.18	c0.50	
v/s Ratio Perm	0.06	c0.43				
v/c Ratio	0.18	1.27	1.18	0.30	1.14	
Uniform Delay, d1	27.7	39.5	52.5	12.2	34.0	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.1	135.5	103.4	0.1	70.6	
Delay (s)	27.8	175.0	155.9	12.2	104.6	
Level of Service	C	F	F	B	F	
Approach Delay (s)	158.3			64.0	104.6	
Approach LOS	F			E	F	

Intersection Summary

HCM 2000 Control Delay	103.4	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.20		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	99.8%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

2: Hopyard Road/Dougherty Rd & Dublin Blvd

BART to Livermore Extension Project
2040 Express Bus + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔↔	↑↑↑	↔↔	↔↔↔	↑↑↑	↔	↔↔↔	↑↑↑	↔↔	↔↔	↑↑↑	↔
Traffic Volume (vph)	54	511	527	337	890	478	741	1071	134	947	2183	109
Future Volume (vph)	54	511	527	337	890	478	741	1071	134	947	2183	109
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	6.0	5.0	5.0	5.5	5.0	5.0	5.5	5.0	5.0	5.5	
Lane Util. Factor	0.97	0.91	0.88	0.94	0.91	1.00	0.94	0.91	0.88	0.97	0.86	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	3433	5085	2787	4990	5085	1583	4990	5085	2787	3433	6362	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	3433	5085	2787	4990	5085	1583	4990	5085	2787	3433	6362	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	59	555	573	366	967	520	805	1164	146	1029	2373	118
RTOR Reduction (vph)	0	0	63	0	0	81	0	0	60	0	5	0
Lane Group Flow (vph)	59	555	510	366	967	439	805	1164	86	1029	2486	0
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	
Protected Phases	5	2	3	1	6	7	3	8	1	7	4	
Permitted Phases			2			6			8			
Actuated Green, G (s)	12.0	32.1	49.1	15.0	35.6	62.0	17.0	45.0	60.0	26.4	54.4	
Effective Green, g (s)	12.0	32.1	49.1	15.0	35.6	62.0	17.0	45.0	60.0	26.4	54.4	
Actuated g/C Ratio	0.09	0.23	0.35	0.11	0.25	0.44	0.12	0.32	0.43	0.19	0.39	
Clearance Time (s)	5.0	6.0	5.0	5.0	5.5	5.0	5.0	5.5	5.0	5.0	5.5	
Vehicle Extension (s)	2.0	4.5	2.0	2.0	4.5	2.0	2.0	4.5	2.0	2.0	4.5	
Lane Grp Cap (vph)	294	1165	977	534	1293	701	605	1634	1194	647	2472	
v/s Ratio Prot	0.02	0.11	c0.06	0.07	c0.19	0.12	c0.16	0.23	0.01	c0.30	c0.39	
v/s Ratio Perm			0.12			0.16			0.02			
v/c Ratio	0.20	0.48	0.52	0.69	0.75	0.63	1.33	0.71	0.07	1.59	1.01	
Uniform Delay, d1	59.5	46.7	36.1	60.2	48.1	30.1	61.5	41.8	23.6	56.8	42.8	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	0.96	0.97	0.77	1.00	1.00	
Incremental Delay, d2	0.1	1.4	0.2	2.9	4.0	1.3	157.7	1.4	0.0	273.0	19.5	
Delay (s)	59.7	48.1	36.4	63.1	52.1	31.3	216.8	41.7	18.1	329.8	62.3	
Level of Service	E	D	D	E	D	C	F	D	B	F	E	
Approach Delay (s)		43.0			48.4			106.8			140.5	
Approach LOS		D			D			F			F	

Intersection Summary

HCM 2000 Control Delay	99.3	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.05		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	21.5
Intersection Capacity Utilization	94.9%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 3: Dougherty Rd/Hopyard Road & I-580 WB Ramps

BART to Livermore Extension Project
 2040 Express Bus + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↔↔		↔↔		↑↑↑			↑↑↑	↔
Traffic Volume (vph)	0	0	0	391	0	637	0	1693	0	0	2189	0
Future Volume (vph)	0	0	0	391	0	637	0	1693	0	0	2189	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0		4.0		4.0			4.0	
Lane Util. Factor				0.97		0.88		0.91			0.86	
Frt				1.00		0.85		1.00			1.00	
Flt Protected				0.95		1.00		1.00			1.00	
Satd. Flow (prot)				3433		2787		5085			4806	
Flt Permitted				0.95		1.00		1.00			1.00	
Satd. Flow (perm)				3433		2787		5085			4806	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	425	0	692	0	1840	0	0	2379	0
RTOR Reduction (vph)	0	0	0	0	0	24	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	425	0	668	0	1840	0	0	2379	0
Turn Type				Prot		Prot		NA			NA	Perm
Protected Phases				4		4		2			6	
Permitted Phases												6
Actuated Green, G (s)				39.0		39.0		90.2			90.2	
Effective Green, g (s)				40.4		40.4		91.6			91.6	
Actuated g/C Ratio				0.29		0.29		0.65			0.65	
Clearance Time (s)				5.4		5.4		5.4			5.4	
Vehicle Extension (s)				3.0		3.0		3.0			3.0	
Lane Grp Cap (vph)				990		804		3327			3144	
v/s Ratio Prot				0.12		c0.24		0.36			c0.50	
v/s Ratio Perm												
v/c Ratio				0.43		0.83		0.55			0.76	
Uniform Delay, d1				40.4		46.6		13.1			16.6	
Progression Factor				1.00		1.00		0.78			0.44	
Incremental Delay, d2				0.3		7.3		0.6			0.8	
Delay (s)				40.7		53.9		10.8			8.1	
Level of Service				D		D		B			A	
Approach Delay (s)		0.0			48.9			10.8			8.1	
Approach LOS		A			D			B			A	

Intersection Summary			
HCM 2000 Control Delay	17.5	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.78		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	61.7%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 4: Hopyard Rd/Dougherty Rd & I-580 EB Ramps

BART to Livermore Extension Project
 2040 Express Bus + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗		↖↗					↑↑↑	↖		↑↑↑	↖
Traffic Volume (vph)	895	0	1429	0	0	0	0	897	0	0	1792	0
Future Volume (vph)	895	0	1429	0	0	0	0	897	0	0	1792	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0					4.0			4.0	
Lane Util. Factor	0.97		0.88					0.91			0.86	
Frt	1.00		0.85					1.00			1.00	
Flt Protected	0.95		1.00					1.00			1.00	
Satd. Flow (prot)	3433		2787					5085			4806	
Flt Permitted	0.95		1.00					1.00			1.00	
Satd. Flow (perm)	3433		2787					5085			4806	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	973	0	1553	0	0	0	0	975	0	0	1948	0
RTOR Reduction (vph)	0	0	9	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	973	0	1544	0	0	0	0	975	0	0	1948	0
Turn Type	Prot		Prot					NA	Free		NA	Perm
Protected Phases	4		4					2			6	
Permitted Phases									Free			6
Actuated Green, G (s)	72.6		72.6					56.6			56.6	
Effective Green, g (s)	74.0		74.0					58.0			58.0	
Actuated g/C Ratio	0.53		0.53					0.41			0.41	
Clearance Time (s)	5.4		5.4					5.4			5.4	
Vehicle Extension (s)	3.0		3.0					3.0			3.0	
Lane Grp Cap (vph)	1814		1473					2106			1991	
v/s Ratio Prot	0.28		c0.55					0.19			c0.41	
v/s Ratio Perm												
v/c Ratio	0.54		1.05					0.46			0.98	
Uniform Delay, d1	21.7		33.0					29.7			40.4	
Progression Factor	1.00		1.00					1.00			0.89	
Incremental Delay, d2	0.3		37.2					0.7			12.5	
Delay (s)	22.0		70.2					30.4			48.3	
Level of Service	C		E					C			D	
Approach Delay (s)		51.6			0.0			30.4			48.3	
Approach LOS		D			A			C			D	

Intersection Summary			
HCM 2000 Control Delay	46.7	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	1.02		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	91.3%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
5: Hopyard Rd & Owens Rd

BART to Livermore Extension Project
2040 Express Bus + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↗	↔↗		↖	↖	↖	↖	↑↑↑	↖	↖↗	↑↑↗	
Traffic Volume (vph)	206	92	50	118	122	216	145	835	161	918	1792	560
Future Volume (vph)	206	92	50	118	122	216	145	835	161	918	1792	560
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	2.7	2.7		2.7	2.7	2.7	4.0	2.3	2.3	4.0	2.3	
Lane Util. Factor	0.91	0.91		1.00	0.95	0.95	1.00	0.91	1.00	0.97	0.91	
Frt	1.00	0.97		1.00	0.95	0.85	1.00	1.00	0.85	1.00	0.96	
Flt Protected	0.95	0.98		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1610	3219		1770	1676	1504	1770	5085	1583	3433	4904	
Flt Permitted	0.95	0.98		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1610	3219		1770	1676	1504	1770	5085	1583	3433	4904	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	224	100	54	128	133	235	158	908	175	998	1948	609
RTOR Reduction (vph)	0	25	0	0	22	31	0	0	123	0	62	0
Lane Group Flow (vph)	123	230	0	128	184	131	158	908	52	998	2495	0
Turn Type	Split	NA		Split	NA	pm+ov	Prot	NA	Perm	Prot	NA	
Protected Phases	8	8		4	4	1	5	2		1	6	
Permitted Phases						4			2			
Actuated Green, G (s)	7.0	7.0		9.0	9.0	41.9	9.0	25.1	25.1	32.9	49.0	
Effective Green, g (s)	8.3	8.3		10.3	10.3	44.5	9.0	26.8	26.8	32.9	50.7	
Actuated g/C Ratio	0.09	0.09		0.11	0.11	0.49	0.10	0.30	0.30	0.37	0.56	
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	148	296		202	191	788	177	1514	471	1254	2762	
v/s Ratio Prot	c0.08	0.07		0.07	c0.11	0.06	0.09	0.18		c0.29	c0.51	
v/s Ratio Perm						0.02			0.03			
v/c Ratio	0.83	0.78		0.63	0.96	0.17	0.89	0.60	0.11	0.80	0.90	
Uniform Delay, d1	40.2	39.9		38.0	39.7	12.5	40.0	27.0	22.9	25.5	17.5	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	31.0	12.0		6.4	54.0	0.1	38.7	1.8	0.5	3.6	5.4	
Delay (s)	71.1	51.9		44.4	93.6	12.6	78.7	28.8	23.4	29.1	22.9	
Level of Service	E	D		D	F	B	E	C	C	C	C	
Approach Delay (s)		58.2			54.5			34.4			24.6	
Approach LOS		E			D			C			C	

Intersection Summary

HCM 2000 Control Delay	31.6	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.91		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	11.7
Intersection Capacity Utilization	86.1%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
6: Hopyard Rd & Stoneridge Dr

BART to Livermore Extension Project
2040 Express Bus + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	207	785	468	71	986	131	632	813	74	297	1028	284
Future Volume (vph)	207	785	468	71	986	131	632	813	74	297	1028	284
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.91	1.00	0.97	0.91	1.00	0.94	0.95	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5085	1583	3433	5085	1583	4990	3539	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5085	1583	3433	5085	1583	4990	3539	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	225	853	509	77	1072	142	687	884	80	323	1117	309
RTOR Reduction (vph)	0	0	201	0	0	102	0	0	57	0	0	126
Lane Group Flow (vph)	225	853	308	77	1072	40	687	884	23	323	1117	183
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	NA	6
Permitted Phases			4			8			2			6
Actuated Green, G (s)	4.0	19.1	19.1	2.4	17.5	17.5	8.0	18.0	18.0	6.0	16.0	16.0
Effective Green, g (s)	4.0	19.1	19.1	2.4	17.5	17.5	8.0	18.0	18.0	6.0	16.0	16.0
Actuated g/C Ratio	0.07	0.31	0.31	0.04	0.28	0.28	0.13	0.29	0.29	0.10	0.26	0.26
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	223	1579	491	133	1446	450	649	1035	463	334	1322	411
v/s Ratio Prot	c0.07	0.17		0.02	c0.21		c0.14	c0.25		0.09	0.22	
v/s Ratio Perm			0.19			0.03			0.01			0.12
v/c Ratio	1.01	0.54	0.63	0.58	0.74	0.09	1.06	0.85	0.05	0.97	0.84	0.45
Uniform Delay, d1	28.8	17.6	18.2	29.1	19.9	16.2	26.8	20.5	15.6	27.7	21.6	19.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	62.6	0.4	2.5	6.0	2.1	0.1	51.8	7.0	0.0	40.0	5.1	0.8
Delay (s)	91.3	17.9	20.7	35.0	22.0	16.2	78.6	27.5	15.7	67.7	26.7	19.8
Level of Service	F	B	C	D	C	B	E	C	B	E	C	B
Approach Delay (s)		29.2			22.2			48.2			33.1	
Approach LOS		C			C			D			C	


































Intersection Summary

HCM 2000 Control Delay	33.8	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.88		
Actuated Cycle Length (s)	61.5	Sum of lost time (s)	16.0
Intersection Capacity Utilization	70.2%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
7: Hopyard Rd & Las Positas Blvd

BART to Livermore Extension Project
2040 Express Bus + Garage AM

































												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 	 		 	 		 	  		  	 	
Traffic Volume (vph)	153	487	410	356	458	53	467	1194	394	113	1078	96
Future Volume (vph)	153	487	410	356	458	53	467	1194	394	113	1078	96
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.95	1.00	0.97	0.95	1.00	0.97	0.91	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	3433	3539	1583	3433	5085	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	3433	3539	1583	3433	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	166	529	446	387	498	58	508	1298	428	123	1172	104
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	74
Lane Group Flow (vph)	166	529	446	387	498	58	508	1298	428	123	1172	30
Turn Type	Prot	NA	Free	Prot	NA	Free	Prot	NA	Free	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			Free			Free			Free			6
Actuated Green, G (s)	6.9	14.5	69.4	8.0	15.6	69.4	11.0	27.7	69.4	3.2	19.9	19.9
Effective Green, g (s)	6.9	14.5	69.4	8.0	15.6	69.4	11.0	27.7	69.4	3.2	19.9	19.9
Actuated g/C Ratio	0.10	0.21	1.00	0.12	0.22	1.00	0.16	0.40	1.00	0.05	0.29	0.29
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	341	739	1583	395	795	1583	544	2029	1583	158	1458	453
v/s Ratio Prot	0.05	c0.15		c0.11	0.14		c0.15	0.26		0.04	c0.23	
v/s Ratio Perm			c0.28			0.04			0.27			0.02
v/c Ratio	0.49	0.72	0.28	0.98	0.63	0.04	0.93	0.64	0.27	0.78	0.80	0.07
Uniform Delay, d1	29.6	25.5	0.0	30.6	24.3	0.0	28.8	16.8	0.0	32.7	22.9	18.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.1	3.3	0.4	39.4	1.5	0.0	23.3	0.7	0.4	21.1	3.3	0.1
Delay (s)	30.7	28.8	0.4	70.0	25.8	0.0	52.1	17.5	0.4	53.8	26.3	18.1
Level of Service	C	C	A	E	C	A	D	B	A	D	C	B
Approach Delay (s)		18.0			42.4			22.1			28.1	
Approach LOS		B			D			C			C	

Intersection Summary		
HCM 2000 Control Delay	26.1	HCM 2000 Level of Service C
HCM 2000 Volume to Capacity ratio	0.84	
Actuated Cycle Length (s)	69.4	Sum of lost time (s) 16.0
Intersection Capacity Utilization	71.1%	ICU Level of Service C
Analysis Period (min)	15	

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
8: Willow Rd & Owens Rd

BART to Livermore Extension Project
2040 Express Bus + Garage AM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 	  		 	  			 		 	 	
Traffic Volume (vph)	101	488	214	120	332	80	115	101	0	158	104	93
Future Volume (vph)	101	488	214	120	332	80	115	101	0	158	104	93
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	5.3	4.0		5.3	4.0	4.0
Lane Util. Factor	0.97	0.91		0.97	0.91	1.00	1.00	0.95		1.00	1.00	1.00
Frt	1.00	0.95		1.00	1.00	0.85	1.00	1.00		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	4852		3433	5085	1583	1770	3539		1770	1863	1583
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.68	1.00		0.68	1.00	1.00
Satd. Flow (perm)	3433	4852		3433	5085	1583	1275	3539		1271	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	110	530	233	130	361	87	125	110	0	172	113	101
RTOR Reduction (vph)	0	109	0	0	0	50	0	0	0	0	0	77
Lane Group Flow (vph)	110	654	0	130	361	37	125	110	0	172	113	24
Turn Type	Prot	NA		Prot	NA	Perm	Perm	NA	Perm	Perm	NA	Perm
Protected Phases	1	6		5	2			4			8	
Permitted Phases						2	4		4	8		8
Actuated Green, G (s)	3.6	17.1		4.4	17.9	17.9	9.8	9.8		9.8	9.8	9.8
Effective Green, g (s)	3.6	18.8		4.4	19.6	19.6	9.8	11.1		9.8	11.1	11.1
Actuated g/C Ratio	0.08	0.41		0.10	0.42	0.42	0.21	0.24		0.21	0.24	0.24
Clearance Time (s)	4.0	5.7		4.0	5.7	5.7	5.3	5.3		5.3	5.3	5.3
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	266	1970		326	2152	670	269	848		269	446	379
v/s Ratio Prot	0.03	c0.13		c0.04	0.07			0.03			0.06	
v/s Ratio Perm						0.02	0.10			c0.14		0.02
v/c Ratio	0.41	0.33		0.40	0.17	0.05	0.46	0.13		0.64	0.25	0.06
Uniform Delay, d1	20.3	9.4		19.7	8.3	7.9	16.0	13.8		16.6	14.2	13.6
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	1.0	0.1		0.8	0.0	0.0	1.3	0.1		4.9	0.3	0.1
Delay (s)	21.4	9.5		20.5	8.3	7.9	17.2	13.9		21.6	14.5	13.7
Level of Service	C	A		C	A	A	B	B		C	B	B
Approach Delay (s)		11.0			11.0			15.7			17.4	
Approach LOS		B			B			B			B	








































Intersection Summary

HCM 2000 Control Delay	12.7	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.42		
Actuated Cycle Length (s)	46.3	Sum of lost time (s)	12.0
Intersection Capacity Utilization	43.1%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 9: Hacienda Dr & Dublin Blvd

BART to Livermore Extension Project
 2040 Express Bus + Garage AM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 	  	 	 	  		  	 	 	  	  	 
Traffic Volume (vph)	86	387	118	291	819	81	191	704	125	11	391	136
Future Volume (vph)	86	387	118	291	819	81	191	704	125	11	391	136
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	6.0	5.0	4.5	6.0		5.0	6.0	6.0	4.5	5.5	5.5
Lane Util. Factor	0.97	0.91	0.88	0.97	0.91		0.94	0.95	0.88	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5085	2787	3433	5017		4990	3539	2787	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5085	2787	3433	5017		4990	3539	2787	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	93	421	128	316	890	88	208	765	136	12	425	148
RTOR Reduction (vph)	0	0	53	0	7	0	0	0	98	0	0	129
Lane Group Flow (vph)	93	421	75	316	971	0	208	765	38	12	425	19
Turn Type	Prot	NA	pm+ov	Prot	NA		Prot	NA	Perm	Prot	NA	Perm
Protected Phases	5	2	3	1	6		3	8		7	4	
Permitted Phases			2						8			4
Actuated Green, G (s)	9.2	59.5	82.5	18.1	68.4		23.0	38.8	38.8	2.6	18.4	18.4
Effective Green, g (s)	9.2	59.5	82.5	18.1	68.4		23.0	38.8	38.8	2.6	18.4	18.4
Actuated g/C Ratio	0.07	0.42	0.59	0.13	0.49		0.16	0.28	0.28	0.02	0.13	0.13
Clearance Time (s)	4.5	6.0	5.0	4.5	6.0		5.0	6.0	6.0	4.5	5.5	5.5
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	225	2161	1642	443	2451		819	980	772	63	668	208
v/s Ratio Prot	0.03	0.08	0.01	c0.09	c0.19		0.04	c0.22		0.00	c0.08	
v/s Ratio Perm			0.02						0.01			0.01
v/c Ratio	0.41	0.19	0.05	0.71	0.40		0.25	0.78	0.05	0.19	0.64	0.09
Uniform Delay, d1	62.8	25.2	12.1	58.5	22.7		51.0	46.7	37.1	67.7	57.6	53.5
Progression Factor	1.00	1.00	1.00	1.00	1.00		0.77	0.76	0.41	1.00	1.00	1.00
Incremental Delay, d2	1.2	0.2	0.0	5.4	0.5		0.2	4.0	0.0	1.5	2.0	0.2
Delay (s)	64.0	25.4	12.1	63.8	23.2		39.6	39.4	15.1	69.1	59.6	53.7
Level of Service	E	C	B	E	C		D	D	B	E	E	D
Approach Delay (s)		28.4			33.1			36.5			58.3	
Approach LOS		C			C			D			E	
Intersection Summary												
HCM 2000 Control Delay			37.4	HCM 2000 Level of Service				D				
HCM 2000 Volume to Capacity ratio			0.59									
Actuated Cycle Length (s)			140.0	Sum of lost time (s)				21.0				
Intersection Capacity Utilization			61.3%	ICU Level of Service				B				
Analysis Period (min)			15									

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 10: Hacienda Dr & Martinelli Blvd/Hacienda Crossings

BART to Livermore Extension Project
 2040 Express Bus + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗	↖↗	↖↗	↗		↖↗	↖↗	↗	↖↗	↖↗	
Traffic Volume (vph)	16	11	224	107	13	10	256	977	109	18	737	56
Future Volume (vph)	16	11	224	107	13	10	256	977	109	18	737	56
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	2.0	2.0	4.5	2.0		3.0	2.0	2.0	4.5	2.5	
Lane Util. Factor	1.00	0.91	0.91	0.97	1.00		0.94	0.91	1.00	0.97	0.86	
Frt	1.00	0.90	0.85	1.00	0.93		1.00	1.00	0.85	1.00	0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1770	1526	2882	3433	1740		4990	5085	1583	3433	6340	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1770	1526	2882	3433	1740		4990	5085	1583	3433	6340	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	17	12	243	116	14	11	278	1062	118	20	801	61
RTOR Reduction (vph)	0	22	197	0	9	0	0	0	26	0	5	0
Lane Group Flow (vph)	17	14	22	116	16	0	278	1062	92	20	857	0
Turn Type	Prot	NA	Perm	Prot	NA		Prot	NA	pm+ov	Prot	NA	
Protected Phases	5	2		1	6		3	8		1	7	4
Permitted Phases			2						8			
Actuated Green, G (s)	4.8	12.0	12.0	11.5	18.7		13.1	93.1	104.6	7.4	87.4	
Effective Green, g (s)	4.3	14.0	14.0	11.0	20.7		14.1	95.1	108.6	6.9	88.9	
Actuated g/C Ratio	0.03	0.10	0.10	0.08	0.15		0.10	0.68	0.78	0.05	0.64	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	4.0	4.0	2.0	4.0		3.0	4.0	2.0	3.0	4.0	
Lane Grp Cap (vph)	54	152	288	269	257		502	3454	1250	169	4025	
v/s Ratio Prot	0.01	c0.01		c0.03	0.01		c0.06	c0.21	0.01	0.01	c0.14	
v/s Ratio Perm			0.01						0.05			
v/c Ratio	0.31	0.09	0.08	0.43	0.06		0.55	0.31	0.07	0.12	0.21	
Uniform Delay, d1	66.4	57.2	57.1	61.5	51.3		60.0	9.1	3.7	63.6	10.8	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.02	1.06	2.13	0.79	0.15	
Incremental Delay, d2	3.3	0.4	0.2	0.4	0.1		1.2	0.2	0.0	0.3	0.1	
Delay (s)	69.7	57.6	57.3	61.9	51.4		62.0	9.9	8.0	50.7	1.8	
Level of Service	E	E	E	E	D		E	A	A	D	A	
Approach Delay (s)		58.1			60.1			19.7			2.9	
Approach LOS		E			E			B			A	

Intersection Summary		
HCM 2000 Control Delay	20.2	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.32	C
Actuated Cycle Length (s)	140.0	Sum of lost time (s)
Intersection Capacity Utilization	44.3%	13.0
Analysis Period (min)	15	ICU Level of Service
		A

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 11: Hacienda Dr & I-580 WB Ramps

BART to Livermore Extension Project
 2040 Express Bus + Garage AM


























Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↔↔		↔↔		↑↑↑			↑↑↑	↔
Traffic Volume (vph)	0	0	0	275	0	451	0	1246	284	0	723	416
Future Volume (vph)	0	0	0	275	0	451	0	1246	284	0	723	416
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				2.6		2.6		2.1			2.1	2.1
Lane Util. Factor				0.97		0.88		0.91			0.86	0.86
Frt				1.00		0.85		0.97			0.97	0.85
Flt Protected				0.95		1.00		1.00			1.00	1.00
Satd. Flow (prot)				3433		2787		4944			4645	1362
Flt Permitted				0.95		1.00		1.00			1.00	1.00
Satd. Flow (perm)				3433		2787		4944			4645	1362
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	299	0	490	0	1354	309	0	786	452
RTOR Reduction (vph)	0	0	0	0	0	69	0	42	0	0	55	72
Lane Group Flow (vph)	0	0	0	299	0	421	0	1621	0	0	957	154
Turn Type				Prot		Prot		NA			NA	Perm
Protected Phases				4		4		2			6	
Permitted Phases												6
Actuated Green, G (s)				16.1		16.1		45.9			45.9	45.9
Effective Green, g (s)				17.5		17.5		47.8			47.8	47.8
Actuated g/C Ratio				0.25		0.25		0.68			0.68	0.68
Clearance Time (s)				4.0		4.0		4.0			4.0	4.0
Vehicle Extension (s)				3.0		3.0		3.0			3.0	3.0
Lane Grp Cap (vph)				858		696		3376			3171	930
v/s Ratio Prot				0.09		c0.15		c0.33			0.21	
v/s Ratio Perm												0.11
v/c Ratio				0.35		0.60		0.48			0.30	0.17
Uniform Delay, d1				21.6		23.2		5.2			4.4	4.0
Progression Factor				1.00		1.00		0.70			0.47	0.80
Incremental Delay, d2				0.2		1.5		0.4			0.2	0.4
Delay (s)				21.8		24.7		4.1			2.3	3.6
Level of Service				C		C		A			A	A
Approach Delay (s)		0.0			23.6			4.1			2.6	
Approach LOS		A			C			A			A	

Intersection Summary			
HCM 2000 Control Delay	7.8	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.51		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	4.7
Intersection Capacity Utilization	52.9%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group





































HCM Signalized Intersection Capacity Analysis
 12: Hacienda Dr & I-580 EB Ramps

BART to Livermore Extension Project
 2040 Express Bus + Garage AM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 		 					  			  	
Traffic Volume (vph)	817	0	1170	0	0	0	0	677	289	0	1055	197
Future Volume (vph)	817	0	1170	0	0	0	0	677	289	0	1055	197
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0					4.0	4.0		4.0	
Lane Util. Factor	0.97		0.88					0.86	0.86		0.91	
Frt	1.00		0.85					0.98	0.85		0.98	
Flt Protected	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (prot)	3433		2787					4722	1362		4965	
Flt Permitted	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (perm)	3433		2787					4722	1362		4965	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	888	0	1272	0	0	0	0	736	314	0	1147	214
RTOR Reduction (vph)	0	0	23	0	0	0	0	23	130	0	39	0
Lane Group Flow (vph)	888	0	1249	0	0	0	0	810	87	0	1322	0
Turn Type	Prot		Prot					NA	Perm		NA	
Protected Phases	4		4					2			6	
Permitted Phases									2			
Actuated Green, G (s)	32.4		32.4					26.3	26.3		26.3	
Effective Green, g (s)	33.8		33.8					28.2	28.2		28.2	
Actuated g/C Ratio	0.48		0.48					0.40	0.40		0.40	
Clearance Time (s)	5.4		5.4					5.9	5.9		5.9	
Vehicle Extension (s)	2.0		2.0					2.0	2.0		2.0	
Lane Grp Cap (vph)	1657		1345					1902	548		2000	
v/s Ratio Prot	0.26		c0.45					0.17			c0.27	
v/s Ratio Perm									0.06			
v/c Ratio	0.54		0.93					0.43	0.16		0.66	
Uniform Delay, d1	12.6		17.0					15.1	13.3		17.0	
Progression Factor	1.00		1.00					1.00	1.00		0.89	
Incremental Delay, d2	0.2		11.1					0.7	0.6		1.7	
Delay (s)	12.8		28.0					15.8	14.0		16.9	
Level of Service	B		C					B	B		B	
Approach Delay (s)		21.8			0.0			15.4			16.9	
Approach LOS		C			A			B			B	
Intersection Summary												
HCM 2000 Control Delay			18.8					HCM 2000 Level of Service			B	
HCM 2000 Volume to Capacity ratio			0.81									
Actuated Cycle Length (s)			70.0					Sum of lost time (s)			8.0	
Intersection Capacity Utilization			72.4%					ICU Level of Service			C	
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis
13: Hacienda Dr & Owens Rd

BART to Livermore Extension Project
2040 Express Bus + Garage AM

























												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 	  		 	  		 	  		 	  	
Traffic Volume (vph)	188	283	27	132	417	452	26	321	125	658	912	628
Future Volume (vph)	188	283	27	132	417	452	26	321	125	658	912	628
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	2.3	4.0	4.0	2.3	4.0	4.0	2.7	4.0	4.0	2.7
Lane Util. Factor	0.97	0.91	1.00	0.97	0.91	1.00	0.97	0.91	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5085	1583	3433	5085	1583	3433	5085	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5085	1583	3433	5085	1583	3433	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	204	308	29	143	453	491	28	349	136	715	991	683
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	204	308	29	143	453	491	28	349	136	715	991	683
Turn Type	Prot	NA	Free	Prot	NA	Free	Prot	NA	Free	Prot	NA	Free
Protected Phases	1	6		5	2		7	4		3	8	
Permitted Phases			Free			Free			Free			Free
Actuated Green, G (s)	13.6	19.3	115.0	10.2	15.9	115.0	4.2	32.6	115.0	33.9	62.3	115.0
Effective Green, g (s)	13.6	21.0	115.0	10.2	17.6	115.0	4.2	33.9	115.0	33.9	63.6	115.0
Actuated g/C Ratio	0.12	0.18	1.00	0.09	0.15	1.00	0.04	0.29	1.00	0.29	0.55	1.00
Clearance Time (s)	4.0	5.7		4.0	5.7		4.0	5.3		4.0	5.3	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	405	928	1583	304	778	1583	125	1498	1583	1011	2812	1583
v/s Ratio Prot	0.06	0.06		0.04	c0.09		0.01	0.07		c0.21	0.19	
v/s Ratio Perm			0.02			0.31			0.09			c0.43
v/c Ratio	0.50	0.33	0.02	0.47	0.58	0.31	0.22	0.23	0.09	0.71	0.35	0.43
Uniform Delay, d1	47.5	40.9	0.0	49.8	45.3	0.0	53.8	30.7	0.0	36.1	14.3	0.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.0	0.2	0.0	1.2	1.1	0.5	0.9	0.4	0.1	2.3	0.3	0.9
Delay (s)	48.5	41.1	0.0	51.0	46.4	0.5	54.7	31.1	0.1	38.4	14.6	0.9
Level of Service	D	D	A	D	D	A	D	C	A	D	B	A
Approach Delay (s)		41.7			26.3			24.2			17.8	
Approach LOS		D			C			C			B	

Intersection Summary		
HCM 2000 Control Delay	23.4	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.59	C
Actuated Cycle Length (s)	115.0	Sum of lost time (s)
Intersection Capacity Utilization	51.7%	16.0
Analysis Period (min)	15	ICU Level of Service
		A

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 14: Tassajara Rd & Dublin Blvd

BART to Livermore Extension Project
 2040 Express Bus + Garage AM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	102	203	141	647	1295	67	271	485	171	35	1141	335
Future Volume (vph)	102	203	141	647	1295	67	271	485	171	35	1141	335
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	6.0	6.0	5.0	6.0		5.0	6.0	6.0	5.0	5.7	5.7
Lane Util. Factor	0.97	0.86	0.88	0.94	0.91		0.94	0.86	1.00	0.97	0.86	0.88
Frt	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	6408	2787	4990	5048		4990	6408	1583	3433	6408	2787
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	6408	2787	4990	5048		4990	6408	1583	3433	6408	2787
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	111	221	153	703	1408	73	295	527	186	38	1240	364
RTOR Reduction (vph)	0	0	111	0	4	0	0	0	139	0	0	260
Lane Group Flow (vph)	111	221	42	703	1477	0	295	527	47	38	1240	104
Turn Type	Prot	NA	Perm	Prot	NA		Prot	NA	Perm	Prot	NA	Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases			2						8			4
Actuated Green, G (s)	16.1	39.8	39.8	24.8	48.5		18.2	36.9	36.9	22.8	41.8	41.8
Effective Green, g (s)	16.1	39.8	39.8	24.8	48.5		18.2	36.9	36.9	22.8	41.8	41.8
Actuated g/C Ratio	0.11	0.27	0.27	0.17	0.33		0.12	0.25	0.25	0.16	0.29	0.29
Clearance Time (s)	5.0	6.0	6.0	5.0	6.0		5.0	6.0	6.0	5.0	5.7	5.7
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	377	1743	758	845	1673		620	1616	399	535	1830	796
v/s Ratio Prot	0.03	0.03		c0.14	c0.29		c0.06	0.08		c0.01	c0.19	
v/s Ratio Perm			0.01						0.03			0.04
v/c Ratio	0.29	0.13	0.05	0.83	0.88		0.48	0.33	0.12	0.07	0.68	0.13
Uniform Delay, d1	59.9	40.1	39.4	58.7	46.2		59.6	44.6	42.2	52.7	46.3	38.8
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.4	0.0	0.0	7.0	5.9		0.6	0.1	0.1	0.1	1.0	0.1
Delay (s)	60.3	40.2	39.4	65.8	52.1		60.2	44.7	42.3	52.8	47.3	38.8
Level of Service	E	D	D	E	D		E	D	D	D	D	D
Approach Delay (s)		44.5			56.5			48.8			45.5	
Approach LOS		D			E			D			D	

Intersection Summary		
HCM 2000 Control Delay	50.6	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.76	D
Actuated Cycle Length (s)	146.3	Sum of lost time (s)
Intersection Capacity Utilization	87.8%	22.0
Analysis Period (min)	15	ICU Level of Service
		E

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 15: Tassajara Rd & I-580 WB Ramps

BART to Livermore Extension Project
 2040 Express Bus + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↔↔		↔↔		↑↑	↔		↑↑↔	↔
Traffic Volume (vph)	0	0	0	594	0	296	0	1185	474	0	1033	935
Future Volume (vph)	0	0	0	594	0	296	0	1185	474	0	1033	935
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0		4.0		4.0	4.0		4.0	4.0
Lane Util. Factor				0.97		0.88		0.95	1.00		0.86	0.86
Frt				1.00		0.85		1.00	0.85		0.95	0.85
Flt Protected				0.95		1.00		1.00	1.00		1.00	1.00
Satd. Flow (prot)				3433		2787		3539	1583		4581	1362
Flt Permitted				0.95		1.00		1.00	1.00		1.00	1.00
Satd. Flow (perm)				3433		2787		3539	1583		4581	1362
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	646	0	322	0	1288	515	0	1123	1016
RTOR Reduction (vph)	0	0	0	0	0	69	0	0	196	0	104	194
Lane Group Flow (vph)	0	0	0	646	0	253	0	1288	319	0	1527	314
Turn Type				Perm		Perm		NA	Perm		NA	Perm
Protected Phases								2			6	
Permitted Phases				8		8			2			6
Actuated Green, G (s)				18.7		18.7		43.3	43.3		43.3	43.3
Effective Green, g (s)				18.7		18.7		43.3	43.3		43.3	43.3
Actuated g/C Ratio				0.27		0.27		0.62	0.62		0.62	0.62
Clearance Time (s)				4.0		4.0		4.0	4.0		4.0	4.0
Vehicle Extension (s)				3.0		3.0		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)				917		744		2189	979		2833	842
v/s Ratio Prot								c0.36			0.33	
v/s Ratio Perm				c0.19		0.09			0.20			0.23
v/c Ratio				0.70		0.34		0.59	0.33		0.54	0.37
Uniform Delay, d1				23.2		20.7		8.0	6.4		7.6	6.6
Progression Factor				1.00		1.00		1.00	1.00		1.00	1.00
Incremental Delay, d2				2.5		0.3		1.2	0.9		0.7	1.3
Delay (s)				25.6		21.0		9.2	7.3		8.4	7.9
Level of Service				C		C		A	A		A	A
Approach Delay (s)		0.0			24.1			8.6			8.3	
Approach LOS		A			C			A			A	






























Intersection Summary

HCM 2000 Control Delay	11.5	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.62		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	56.4%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 16: Santa Rita Rd & I-580 EB Ramps/Pimilco Dr

BART to Livermore Extension Project
 2040 Express Bus + Garage AM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 		 	 		 		  		 	 	
Traffic Volume (vph)	567	115	742	186	0	188	0	879	116	182	1348	0
Future Volume (vph)	567	115	742	186	0	188	0	879	116	182	1348	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0		4.0		4.0		4.0	4.0	
Lane Util. Factor	0.97	1.00	1.00	0.97		0.88		0.86		1.00	0.95	
Frt	1.00	1.00	0.85	1.00		0.85		0.98		1.00	1.00	
Flt Protected	0.95	1.00	1.00	0.95		1.00		1.00		0.95	1.00	
Satd. Flow (prot)	3433	1863	1583	3433		2787		6296		1770	3539	
Flt Permitted	0.95	1.00	1.00	0.95		1.00		1.00		0.95	1.00	
Satd. Flow (perm)	3433	1863	1583	3433		2787		6296		1770	3539	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	616	125	807	202	0	204	0	955	126	198	1465	0
RTOR Reduction (vph)	0	0	0	0	0	71	0	39	0	0	0	0
Lane Group Flow (vph)	616	125	807	202	0	133	0	1042	0	198	1465	0
Turn Type	Perm	NA	Free	Prot		pm+ov		NA		Prot	NA	Perm
Protected Phases		4		3		1		2		1	6	
Permitted Phases	4		Free			3						6
Actuated Green, G (s)	14.9	14.9	60.0	4.5		12.9		16.2		8.4	28.6	
Effective Green, g (s)	14.9	14.9	60.0	4.5		12.9		16.2		8.4	28.6	
Actuated g/C Ratio	0.25	0.25	1.00	0.08		0.22		0.27		0.14	0.48	
Clearance Time (s)	4.0	4.0		4.0		4.0		4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0		3.0		3.0		3.0	3.0	
Lane Grp Cap (vph)	852	462	1583	257		599		1699		247	1686	
v/s Ratio Prot		0.07		0.06		0.03		0.17		0.11	c0.41	
v/s Ratio Perm	c0.18		c0.51			0.02						
v/c Ratio	0.72	0.27	0.51	0.79		0.22		0.61		0.80	0.87	
Uniform Delay, d1	20.7	18.2	0.0	27.3		19.4		19.2		25.0	14.0	
Progression Factor	1.00	1.00	1.00	1.00		1.00		1.00		1.00	1.00	
Incremental Delay, d2	3.1	0.3	1.2	14.6		0.2		1.7		16.8	6.4	
Delay (s)	23.7	18.5	1.2	41.8		19.6		20.8		41.8	20.4	
Level of Service	C	B	A	D		B		C		D	C	
Approach Delay (s)		11.5			30.7			20.8			23.0	
Approach LOS		B			C			C			C	

Intersection Summary		
HCM 2000 Control Delay	19.4	HCM 2000 Level of Service B
HCM 2000 Volume to Capacity ratio	0.91	
Actuated Cycle Length (s)	60.0	Sum of lost time (s) 16.0
Intersection Capacity Utilization	60.1%	ICU Level of Service B
Analysis Period (min)	15	

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
17: Santa Rita Rd & Valley Ave

BART to Livermore Extension Project
2040 Express Bus + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	212	252	83	195	436	970	120	550	83	597	893	183
Future Volume (vph)	212	252	83	195	436	970	120	550	83	597	893	183
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.97	0.95		0.97	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.98		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	3433	3470		3433	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	3433	3470		3433	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	230	274	90	212	474	1054	130	598	90	649	971	199
RTOR Reduction (vph)	0	0	73	0	0	0	0	16	0	0	0	121
Lane Group Flow (vph)	230	274	17	212	474	1054	130	672	0	649	971	78
Turn Type	Prot	NA	Perm	Prot	NA	Free	Prot	NA		Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1		6
Permitted Phases			4			Free						6
Actuated Green, G (s)	8.6	13.1	13.1	10.1	14.6	71.3	4.0	17.0		15.1	28.1	28.1
Effective Green, g (s)	8.6	13.1	13.1	10.1	14.6	71.3	4.0	17.0		15.1	28.1	28.1
Actuated g/C Ratio	0.12	0.18	0.18	0.14	0.20	1.00	0.06	0.24		0.21	0.39	0.39
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	414	650	290	250	724	1583	192	827		727	1394	623
v/s Ratio Prot	0.07	0.08		c0.12	0.13		0.04	0.19		c0.19	0.27	
v/s Ratio Perm			0.01			c0.67						0.05
v/c Ratio	0.56	0.42	0.06	0.85	0.65	0.67	0.68	0.81		0.89	0.70	0.13
Uniform Delay, d1	29.5	25.7	24.0	29.9	26.0	0.0	33.0	25.6		27.3	18.0	13.8
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	1.6	0.4	0.1	22.5	2.1	2.2	9.1	6.1		13.3	1.5	0.1
Delay (s)	31.2	26.2	24.1	52.3	28.2	2.2	42.1	31.8		40.6	19.6	13.9
Level of Service	C	C	C	D	C	A	D	C		D	B	B
Approach Delay (s)		27.8			15.4			33.4			26.5	
Approach LOS		C			B			C			C	

Intersection Summary

HCM 2000 Control Delay	23.9	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.88		
Actuated Cycle Length (s)	71.3	Sum of lost time (s)	16.0
Intersection Capacity Utilization	66.3%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
18: Bernal Ave/Valley Ave & Stanley Blvd

BART to Livermore Extension Project
2040 Express Bus + Garage AM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	215	203	55	248	897	954	174	479	102	142	363	124
Future Volume (vph)	215	203	55	248	897	954	174	479	102	142	363	124
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.95	1.00	0.97	0.91	0.91	1.00	0.95	1.00	0.97	0.95	
Frt	1.00	1.00	0.85	1.00	0.96	0.85	1.00	1.00	0.85	1.00	0.96	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	3433	3539	1583	3433	3238	1441	1770	3539	1583	3433	3404	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	3433	3539	1583	3433	3238	1441	1770	3539	1583	3433	3404	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	234	221	60	270	975	1037	189	521	111	154	395	135
RTOR Reduction (vph)	0	0	30	0	47	28	0	0	88	0	38	0
Lane Group Flow (vph)	234	221	30	270	1343	594	189	521	23	154	492	0
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	
Protected Phases	7	4	5	3	8	1	5	2		1	6	
Permitted Phases			4			8			2			
Actuated Green, G (s)	7.0	33.0	44.6	11.0	37.0	46.9	11.6	18.1	18.1	9.9	16.4	
Effective Green, g (s)	7.0	33.0	44.6	11.0	37.0	46.9	11.6	18.1	18.1	9.9	16.4	
Actuated g/C Ratio	0.08	0.38	0.51	0.12	0.42	0.53	0.13	0.21	0.21	0.11	0.19	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	273	1327	874	429	1361	833	233	727	325	386	634	
v/s Ratio Prot	c0.07	0.06	0.00	0.08	c0.41	0.08	c0.11	c0.15		0.04	0.14	
v/s Ratio Perm			0.01			0.33			0.01			
v/c Ratio	0.86	0.17	0.03	0.63	0.99	0.71	0.81	0.72	0.07	0.40	0.78	
Uniform Delay, d1	40.0	18.3	10.9	36.6	25.3	15.5	37.1	32.6	28.2	36.3	34.1	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	22.3	0.1	0.0	2.9	21.1	2.9	18.9	3.4	0.1	0.7	5.9	
Delay (s)	62.3	18.4	10.9	39.4	46.3	18.4	56.0	35.9	28.3	37.0	40.0	
Level of Service	E	B	B	D	D	B	E	D	C	D	D	
Approach Delay (s)		37.5			37.9			39.5			39.3	
Approach LOS		D			D			D			D	
Intersection Summary												
HCM 2000 Control Delay			38.4			HCM 2000 Level of Service				D		
HCM 2000 Volume to Capacity ratio			0.90									
Actuated Cycle Length (s)			88.0	Sum of lost time (s)				16.0				
Intersection Capacity Utilization			78.1%	ICU Level of Service				D				
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis
19: Fallon Rd & Dublin Blvd/Croak Rd

BART to Livermore Extension Project
2040 Express Bus + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↑↑↑	↖↗	↖↗↘	↑↑↑	↖	↖↗↘	↑↑↑	↖↗	↖↗	↑↑↑	↖
Traffic Volume (vph)	48	79	92	354	1304	419	835	276	43	80	710	325
Future Volume (vph)	48	79	92	354	1304	419	835	276	43	80	710	325
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.91	0.88	0.94	0.91	1.00	0.94	0.91	0.88	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5085	2787	4990	5085	1583	4990	5085	2787	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5085	2787	4990	5085	1583	4990	5085	2787	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	52	86	100	385	1417	455	908	300	47	87	772	353
RTOR Reduction (vph)	0	0	42	0	0	229	0	0	32	0	0	133
Lane Group Flow (vph)	52	86	58	385	1417	226	908	300	15	87	772	220
Turn Type	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4	5	3	8		5	2		1	6	
Permitted Phases			4			8			2			6
Actuated Green, G (s)	2.4	9.6	28.3	31.3	38.5	38.5	18.7	28.7	28.7	4.4	14.4	14.4
Effective Green, g (s)	2.4	9.6	28.3	31.3	38.5	38.5	18.7	28.7	28.7	4.4	14.4	14.4
Actuated g/C Ratio	0.03	0.11	0.31	0.35	0.43	0.43	0.21	0.32	0.32	0.05	0.16	0.16
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	91	542	876	1735	2175	677	1036	1621	888	167	813	253
v/s Ratio Prot	c0.02	0.02	0.01	0.08	c0.28		c0.18	0.06		0.03	c0.15	
v/s Ratio Perm			0.01			0.14			0.01			0.14
v/c Ratio	0.57	0.16	0.07	0.22	0.65	0.33	0.88	0.19	0.02	0.52	0.95	0.87
Uniform Delay, d1	43.3	36.5	21.6	20.7	20.4	17.2	34.5	22.2	21.0	41.8	37.4	36.9
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	8.4	0.1	0.0	0.1	0.7	0.3	8.5	0.3	0.0	2.9	21.4	31.2
Delay (s)	51.7	36.7	21.6	20.8	21.1	17.5	43.0	22.4	21.0	44.7	58.9	68.1
Level of Service	D	D	C	C	C	B	D	C	C	D	E	E
Approach Delay (s)		33.6			20.3			37.3			60.5	
Approach LOS		C			C			D			E	

Intersection Summary

HCM 2000 Control Delay	35.1	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.76		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	71.2%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 20: El Charro Rd/Fallon Rd & I-580 WB Ramps

BART to Livermore Extension Project
 2040 Express Bus + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↙	↖	↗		↑↑↑	↗		↑↑↑	↗
Traffic Volume (vph)	0	0	0	169	0	613	0	872	478	0	648	399
Future Volume (vph)	0	0	0	169	0	613	0	872	478	0	648	399
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0	4.0	4.0		4.0	4.0		4.0	4.0
Lane Util. Factor				0.95	0.95	0.88		0.91	1.00		0.91	1.00
Frt				1.00	1.00	0.85		1.00	0.85		1.00	0.85
Flt Protected				0.95	0.95	1.00		1.00	1.00		1.00	1.00
Satd. Flow (prot)				1681	1681	2787		5085	1583		5085	1583
Flt Permitted				0.95	0.95	1.00		1.00	1.00		1.00	1.00
Satd. Flow (perm)				1681	1681	2787		5085	1583		5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	184	0	666	0	948	520	0	704	434
RTOR Reduction (vph)	0	0	0	0	0	115	0	0	195	0	0	162
Lane Group Flow (vph)	0	0	0	94	90	551	0	948	325	0	704	272
Turn Type				Perm	NA	Perm		NA	Perm		NA	Perm
Protected Phases					8			2			6	
Permitted Phases				8		8			2			6
Actuated Green, G (s)				18.7	18.7	18.7		43.8	43.8		43.8	43.8
Effective Green, g (s)				18.2	18.2	18.2		43.8	43.8		43.8	43.8
Actuated g/C Ratio				0.26	0.26	0.26		0.63	0.63		0.63	0.63
Clearance Time (s)				3.5	3.5	3.5		4.0	4.0		4.0	4.0
Vehicle Extension (s)				2.0	2.0	2.0		2.0	2.0		2.0	2.0
Lane Grp Cap (vph)				437	437	724		3181	990		3181	990
v/s Ratio Prot								0.19			0.14	
v/s Ratio Perm				0.06	0.05	c0.20			c0.21			0.17
v/c Ratio				0.22	0.21	0.76		0.30	0.33		0.22	0.27
Uniform Delay, d1				20.3	20.3	23.9		6.0	6.2		5.7	5.9
Progression Factor				1.00	1.00	1.00		0.89	1.16		1.00	1.00
Incremental Delay, d2				0.1	0.1	4.3		0.2	0.7		0.2	0.7
Delay (s)				20.4	20.3	28.2		5.5	7.9		5.9	6.6
Level of Service				C	C	C		A	A		A	A
Approach Delay (s)		0.0			26.5			6.4			6.1	
Approach LOS		A			C			A			A	

Intersection Summary			
HCM 2000 Control Delay	11.2	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.46		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	45.0%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 21: El Charro Rd & I-580 EB Ramps

BART to Livermore Extension Project
 2040 Express Bus + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔		↔					↕	↗		↕	↗
Traffic Volume (vph)	278	0	616	0	0	0	0	1350	425	0	469	0
Future Volume (vph)	278	0	616	0	0	0	0	1350	425	0	469	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0					4.0	4.0		4.0	
Lane Util. Factor	0.97		0.88					0.91	0.91		0.91	
Frt	1.00		0.85					0.99	0.85		1.00	
Flt Protected	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (prot)	3433		2787					3372	1441		3390	
Flt Permitted	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (perm)	3433		2787					3372	1441		3390	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	302	0	670	0	0	0	0	1467	462	0	510	0
RTOR Reduction (vph)	0	0	570	0	0	0	0	3	108	0	0	0
Lane Group Flow (vph)	302	0	101	0	0	0	0	1519	299	0	510	0
Turn Type	Prot		Perm					NA	Perm		NA	Perm
Protected Phases	4							2			6	
Permitted Phases			4						2			6
Actuated Green, G (s)	10.5		10.5					51.5	51.5		51.5	
Effective Green, g (s)	10.5		10.5					51.5	51.5		51.5	
Actuated g/C Ratio	0.15		0.15					0.74	0.74		0.74	
Clearance Time (s)	4.0		4.0					4.0	4.0		4.0	
Vehicle Extension (s)	2.0		2.0					3.0	3.0		3.0	
Lane Grp Cap (vph)	514		418					2480	1060		2494	
v/s Ratio Prot	c0.09							c0.45			0.15	
v/s Ratio Perm			0.04						0.21			
v/c Ratio	0.59		0.24					0.61	0.28		0.20	
Uniform Delay, d1	27.7		26.2					4.5	3.1		2.9	
Progression Factor	1.00		1.00					1.00	1.00		0.93	
Incremental Delay, d2	1.1		0.1					1.1	0.7		0.2	
Delay (s)	28.8		26.3					5.6	3.8		2.9	
Level of Service	C		C					A	A		A	
Approach Delay (s)		27.1			0.0			5.2			2.9	
Approach LOS		C			A			A			A	

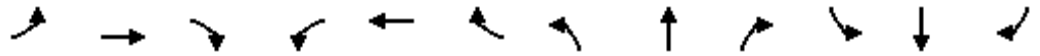
Intersection Summary

HCM 2000 Control Delay	11.1	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.61		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	56.4%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 22: El Charro Rd & Stoneridge Dr/Jack London Blvd

BART to Livermore Extension Project
 2040 Express Bus + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔↔↔	↑↑	↗	↖	↑↑	↗↗	↖	↑↑		↖↖↖	↑	↗↗
Traffic Volume (vph)	93	130	16	65	636	809	31	537	27	322	211	108
Future Volume (vph)	93	130	16	65	636	809	31	537	27	322	211	108
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	0.94	0.95	1.00	1.00	0.95	0.88	1.00	0.95		0.94	1.00	0.88
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	4491	3185	1425	1593	3185	2508	1593	3163		4491	1676	2508
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	4491	3185	1425	1593	3185	2508	1593	3163		4491	1676	2508
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	101	141	17	71	691	879	34	584	29	350	229	117
RTOR Reduction (vph)	0	0	13	0	0	100	0	6	0	0	0	72
Lane Group Flow (vph)	101	141	4	71	691	779	34	607	0	350	229	45
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Prot	NA		Prot	NA	Perm
Protected Phases	7	4		3	8	1	5	2		1	6	
Permitted Phases			4			8						6
Actuated Green, G (s)	3.0	15.1	15.1	3.0	15.1	23.3	2.5	17.1		8.2	22.8	22.8
Effective Green, g (s)	3.0	15.1	15.1	3.0	15.1	23.3	2.5	17.1		8.2	22.8	22.8
Actuated g/C Ratio	0.05	0.25	0.25	0.05	0.25	0.39	0.04	0.29		0.14	0.38	0.38
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	226	809	362	80	809	983	67	910		619	643	962
v/s Ratio Prot	c0.02	0.04		0.04	c0.22	c0.11	0.02	c0.19		0.08	0.14	
v/s Ratio Perm			0.00			0.20						0.02
v/c Ratio	0.45	0.17	0.01	0.89	0.85	0.79	0.51	0.67		0.57	0.36	0.05
Uniform Delay, d1	27.4	17.3	16.6	28.0	21.1	15.9	27.8	18.6		23.9	13.1	11.5
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	1.4	0.1	0.0	63.6	8.7	4.5	5.9	1.9		1.2	0.3	0.0
Delay (s)	28.8	17.4	16.6	91.6	29.8	20.4	33.8	20.5		25.1	13.4	11.5
Level of Service	C	B	B	F	C	C	C	C		C	B	B
Approach Delay (s)		21.8			27.4			21.2			19.0	
Approach LOS		C			C			C			B	

Intersection Summary

HCM 2000 Control Delay	23.9	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.74		
Actuated Cycle Length (s)	59.4	Sum of lost time (s)	16.0
Intersection Capacity Utilization	62.2%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 23: Stanley Blvd & El Charro Rd

BART to Livermore Extension Project
 2040 Express Bus + Garage AM



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	↰	↑↑	↑↑↑	↰	↰↰	↰↰
Traffic Volume (vph)	392	459	2786	108	25	117
Future Volume (vph)	392	459	2786	108	25	117
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95	0.91	1.00	0.97	0.88
Frt	1.00	1.00	1.00	0.85	1.00	0.85
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1770	3539	5085	1583	3433	2787
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1770	3539	5085	1583	3433	2787
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	426	499	3028	117	27	127
RTOR Reduction (vph)	0	0	0	26	0	119
Lane Group Flow (vph)	426	499	3028	91	27	8
Turn Type	Prot	NA	NA	Perm	Prot	Perm
Protected Phases	7	4	8		6	
Permitted Phases				8		6
Actuated Green, G (s)	27.0	96.0	65.0	65.0	6.6	6.6
Effective Green, g (s)	27.0	96.0	65.0	65.0	6.6	6.6
Actuated g/C Ratio	0.24	0.87	0.59	0.59	0.06	0.06
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	432	3071	2988	930	204	166
v/s Ratio Prot	c0.24	0.14	c0.60		c0.01	
v/s Ratio Perm				0.06		0.00
v/c Ratio	0.99	0.16	1.01	0.10	0.13	0.05
Uniform Delay, d1	41.6	1.1	22.8	10.0	49.3	49.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	39.3	0.0	19.9	0.0	0.3	0.1
Delay (s)	80.9	1.1	42.7	10.0	49.6	49.1
Level of Service	F	A	D	B	D	D
Approach Delay (s)		37.9	41.4		49.2	
Approach LOS		D	D		D	

Intersection Summary

HCM 2000 Control Delay	40.9	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.95		
Actuated Cycle Length (s)	110.6	Sum of lost time (s)	12.0
Intersection Capacity Utilization	88.9%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 24: Airway Blvd/Driveway & N Canyons Pkwy

BART to Livermore Extension Project
 2040 Express Bus + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑	↑	↑↑	↑	↑		↑	↑↑		↑	
Traffic Volume (vph)	0	91	50	718	1028	0	968	0	970	0	0	0
Future Volume (vph)	0	91	50	718	1028	0	968	0	970	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		2.0	2.0	2.0	2.0			4.2	2.0			
Lane Util. Factor		0.95	1.00	0.97	1.00			1.00	0.88			
Frt		1.00	0.85	1.00	1.00			1.00	0.85			
Flt Protected		1.00	1.00	0.95	1.00			0.95	1.00			
Satd. Flow (prot)		3539	1583	3433	1863			1770	2787			
Flt Permitted		1.00	1.00	0.95	1.00			0.95	1.00			
Satd. Flow (perm)		3539	1583	3433	1863			1770	2787			
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	99	54	780	1117	0	1052	0	1054	0	0	0
RTOR Reduction (vph)	0	0	48	0	0	0	0	0	85	0	0	0
Lane Group Flow (vph)	0	99	6	780	1117	0	0	1052	969	0	0	0
Turn Type		NA	Perm	Prot	NA	Perm	Split	NA	pm+ov			
Protected Phases		2		1	6		8	8	1	4	4	
Permitted Phases			2			6			8			
Actuated Green, G (s)		10.0	10.0	41.0	55.0			39.0	80.0			
Effective Green, g (s)		12.0	12.0	43.0	57.0			38.8	84.0			
Actuated g/C Ratio		0.12	0.12	0.42	0.56			0.38	0.82			
Clearance Time (s)		4.0	4.0	4.0	4.0			4.0	4.0			
Vehicle Extension (s)		3.0	3.0	3.0	3.0			3.0	3.0			
Lane Grp Cap (vph)		416	186	1447	1041			673	2349			
v/s Ratio Prot		0.03		0.23	c0.60			c0.59	0.17			
v/s Ratio Perm			0.00						0.17			
v/c Ratio		0.24	0.03	0.54	1.07			1.56	0.41			
Uniform Delay, d1		40.8	39.9	22.1	22.5			31.6	2.4			
Progression Factor		1.00	1.00	1.00	1.00			1.00	1.00			
Incremental Delay, d2		0.3	0.1	0.4	49.7			260.6	0.1			
Delay (s)		41.1	39.9	22.5	72.2			292.2	2.5			
Level of Service		D	D	C	E			F	A			
Approach Delay (s)		40.7			51.7			147.2			0.0	
Approach LOS		D			D			F			A	

Intersection Summary			
HCM 2000 Control Delay	99.7	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.35		
Actuated Cycle Length (s)	102.0	Sum of lost time (s)	12.2
Intersection Capacity Utilization	114.6%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

25: Airway Blvd & I-580 WB Ramps

BART to Livermore Extension Project
2040 Express Bus + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↙	↖	↗		↑↑	↗		↑↑↑	
Traffic Volume (vph)	0	0	0	69	44	818	0	1231	343	0	296	552
Future Volume (vph)	0	0	0	69	44	818	0	1231	343	0	296	552
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0	4.0	4.0		4.0	4.0		4.0	
Lane Util. Factor				0.95	0.95	0.88		0.95	1.00		0.91	
Frt				1.00	1.00	0.85		1.00	0.85		0.90	
Flt Protected				0.95	0.98	1.00		1.00	1.00		1.00	
Satd. Flow (prot)				1681	1733	2787		3539	1583		4589	
Flt Permitted				0.95	0.98	1.00		1.00	1.00		1.00	
Satd. Flow (perm)				1681	1733	2787		3539	1583		4589	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	75	48	889	0	1338	373	0	322	600
RTOR Reduction (vph)	0	0	0	0	0	33	0	0	185	0	297	0
Lane Group Flow (vph)	0	0	0	40	83	856	0	1338	188	0	625	0
Turn Type				Split	NA	Perm		NA	Perm		NA	
Protected Phases				8	8			2			6	
Permitted Phases						8			2			
Actuated Green, G (s)				20.1	20.1	20.1		27.3	27.3		27.3	
Effective Green, g (s)				20.1	20.1	20.1		28.6	28.6		28.6	
Actuated g/C Ratio				0.35	0.35	0.35		0.50	0.50		0.50	
Clearance Time (s)				4.0	4.0	4.0		5.3	5.3		5.3	
Vehicle Extension (s)				2.0	2.0	2.0		4.0	4.0		4.0	
Lane Grp Cap (vph)				595	614	987		1785	798		2314	
v/s Ratio Prot				0.02	0.05			c0.38			0.14	
v/s Ratio Perm						c0.31			0.12			
v/c Ratio				0.07	0.14	0.87		0.75	0.24		0.27	
Uniform Delay, d1				12.1	12.4	17.1		11.2	7.9		8.1	
Progression Factor				1.00	1.00	1.00		1.00	1.00		1.00	
Incremental Delay, d2				0.0	0.0	7.9		1.9	0.2		0.1	
Delay (s)				12.1	12.4	24.9		13.1	8.1		8.1	
Level of Service				B	B	C		B	A		A	
Approach Delay (s)		0.0			23.4			12.0			8.1	
Approach LOS		A			C			B			A	

Intersection Summary

HCM 2000 Control Delay	14.2	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.80		
Actuated Cycle Length (s)	56.7	Sum of lost time (s)	8.0
Intersection Capacity Utilization	69.3%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 26: Airway Blvd & I-580 EB Ramps/Kitty Hawk Rd

BART to Livermore Extension Project
 2040 Express Bus + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↑	↖	↖	↑	↖	↖	↑↘		↖	↑↘	
Traffic Volume (vph)	643	194	230	28	37	92	32	517	164	74	146	164
Future Volume (vph)	643	194	230	28	37	92	32	517	164	74	146	164
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.4	4.4	4.4	4.5	2.7		4.0	2.7	
Lane Util. Factor	0.97	1.00	1.00	1.00	1.00	1.00	1.00	0.95		1.00	0.95	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.96		1.00	0.92	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	3433	1863	1583	1770	1863	1583	1770	3412		1770	3259	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	3433	1863	1583	1770	1863	1583	1770	3412		1770	3259	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	699	211	250	30	40	100	35	562	178	80	159	178
RTOR Reduction (vph)	0	0	186	0	0	80	0	42	0	0	109	0
Lane Group Flow (vph)	699	211	64	30	40	20	35	698	0	80	228	0
Turn Type	Split	NA	Perm	Split	NA	pm+ov	Prot	NA		Prot	NA	
Protected Phases	7	7		8	8	1	5	2		1	6	
Permitted Phases			7			8						
Actuated Green, G (s)	17.0	17.0	17.0	7.1	7.1	14.3	2.0	19.1		7.2	24.3	
Effective Green, g (s)	17.0	17.0	17.0	6.7	6.7	13.5	1.5	20.4		7.2	25.6	
Actuated g/C Ratio	0.26	0.26	0.26	0.10	0.10	0.20	0.02	0.31		0.11	0.39	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Vehicle Extension (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	3.5		2.0	4.0	
Lane Grp Cap (vph)	878	476	405	178	187	426	39	1048		191	1256	
v/s Ratio Prot	c0.20	0.11		0.02	c0.02	0.00	0.02	c0.20		c0.05	0.07	
v/s Ratio Perm			0.04			0.01						
v/c Ratio	0.80	0.44	0.16	0.17	0.21	0.05	0.90	0.67		0.42	0.18	
Uniform Delay, d1	23.1	20.7	19.2	27.3	27.4	21.3	32.4	20.0		27.6	13.5	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	4.7	0.2	0.1	0.2	0.2	0.0	101.3	1.7		0.5	0.1	
Delay (s)	27.8	21.0	19.2	27.5	27.6	21.3	133.7	21.7		28.2	13.6	
Level of Service	C	C	B	C	C	C	F	C		C	B	
Approach Delay (s)		24.7			23.9			26.8			16.4	
Approach LOS		C			C			C			B	

Intersection Summary

HCM 2000 Control Delay	23.9	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.62		
Actuated Cycle Length (s)	66.4	Sum of lost time (s)	15.6
Intersection Capacity Utilization	58.6%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 27: Collier Canyon Rd & N Canyons Pkwy/Portola Ave

BART to Livermore Extension Project
 2040 Express Bus + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↕	↖	↖	↕	↖	↖	↕		↖	↕	↖
Traffic Volume (vph)	269	189	98	151	927	59	80	8	102	56	13	207
Future Volume (vph)	269	189	98	151	927	59	80	8	102	56	13	207
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	2.7	2.7	4.0	2.7	2.7	4.0	3.0		4.0	4.6	4.6
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.86		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	1770	1604		1770	1863	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	1770	1604		1770	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	292	205	107	164	1008	64	87	9	111	61	14	225
RTOR Reduction (vph)	0	0	65	0	0	38	0	91	0	0	0	189
Lane Group Flow (vph)	292	205	42	164	1008	26	87	29	0	61	14	36
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA		Prot	NA	Perm
Protected Phases	1	6		5	2		3	8		7	NA	4
Permitted Phases			6			2						4
Actuated Green, G (s)	11.1	28.0	28.0	12.4	29.3	29.3	5.9	12.8		5.7	12.6	12.6
Effective Green, g (s)	11.1	29.3	29.3	12.4	30.6	30.6	5.9	13.8		5.7	12.0	12.0
Actuated g/C Ratio	0.15	0.39	0.39	0.17	0.41	0.41	0.08	0.18		0.08	0.16	0.16
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	508	1384	619	293	1445	646	139	295		134	298	253
v/s Ratio Prot	0.09	0.06		c0.09	c0.28		c0.05	0.02		0.03	0.01	
v/s Ratio Perm			0.03			0.02						c0.02
v/c Ratio	0.57	0.15	0.07	0.56	0.70	0.04	0.63	0.10		0.46	0.05	0.14
Uniform Delay, d1	29.7	14.7	14.3	28.7	18.3	13.3	33.4	25.4		33.1	26.6	27.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	1.6	0.0	0.0	2.3	1.5	0.0	8.5	0.1		2.4	0.1	0.3
Delay (s)	31.3	14.8	14.3	31.1	19.8	13.3	41.9	25.5		35.6	26.7	27.3
Level of Service	C	B	B	C	B	B	D	C		D	C	C
Approach Delay (s)		22.7			21.0			32.4			28.9	
Approach LOS		C			C			C			C	

Intersection Summary

HCM 2000 Control Delay	23.4	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.56		
Actuated Cycle Length (s)	74.9	Sum of lost time (s)	15.3
Intersection Capacity Utilization	54.4%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
28: Isabel Ave/Campus Hill Dr & Portola Ave

BART to Livermore Extension Project
2040 Express Bus + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↘	↑↑	↗↗	↘↘↘	↑↑		↘↘	↑↑	↗	↘	↑↑	↗
Traffic Volume (vph)	1	198	224	502	626	145	504	296	79	66	199	2
Future Volume (vph)	1	198	224	502	626	145	504	296	79	66	199	2
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	5.8	5.8
Lane Util. Factor	1.00	0.95	0.88	0.94	0.95		0.97	0.95	1.00	1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	0.97		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3539	2787	4990	3439		3433	3539	1583	1770	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	3539	2787	4990	3439		3433	3539	1583	1770	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	1	215	243	546	680	158	548	322	86	72	216	2
RTOR Reduction (vph)	0	0	188	0	13	0	0	0	58	0	0	2
Lane Group Flow (vph)	1	215	55	546	825	0	548	322	28	72	216	0
Turn Type	Prot	NA	Perm	Prot	NA		Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4						2			6
Actuated Green, G (s)	1.5	18.5	18.5	15.2	32.2		21.3	26.7	26.7	7.7	13.5	13.5
Effective Green, g (s)	1.5	19.8	19.8	15.2	33.5		21.3	28.0	28.0	7.7	12.6	12.6
Actuated g/C Ratio	0.02	0.23	0.23	0.18	0.39		0.25	0.32	0.32	0.09	0.15	0.15
Clearance Time (s)	4.0	5.3	5.3	4.0	5.3		4.0	5.3	5.3	4.0	4.9	4.9
Vehicle Extension (s)	2.0	3.0	3.0	2.0	3.0		2.0	3.0	3.0	2.0	3.0	3.0
Lane Grp Cap (vph)	30	808	636	874	1328		843	1142	511	157	514	230
v/s Ratio Prot	0.00	0.06		c0.11	c0.24		c0.16	0.09		0.04	c0.06	
v/s Ratio Perm			0.02						0.02			0.00
v/c Ratio	0.03	0.27	0.09	0.62	0.62		0.65	0.28	0.05	0.46	0.42	0.00
Uniform Delay, d1	41.9	27.5	26.3	33.1	21.5		29.4	21.9	20.2	37.5	33.7	31.7
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.2	0.2	0.1	1.0	0.9		1.4	0.1	0.0	0.8	0.6	0.0
Delay (s)	42.1	27.7	26.4	34.1	22.4		30.7	22.0	20.3	38.3	34.3	31.7
Level of Service	D	C	C	C	C		C	C	C	D	C	C
Approach Delay (s)		27.0			27.0			26.8			35.3	
Approach LOS		C			C			C			D	

Intersection Summary

HCM 2000 Control Delay	27.7	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.62		
Actuated Cycle Length (s)	86.7	Sum of lost time (s)	17.8
Intersection Capacity Utilization	68.6%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 29: Isabel Ave & I-580 WB Ramps

BART to Livermore Extension Project
 2040 Express Bus + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↔↔		↗		↑↑↑	↗		↑↑↑	↗
Traffic Volume (vph)	0	0	0	653	0	471	0	496	0	0	671	426
Future Volume (vph)	0	0	0	653	0	471	0	496	0	0	671	426
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0		4.0		4.8			4.8	4.8
Lane Util. Factor				0.97		1.00		0.91			0.91	1.00
Frt				1.00		0.85		1.00			1.00	0.85
Flt Protected				0.95		1.00		1.00			1.00	1.00
Satd. Flow (prot)				3433		1583		5085			5085	1583
Flt Permitted				0.95		1.00		1.00			1.00	1.00
Satd. Flow (perm)				3433		1583		5085			5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	710	0	512	0	539	0	0	729	463
RTOR Reduction (vph)	0	0	0	0	0	107	0	0	0	0	0	223
Lane Group Flow (vph)	0	0	0	710	0	405	0	539	0	0	729	240
Turn Type				Prot		Prot		NA	Free		NA	Prot
Protected Phases				8		8		2			6	6
Permitted Phases									Free			
Actuated Green, G (s)				20.1		20.1		31.9			31.9	31.9
Effective Green, g (s)				20.1		20.1		31.1			31.1	31.1
Actuated g/C Ratio				0.34		0.34		0.52			0.52	0.52
Clearance Time (s)				4.0		4.0		4.0			4.0	4.0
Vehicle Extension (s)				2.0		2.0		4.0			4.0	4.0
Lane Grp Cap (vph)				1150		530		2635			2635	820
v/s Ratio Prot				0.21		c0.26		0.11			0.14	c0.15
v/s Ratio Perm												
v/c Ratio				0.62		0.76		0.20			0.28	0.29
Uniform Delay, d1				16.7		17.8		7.8			8.1	8.2
Progression Factor				1.00		1.00		0.76			1.00	1.00
Incremental Delay, d2				0.7		5.8		0.2			0.3	0.9
Delay (s)				17.4		23.7		6.1			8.4	9.1
Level of Service				B		C		A			A	A
Approach Delay (s)		0.0			20.0			6.1			8.7	
Approach LOS		A			C			A			A	

Intersection Summary			
HCM 2000 Control Delay	12.9	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.48		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.8
Intersection Capacity Utilization	46.1%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 30: Isabel Ave & I-580 EB Ramps

BART to Livermore Extension Project
 2040 Express Bus + Garage AM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations													
Traffic Volume (vph)	228	0	491	0	0	0	0	720	524	0	1002	363	
Future Volume (vph)	228	0	491	0	0	0	0	720	524	0	1002	363	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)	4.0		4.0					4.0	4.0		4.0	4.0	
Lane Util. Factor	0.97		0.88					0.91	1.00		0.91	1.00	
Frt	1.00		0.85					1.00	0.85		1.00	0.85	
Flt Protected	0.95		1.00					1.00	1.00		1.00	1.00	
Satd. Flow (prot)	3433		2787					5085	1583		5085	1583	
Flt Permitted	0.95		1.00					1.00	1.00		1.00	1.00	
Satd. Flow (perm)	3433		2787					5085	1583		5085	1583	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	
Adj. Flow (vph)	248	0	534	0	0	0	0	783	570	0	1089	395	
RTOR Reduction (vph)	0	0	127	0	0	0	0	0	0	0	0	0	
Lane Group Flow (vph)	248	0	407	0	0	0	0	783	570	0	1089	395	
Turn Type	Prot		Perm					NA	Free		NA	Free	
Protected Phases	4							2			6		
Permitted Phases			4						Free			Free	
Actuated Green, G (s)	12.8		12.8					38.2	60.0		38.2	60.0	
Effective Green, g (s)	12.8		12.8					39.2	60.0		39.2	60.0	
Actuated g/C Ratio	0.21		0.21					0.65	1.00		0.65	1.00	
Clearance Time (s)	4.0		4.0					5.0			5.0		
Vehicle Extension (s)	2.0		2.0					4.0			4.0		
Lane Grp Cap (vph)	732		594					3322	1583		3322	1583	
v/s Ratio Prot	0.07							0.15			0.21		
v/s Ratio Perm			c0.15						c0.36			0.25	
v/c Ratio	0.34		0.69					0.24	0.36		0.33	0.25	
Uniform Delay, d1	20.0		21.7					4.3	0.0		4.6	0.0	
Progression Factor	1.00		1.00					1.00	1.00		0.90	1.00	
Incremental Delay, d2	0.1		2.6					0.2	0.6		0.3	0.4	
Delay (s)	20.1		24.4					4.4	0.6		4.4	0.4	
Level of Service	C		C					A	A		A	A	
Approach Delay (s)		23.0			0.0			2.8			3.3		
Approach LOS		C			A			A			A		
Intersection Summary													
HCM 2000 Control Delay			7.4									HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio			0.47										
Actuated Cycle Length (s)			60.0									Sum of lost time (s)	8.0
Intersection Capacity Utilization			43.2%									ICU Level of Service	A
Analysis Period (min)			15										
c Critical Lane Group													



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	77	273	199	299	133	340	1069	22	252	1421	17
Future Volume (vph)	0	77	273	199	299	133	340	1069	22	252	1421	17
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.2	5.6	5.2	5.2	5.6	4.0	4.0	4.0	4.0	4.0	5.0
Lane Util. Factor		1.00	1.00	1.00	1.00	1.00	1.00	0.91	1.00	0.97	0.91	1.00
Frt		1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1863	1583	1770	1863	1583	1770	5085	1583	3433	5085	1583
Flt Permitted		1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)		1863	1583	1770	1863	1583	1770	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	84	297	216	325	145	370	1162	24	274	1545	18
RTOR Reduction (vph)	0	0	108	0	0	79	0	0	13	0	0	11
Lane Group Flow (vph)	0	84	189	216	325	66	370	1162	11	274	1545	7
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4	5	3	8	1	5	2		1	6	
Permitted Phases			4			8			2			6
Actuated Green, G (s)		7.8	23.9	11.8	24.2	34.8	16.1	37.0	37.0	10.6	31.5	31.5
Effective Green, g (s)		7.2	22.7	11.2	23.6	33.6	17.1	38.0	38.0	11.6	32.5	31.5
Actuated g/C Ratio		0.08	0.26	0.13	0.27	0.39	0.20	0.44	0.44	0.13	0.38	0.36
Clearance Time (s)		4.6	5.0	4.6	4.6	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Extension (s)		3.0	3.0	3.0	3.0	3.0	3.0	5.0	5.0	3.0	5.0	5.0
Lane Grp Cap (vph)		155	415	229	508	615	350	2236	696	460	1912	577
v/s Ratio Prot		0.05	0.08	c0.12	c0.17	0.01	c0.21	0.23		0.08	c0.30	
v/s Ratio Perm			0.04			0.03			0.01			0.00
v/c Ratio		0.54	0.45	0.94	0.64	0.11	1.06	0.52	0.02	0.60	0.81	0.01
Uniform Delay, d1		38.0	26.7	37.3	27.7	16.8	34.7	17.6	13.6	35.2	24.2	17.5
Progression Factor		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2		3.8	0.8	43.6	2.6	0.1	64.0	0.4	0.0	2.1	3.0	0.0
Delay (s)		41.8	27.5	80.9	30.3	16.9	98.6	18.0	13.7	37.3	27.1	17.5
Level of Service		D	C	F	C	B	F	B	B	D	C	B
Approach Delay (s)		30.6			43.4			37.1			28.6	
Approach LOS		C			D			D			C	

Intersection Summary

HCM 2000 Control Delay	34.0	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.92		
Actuated Cycle Length (s)	86.4	Sum of lost time (s)	20.0
Intersection Capacity Utilization	75.0%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

32: Isabel Ave & Jack London Blvd

BART to Livermore Extension Project

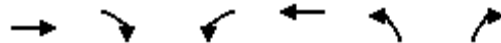
2040 Express Bus + Garage AM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	23	55	62	327	1030	359	423	891	119	168	1380	296
Future Volume (vph)	23	55	62	327	1030	359	423	891	119	168	1380	296
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.97	0.91	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	3433	5085	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	3433	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	25	60	67	355	1120	390	460	968	129	183	1500	322
RTOR Reduction (vph)	0	0	55	0	0	54	0	0	82	0	0	97
Lane Group Flow (vph)	25	60	12	355	1120	336	460	968	47	183	1500	225
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8	1	5	2		1	NA	6
Permitted Phases			4			8			2			6
Actuated Green, G (s)	3.9	23.2	23.2	27.0	46.3	58.4	18.1	47.6	47.6	12.1	41.6	41.6
Effective Green, g (s)	3.9	23.2	23.2	27.0	46.3	58.4	18.1	47.6	47.6	12.1	41.6	41.6
Actuated g/C Ratio	0.03	0.18	0.18	0.21	0.35	0.45	0.14	0.36	0.36	0.09	0.32	0.32
Clearance Time (s)	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	102	626	280	364	1249	769	473	1846	574	316	1613	502
v/s Ratio Prot	0.01	0.02		c0.20	c0.32	0.04	c0.13	0.19		0.05	c0.29	
v/s Ratio Perm			0.01			0.17			0.03			0.14
v/c Ratio	0.25	0.10	0.04	0.98	0.90	0.44	0.97	0.52	0.08	0.58	0.93	0.45
Uniform Delay, d1	62.2	45.2	44.7	51.7	40.1	25.0	56.3	32.8	27.4	57.1	43.3	35.6
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.3	0.1	0.1	40.2	8.7	0.4	34.1	0.3	0.1	2.6	9.8	0.6
Delay (s)	63.4	45.2	44.8	91.9	48.8	25.4	90.4	33.1	27.5	59.6	53.2	36.3
Level of Service	E	D	D	F	D	C	F	C	C	E	D	D
Approach Delay (s)		48.0			52.1			49.6			51.1	
Approach LOS		D			D			D			D	

Intersection Summary			
HCM 2000 Control Delay	50.9	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.96		
Actuated Cycle Length (s)	131.1	Sum of lost time (s)	21.2
Intersection Capacity Utilization	80.5%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 33: Isabel Ave Connector & Stanley Blvd



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑	↑	↔	↑↑	↔	↔
Traffic Volume (vph)	339	139	734	2536	551	615
Future Volume (vph)	339	139	734	2536	551	615
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	2.3	2.3	4.0	2.3	2.5	2.5
Lane Util. Factor	0.95	1.00	0.97	0.95	0.97	0.88
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	3539	1583	3433	3539	3433	2787
Flt Permitted	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (perm)	3539	1583	3433	3539	3433	2787
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	368	151	798	2757	599	668
RTOR Reduction (vph)	0	20	0	0	0	112
Lane Group Flow (vph)	368	131	798	2757	599	556
Turn Type	NA	pm+ov	Prot	NA	Prot	pm+ov
Protected Phases	2	8	1	6	8	1
Permitted Phases		2				8
Actuated Green, G (s)	16.4	40.2	61.7	82.1	23.8	85.5
Effective Green, g (s)	18.1	43.6	61.7	83.8	25.3	88.5
Actuated g/C Ratio	0.16	0.38	0.54	0.74	0.22	0.78
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Grp Cap (vph)	562	637	1859	2603	762	2226
v/s Ratio Prot	0.10	0.05	0.23	c0.78	c0.17	0.14
v/s Ratio Perm		0.04				0.06
v/c Ratio	0.65	0.21	0.43	1.06	0.79	0.25
Uniform Delay, d1	45.0	23.5	15.6	15.1	41.7	3.5
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	2.1	0.1	0.1	35.8	5.0	0.0
Delay (s)	47.1	23.6	15.6	50.9	46.7	3.5
Level of Service	D	C	B	D	D	A
Approach Delay (s)	40.2			43.0	23.9	
Approach LOS	D			D	C	

Intersection Summary

HCM 2000 Control Delay	38.2	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	1.03		
Actuated Cycle Length (s)	113.9	Sum of lost time (s)	8.8
Intersection Capacity Utilization	92.5%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 34: Murrieta Blvd/Driveway & Portola Ave

BART to Livermore Extension Project
 2040 Express Bus + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗		↖	↗		↖	↗	↗		↗	
Traffic Volume (vph)	0	438	103	268	1244	1	188	6	148	1	3	0
Future Volume (vph)	0	438	103	268	1244	1	188	6	148	1	3	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.8		4.0	5.8		5.2	5.2	5.2		4.0	
Lane Util. Factor		0.95		1.00	0.95		0.95	0.95	1.00		1.00	
Frt		0.97		1.00	1.00		1.00	1.00	0.85		1.00	
Flt Protected		1.00		0.95	1.00		0.95	0.96	1.00		0.99	
Satd. Flow (prot)		3438		1770	3539		1681	1691	1583		1840	
Flt Permitted		1.00		0.95	1.00		0.95	0.96	1.00		0.99	
Satd. Flow (perm)		3438		1770	3539		1681	1691	1583		1840	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	476	112	291	1352	1	204	7	161	1	3	0
RTOR Reduction (vph)	0	25	0	0	0	0	0	0	138	0	0	0
Lane Group Flow (vph)	0	563	0	291	1353	0	106	105	23	0	4	0
Turn Type	Prot	NA		Prot	NA		Split	NA	Perm		Split	NA
Protected Phases	5	2		1	6		8	8			4	4
Permitted Phases									8			
Actuated Green, G (s)		13.5		14.5	32.0		8.2	8.2	8.2		0.6	
Effective Green, g (s)		12.6		14.5	31.1		7.6	7.6	7.6		0.6	
Actuated g/C Ratio		0.23		0.27	0.57		0.14	0.14	0.14		0.01	
Clearance Time (s)		4.9		4.0	4.9		4.6	4.6	4.6		4.0	
Vehicle Extension (s)		2.0		2.0	2.0		2.0	2.0	2.0		2.0	
Lane Grp Cap (vph)		797		472	2026		235	236	221		20	
v/s Ratio Prot		0.16		0.16	c0.38		c0.06	0.06			c0.00	
v/s Ratio Perm									0.01			
v/c Ratio		0.71		0.62	0.67		0.45	0.44	0.10		0.20	
Uniform Delay, d1		19.1		17.5	8.0		21.4	21.4	20.4		26.6	
Progression Factor		1.00		1.00	1.00		1.00	1.00	1.00		1.00	
Incremental Delay, d2		2.3		1.7	0.7		0.5	0.5	0.1		1.8	
Delay (s)		21.5		19.1	8.7		21.9	21.9	20.4		28.4	
Level of Service		C		B	A		C	C	C		C	
Approach Delay (s)		21.5			10.5			21.3			28.4	
Approach LOS		C			B			C			C	

Intersection Summary		
HCM 2000 Control Delay	14.6	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.69	B
Actuated Cycle Length (s)	54.3	Sum of lost time (s)
Intersection Capacity Utilization	62.3%	19.0
Analysis Period (min)	15	ICU Level of Service
		B

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 35: Murrieta Blvd & Jack London Blvd

BART to Livermore Extension Project
 2040 Express Bus + Garage AM



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	69	297	860	214	243	175
Future Volume (vph)	69	297	860	214	243	175
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00	1.00	0.95	0.91	
Frt	1.00	0.85	1.00	1.00	0.94	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1770	1583	1770	3539	4766	
Flt Permitted	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	1770	1583	1770	3539	4766	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	75	323	935	233	264	190
RTOR Reduction (vph)	0	285	0	0	154	0
Lane Group Flow (vph)	75	38	935	233	300	0
Turn Type	Prot	Perm	Prot	NA	NA	
Protected Phases	4		5	2	6	
Permitted Phases		4				
Actuated Green, G (s)	9.2	9.2	46.3	60.6	10.3	
Effective Green, g (s)	9.2	9.2	46.3	60.6	10.3	
Actuated g/C Ratio	0.12	0.12	0.60	0.78	0.13	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	209	187	1053	2756	630	
v/s Ratio Prot	c0.04		c0.53	0.07	c0.06	
v/s Ratio Perm		0.02				
v/c Ratio	0.36	0.20	0.89	0.08	0.48	
Uniform Delay, d1	31.6	31.0	13.5	2.0	31.2	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	1.1	0.5	9.2	0.0	0.6	
Delay (s)	32.6	31.5	22.8	2.0	31.8	
Level of Service	C	C	C	A	C	
Approach Delay (s)	31.7			18.6	31.8	
Approach LOS	C			B	C	

Intersection Summary

HCM 2000 Control Delay	24.2	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.75		
Actuated Cycle Length (s)	77.8	Sum of lost time (s)	12.0
Intersection Capacity Utilization	70.1%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 36: Murrieta Blvd & Stanley Blvd

BART to Livermore Extension Project
 2040 Express Bus + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↕	↖	↖	↕	↖	↖↗	↕		↖	↕	↖
Traffic Volume (vph)	214	760	259	23	1356	132	716	392	17	196	191	471
Future Volume (vph)	214	760	259	23	1356	132	716	392	17	196	191	471
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	5.8	5.8	4.0	5.8	4.9	4.9	5.8		4.9	5.8	4.9
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.97	0.95		1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	3433	3518		1770	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	3433	3518		1770	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	233	826	282	25	1474	143	778	426	18	213	208	512
RTOR Reduction (vph)	0	0	131	0	0	54	0	2	0	0	0	63
Lane Group Flow (vph)	233	826	151	25	1474	89	778	442	0	213	208	449
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Prot	NA		Prot	NA	custom
Protected Phases	1	6		5	2	3	7	4		3	8	
Permitted Phases			6			2						4
Actuated Green, G (s)	8.0	61.2	61.2	3.6	56.8	74.8	29.0	41.0		18.0	30.0	41.0
Effective Green, g (s)	8.0	60.3	60.3	3.6	55.9	73.0	28.1	40.1		17.1	29.1	41.0
Actuated g/C Ratio	0.06	0.43	0.43	0.03	0.39	0.52	0.20	0.28		0.12	0.21	0.29
Clearance Time (s)	4.0	4.9	4.9	4.0	4.9	4.0	4.0	4.9		4.0	4.9	4.9
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	193	1507	674	45	1397	816	681	996		213	727	458
v/s Ratio Prot	c0.07	0.23		0.01	c0.42	0.01	c0.23	0.13		0.12	0.06	
v/s Ratio Perm			0.10			0.04						c0.28
v/c Ratio	1.21	0.55	0.22	0.56	1.06	0.11	1.14	0.44		1.00	0.29	0.98
Uniform Delay, d1	66.8	30.4	25.8	68.2	42.9	17.6	56.8	41.6		62.2	47.5	49.9
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	131.7	0.4	0.2	14.0	40.1	0.1	80.9	0.3		61.7	0.2	37.0
Delay (s)	198.5	30.9	26.0	82.2	82.9	17.7	137.6	41.9		123.9	47.7	86.9
Level of Service	F	C	C	F	F	B	F	D		F	D	F
Approach Delay (s)		59.0			77.2			102.9			86.6	
Approach LOS		E			E			F			F	

Intersection Summary		
HCM 2000 Control Delay	80.3	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	1.09	F
Actuated Cycle Length (s)	141.6	Sum of lost time (s)
Intersection Capacity Utilization	100.1%	20.5
Analysis Period (min)	15	ICU Level of Service
		G

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
37: Livermore Ave & I-580 WB Ramps

BART to Livermore Extension Project
2040 Express Bus + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	344	92	28	493	83	0	0	151	0
Future Volume (vph)	0	0	0	344	92	28	493	83	0	0	151	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)					4.0		4.0	4.0			4.0	
Lane Util. Factor					0.95		0.97	1.00			0.95	
Frt					0.99		1.00	1.00			1.00	
Flt Protected					0.96		0.95	1.00			1.00	
Satd. Flow (prot)					1691		3433	1863			3539	
Flt Permitted					0.96		0.95	1.00			1.00	
Satd. Flow (perm)					1691		3433	1863			3539	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	374	100	30	536	90	0	0	164	0
RTOR Reduction (vph)	0	0	0	0	4	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	0	500	0	536	90	0	0	164	0
Turn Type				Split	NA		Prot	NA			NA	
Protected Phases				8	8		5	2			6	
Permitted Phases												
Actuated Green, G (s)					20.9		12.9	29.4			13.0	
Effective Green, g (s)					20.9		12.4	31.1			14.7	
Actuated g/C Ratio					0.35		0.21	0.52			0.24	
Clearance Time (s)					4.0		3.5	5.7			5.7	
Vehicle Extension (s)					2.0		2.0	2.5			2.5	
Lane Grp Cap (vph)					589		709	965			867	
v/s Ratio Prot					c0.30		c0.16	0.05			c0.05	
v/s Ratio Perm												
v/c Ratio					0.85		0.76	0.09			0.19	
Uniform Delay, d1					18.1		22.4	7.3			17.9	
Progression Factor					1.00		0.72	0.46			1.00	
Incremental Delay, d2					10.6		3.6	0.2			0.5	
Delay (s)					28.7		19.6	3.5			18.4	
Level of Service					C		B	A			B	
Approach Delay (s)		0.0			28.7			17.3			18.4	
Approach LOS		A			C			B			B	

Intersection Summary

HCM 2000 Control Delay	21.9	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.62		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	56.9%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 38: Livermore Ave & I-580 EB Ramps

BART to Livermore Extension Project
 2040 Express Bus + Garage AM



























Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔	↗					↕		↘	↕	
Traffic Volume (vph)	14	2	694	0	0	0	0	556	379	22	478	0
Future Volume (vph)	14	2	694	0	0	0	0	556	379	22	478	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0					3.0		5.0	3.0	
Lane Util. Factor		0.95	0.95					0.95		1.00	0.95	
Frt		0.86	0.85					0.94		1.00	1.00	
Flt Protected		1.00	1.00					1.00		0.95	1.00	
Satd. Flow (prot)		1513	1504					3324		1770	3539	
Flt Permitted		1.00	1.00					1.00		0.95	1.00	
Satd. Flow (perm)		1513	1504					3324		1770	3539	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	15	2	754	0	0	0	0	604	412	24	520	0
RTOR Reduction (vph)	0	237	237	0	0	0	0	162	0	0	0	0
Lane Group Flow (vph)	0	149	148	0	0	0	0	854	0	24	520	0
Turn Type	Prot	NA	Perm					NA		Prot	NA	
Protected Phases	7	4						2		1	6	
Permitted Phases			4									
Actuated Green, G (s)		15.6	15.6					30.8		1.6	36.4	
Effective Green, g (s)		15.6	15.6					31.8		0.6	37.4	
Actuated g/C Ratio		0.26	0.26					0.53		0.01	0.62	
Clearance Time (s)		4.0	4.0					4.0		4.0	4.0	
Vehicle Extension (s)		2.0	2.0					2.5		2.0	2.5	
Lane Grp Cap (vph)		393	391					1761		17	2205	
v/s Ratio Prot								c0.26		c0.01	0.15	
v/s Ratio Perm		0.10	0.10									
v/c Ratio		0.38	0.38					0.48		1.41	0.24	
Uniform Delay, d1		18.2	18.2					8.9		29.7	5.0	
Progression Factor		1.00	1.00					1.00		1.07	0.30	
Incremental Delay, d2		0.2	0.2					1.0		346.5	0.2	
Delay (s)		18.5	18.4					9.9		378.3	1.7	
Level of Service		B	B					A		F	A	
Approach Delay (s)		18.4			0.0			9.9			18.3	
Approach LOS		B			A			A			B	

Intersection Summary		
HCM 2000 Control Delay	14.7	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.46	B
Actuated Cycle Length (s)	60.0	Sum of lost time (s)
Intersection Capacity Utilization	56.9%	12.0
Analysis Period (min)	15	ICU Level of Service
		B

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 39: Livermore Ave & Portola Ave

BART to Livermore Extension Project
 2040 Express Bus + Garage AM

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations													
Traffic Volume (vph)	288	245	91	32	730	98	249	514	70	139	756	442	
Future Volume (vph)	288	245	91	32	730	98	249	514	70	139	756	442	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)	4.0	2.7	4.0	4.0	2.7	4.0	4.0	4.9		4.0	4.9	4.9	
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	1.00	0.95		1.00	0.95	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.98		1.00	1.00	0.85	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	1770	3476		1770	3539	1583	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	1770	3476		1770	3539	1583	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	
Adj. Flow (vph)	313	266	99	35	793	107	271	559	76	151	822	480	
RTOR Reduction (vph)	0	0	61	0	0	76	0	8	0	0	0	49	
Lane Group Flow (vph)	313	266	38	35	793	31	271	627	0	151	822	431	
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA		Prot	NA	pm+ov	
Protected Phases	3	8		7	4		1	6		5	2	3	
Permitted Phases			8			4						2	
Actuated Green, G (s)	14.5	43.5	43.5	3.3	32.3	32.3	20.3	35.9		14.4	30.0	44.5	
Effective Green, g (s)	14.5	44.8	43.5	3.3	33.6	32.3	20.3	35.0		14.4	29.1	42.7	
Actuated g/C Ratio	0.13	0.40	0.38	0.03	0.30	0.29	0.18	0.31		0.13	0.26	0.38	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	
Lane Grp Cap (vph)	440	1401	608	51	1051	452	317	1075		225	910	597	
v/s Ratio Prot	c0.09	0.08		0.02	c0.22		c0.15	0.18		0.09	c0.23	c0.09	
v/s Ratio Perm			0.02			0.02						0.19	
v/c Ratio	0.71	0.19	0.06	0.69	0.75	0.07	0.85	0.58		0.67	0.90	0.72	
Uniform Delay, d1	47.3	22.3	21.9	54.4	36.0	29.4	45.0	32.9		47.1	40.6	30.1	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	
Incremental Delay, d2	5.4	0.1	0.0	32.0	3.1	0.1	19.6	0.8		7.6	12.1	4.3	
Delay (s)	52.7	22.4	22.0	86.4	39.1	29.5	64.5	33.7		54.7	52.8	34.4	
Level of Service	D	C	C	F	D	C	E	C		D	D	C	
Approach Delay (s)		36.3			39.8			42.9			46.9		
Approach LOS		D			D			D			D		
Intersection Summary													
HCM 2000 Control Delay			42.5									HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio			0.82										
Actuated Cycle Length (s)			113.1									Sum of lost time (s)	16.5
Intersection Capacity Utilization			77.2%									ICU Level of Service	D
Analysis Period (min)			15										

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
40: First St/Springtown Blvd & I-580 WB Ramps

BART to Livermore Extension Project
2040 Express Bus + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations			↗↗			↗	↗↗	↑			↖↖	↖
Traffic Volume (vph)	0	0	443	0	0	0	341	375	0	0	875	509
Future Volume (vph)	0	0	443	0	0	0	341	375	0	0	875	509
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)			4.5				4.5	4.0			4.5	4.5
Lane Util. Factor			0.88				0.97	1.00			0.95	1.00
Frt			0.85				1.00	1.00			1.00	0.85
Flt Protected			1.00				0.95	1.00			1.00	1.00
Satd. Flow (prot)			2787				3433	1863			3539	1583
Flt Permitted			1.00				0.95	1.00			1.00	1.00
Satd. Flow (perm)			2787				3433	1863			3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	482	0	0	0	371	408	0	0	951	553
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	70
Lane Group Flow (vph)	0	0	482	0	0	0	371	408	0	0	951	483
Turn Type			Over			Free	Prot	NA			NA	Perm
Protected Phases			5				5	2			6	
Permitted Phases						Free						6
Actuated Green, G (s)			14.2				14.2	60.0			37.8	37.8
Effective Green, g (s)			13.7				13.7	60.0			37.3	37.3
Actuated g/C Ratio			0.23				0.23	1.00			0.62	0.62
Clearance Time (s)			4.0				4.0	4.0			4.0	4.0
Vehicle Extension (s)			2.0				2.0	0.2			4.0	4.0
Lane Grp Cap (vph)			636				783	1863			2200	984
v/s Ratio Prot			c0.17				0.11	0.22			0.27	
v/s Ratio Perm												c0.30
v/c Ratio			0.76				0.47	0.22			0.43	0.49
Uniform Delay, d1			21.6				20.0	0.0			5.9	6.2
Progression Factor			1.00				0.66	1.00			1.00	1.00
Incremental Delay, d2			4.6				0.1	0.2			0.6	1.7
Delay (s)			26.2				13.3	0.2			6.5	7.9
Level of Service			C				B	A			A	A
Approach Delay (s)		26.2			0.0			6.5			7.0	
Approach LOS		C			A			A			A	



















Intersection Summary

HCM 2000 Control Delay	10.2	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.56		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	48.7%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
41: First St & I-580 EB Ramps

BART to Livermore Extension Project
2040 Express Bus + Garage AM

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations													
Traffic Volume (vph)	74	2	378	0	0	0	0	914	876	90	1201	0	
Future Volume (vph)	74	2	378	0	0	0	0	914	876	90	1201	0	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)		4.0	4.0					5.0	5.0	5.0	5.0		
Lane Util. Factor		1.00	0.88					0.95	1.00	1.00	0.95		
Frt		1.00	0.85					1.00	0.85	1.00	1.00		
Flt Protected		0.95	1.00					1.00	1.00	0.95	1.00		
Satd. Flow (prot)		1776	2787					3539	1583	1770	3539		
Flt Permitted		0.95	1.00					1.00	1.00	0.95	1.00		
Satd. Flow (perm)		1776	2787					3539	1583	1770	3539		
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	
Adj. Flow (vph)	80	2	411	0	0	0	0	993	952	98	1305	0	
RTOR Reduction (vph)	0	0	150	0	0	0	0	0	315	0	0	0	
Lane Group Flow (vph)	0	82	261	0	0	0	0	993	637	98	1305	0	
Turn Type	Perm	NA	Perm					NA	Perm	Prot	NA		
Protected Phases		4						2		1	6		
Permitted Phases	4		4						2				
Actuated Green, G (s)		8.1	8.1					34.4	34.4	5.5	43.9		
Effective Green, g (s)		7.6	7.6					33.9	33.9	4.5	43.4		
Actuated g/C Ratio		0.13	0.13					0.56	0.56	0.08	0.72		
Clearance Time (s)		3.5	3.5					4.5	4.5	4.0	4.5		
Vehicle Extension (s)		2.5	2.5					4.0	4.0	2.0	4.0		
Lane Grp Cap (vph)		224	353					1999	894	132	2559		
v/s Ratio Prot								0.28		0.06	c0.37		
v/s Ratio Perm		0.05	c0.09						c0.40				
v/c Ratio		0.37	0.74					0.50	0.71	0.74	0.51		
Uniform Delay, d1		24.0	25.2					7.9	9.5	27.2	3.6		
Progression Factor		1.00	1.00					1.00	1.00	1.10	0.54		
Incremental Delay, d2		0.7	7.4					0.9	4.8	15.8	0.6		
Delay (s)		24.7	32.7					8.8	14.3	45.8	2.6		
Level of Service		C	C					A	B	D	A		
Approach Delay (s)		31.4			0.0			11.5			5.6		
Approach LOS		C			A			B			A		
Intersection Summary													
HCM 2000 Control Delay			11.9									HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio			0.72										
Actuated Cycle Length (s)			60.0									Sum of lost time (s)	14.0
Intersection Capacity Utilization			75.1%									ICU Level of Service	D
Analysis Period (min)			15										
c Critical Lane Group													

HCM Signalized Intersection Capacity Analysis
42: 1st St & Mines Rd

BART to Livermore Extension Project
2040 Express Bus + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	41	60	47	545	102	368	25	1369	345	167	1281	20
Future Volume (vph)	41	60	47	545	102	368	25	1369	345	167	1281	20
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		0.97	1.00	1.00	1.00	0.91		0.97	0.91	
Frt	1.00	0.93		1.00	1.00	0.85	1.00	0.97		1.00	1.00	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1740		3433	1863	1583	1770	4932		3433	5073	
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	1740		3433	1863	1583	1770	4932		3433	5073	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	45	65	51	592	111	400	27	1488	375	182	1392	22
RTOR Reduction (vph)	0	34	0	0	0	48	0	44	0	0	2	0
Lane Group Flow (vph)	45	82	0	592	111	352	27	1819	0	182	1412	0
Turn Type	Prot	NA		Prot	NA	pm+ov	Prot	NA		Prot	NA	
Protected Phases	7	4		3	8	1	5	2		1	6	
Permitted Phases						8						
Actuated Green, G (s)	3.4	8.6		16.5	21.7	27.8	1.9	37.8		6.1	42.0	
Effective Green, g (s)	3.4	8.6		16.5	21.7	27.8	1.9	37.8		6.1	42.0	
Actuated g/C Ratio	0.04	0.10		0.19	0.26	0.33	0.02	0.44		0.07	0.49	
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	70	176		666	475	592	39	2193		246	2506	
v/s Ratio Prot	0.03	0.05		c0.17	0.06	c0.04	0.02	c0.37		c0.05	0.28	
v/s Ratio Perm						0.18						
v/c Ratio	0.64	0.47		0.89	0.23	0.59	0.69	0.83		0.74	0.56	
Uniform Delay, d1	40.2	36.0		33.4	25.1	23.9	41.3	20.8		38.7	15.1	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	18.4	1.9		13.7	0.3	1.6	41.8	2.7		11.1	0.3	
Delay (s)	58.6	38.0		47.1	25.3	25.5	83.1	23.5		49.7	15.4	
Level of Service	E	D		D	C	C	F	C		D	B	
Approach Delay (s)		43.7			37.1			24.4			19.3	
Approach LOS		D			D			C			B	























Intersection Summary

HCM 2000 Control Delay	26.3	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.85		
Actuated Cycle Length (s)	85.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	71.1%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group























HCM Unsignalized Intersection Capacity Analysis
43: Vasco Rd & I-580 WB Ramps

BART to Livermore Extension Project
2040 Express Bus + Garage AM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations								  			  	
Traffic Volume (veh/h)	0	0	0	0	0	164	0	1040	0	0	1955	0
Future Volume (Veh/h)	0	0	0	0	0	164	0	1040	0	0	1955	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	0	0	0	178	0	1130	0	0	2125	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage (veh)												
Upstream signal (ft)											524	
pX, platoon unblocked												
vC, conflicting volume	2680	3255	708	1838	3255	377	2125			1130		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	2680	3255	708	1838	3255	377	2125			1130		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	100	100	71	100			100		
cM capacity (veh/h)	8	9	377	47	9	621	253			614		
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	NB 4	SB 1	SB 2	SB 3	SB 4		
Volume Total	0	178	377	377	377	0	708	708	708	0		
Volume Left	0	0	0	0	0	0	0	0	0	0		
Volume Right	0	178	0	0	0	0	0	0	0	0		
cSH	1700	621	1700	1700	1700	1700	1700	1700	1700	1700		
Volume to Capacity	0.00	0.29	0.22	0.22	0.22	0.00	0.42	0.42	0.42	0.00		
Queue Length 95th (ft)	0	30	0	0	0	0	0	0	0	0		
Control Delay (s)	0.0	13.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
Lane LOS	A	B										
Approach Delay (s)	0.0	13.1	0.0				0.0					
Approach LOS	A	B										
Intersection Summary												
Average Delay			0.7									
Intersection Capacity Utilization			41.1%		ICU Level of Service				A			
Analysis Period (min)			15									

HCM Unsignalized Intersection Capacity Analysis
 44: Vasco Rd & I-580 EB Ramps

BART to Livermore Extension Project
 2040 Express Bus + Garage AM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations								  			  	
Traffic Volume (veh/h)	0	0	0	0	0	0	0	1072	0	73	2086	0
Future Volume (Veh/h)	0	0	0	0	0	0	0	1072	0	73	2086	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	0	0	0	0	0	1165	0	79	2267	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	2813	3590	756	2079	3590	388	2267			1165		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	2813	3590	756	2079	3590	388	2267			1165		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	100	100	100	100			87		
cM capacity (veh/h)	7	5	351	28	5	610	222			595		
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	NB 4	SB 1	SB 2	SB 3	SB 4		
Volume Total	0	0	388	388	388	0	79	756	756	756		
Volume Left	0	0	0	0	0	0	79	0	0	0		
Volume Right	0	0	0	0	0	0	0	0	0	0		
cSH	1700	1700	1700	1700	1700	1700	595	1700	1700	1700		
Volume to Capacity	0.00	0.00	0.23	0.23	0.23	0.00	0.13	0.44	0.44	0.44		
Queue Length 95th (ft)	0	0	0	0	0	0	11	0	0	0		
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	12.0	0.0	0.0	0.0		
Lane LOS	A	A					B					
Approach Delay (s)	0.0	0.0	0.0				0.4					
Approach LOS	A	A										
Intersection Summary												
Average Delay			0.3									
Intersection Capacity Utilization			43.6%			ICU Level of Service				A		
Analysis Period (min)			15									

HCM Signalized Intersection Capacity Analysis
45: Vasco Rd & East Ave

BART to Livermore Extension Project
2040 Express Bus + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	297	367	52	10	26	19	67	255	196	260	294	306
Future Volume (vph)	297	367	52	10	26	19	67	255	196	260	294	306
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	0.95		0.97	1.00	1.00
Frt	1.00	0.98		1.00	0.94		1.00	0.93		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	3473		1770	3312		1770	3308		3433	1863	1583
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1770	3473		1770	3312		1770	3308		3433	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	323	399	57	11	28	21	73	277	213	283	320	333
RTOR Reduction (vph)	0	18	0	0	19	0	0	158	0	0	0	234
Lane Group Flow (vph)	323	438	0	11	30	0	73	332	0	283	320	99
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												6
Actuated Green, G (s)	12.5	16.9		0.7	5.1		3.1	13.5		5.2	15.6	15.6
Effective Green, g (s)	12.5	16.9		0.7	5.1		3.1	13.5		5.2	15.6	15.6
Actuated g/C Ratio	0.24	0.32		0.01	0.10		0.06	0.26		0.10	0.30	0.30
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	423	1122		23	322		104	853		341	555	472
v/s Ratio Prot	c0.18	c0.13		0.01	0.01		0.04	0.10		c0.08	c0.17	
v/s Ratio Perm												0.06
v/c Ratio	0.76	0.39		0.48	0.09		0.70	0.39		0.83	0.58	0.21
Uniform Delay, d1	18.5	13.7		25.6	21.5		24.1	16.0		23.1	15.6	13.7
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	8.0	0.2		14.8	0.1		19.2	0.3		15.3	1.5	0.2
Delay (s)	26.5	13.9		40.5	21.6		43.4	16.3		38.4	17.0	14.0
Level of Service	C	B		D	C		D	B		D	B	B
Approach Delay (s)		19.1			25.1			19.8			22.4	
Approach LOS		B			C			B			C	





















Intersection Summary

HCM 2000 Control Delay	20.8	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.70		
Actuated Cycle Length (s)	52.3	Sum of lost time (s)	16.0
Intersection Capacity Utilization	53.9%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group






















HCM Signalized Intersection Capacity Analysis
46: Greenville Rd & I-580 WB Ramps

BART to Livermore Extension Project
2040 Express Bus + Garage AM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				 				 			 	
Traffic Volume (vph)	0	0	0	247	0	40	0	121	310	0	943	534
Future Volume (vph)	0	0	0	247	0	40	0	121	310	0	943	534
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0		4.0		4.0	4.0		4.0	
Lane Util. Factor				0.97		1.00		0.95	1.00		0.95	
Frt				1.00		0.85		1.00	0.85		0.95	
Flt Protected				0.95		1.00		1.00	1.00		1.00	
Satd. Flow (prot)				3433		1583		3539	1583		3347	
Flt Permitted				0.95		1.00		1.00	1.00		1.00	
Satd. Flow (perm)				3433		1583		3539	1583		3347	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	268	0	43	0	132	337	0	1025	580
RTOR Reduction (vph)	0	0	0	0	0	37	0	0	95	0	130	0
Lane Group Flow (vph)	0	0	0	268	0	6	0	132	242	0	1475	0
Turn Type				Prot		Prot		NA	Perm		NA	
Protected Phases				3		3		2			6	
Permitted Phases									2			
Actuated Green, G (s)				8.9		8.9		43.1	43.1		43.1	
Effective Green, g (s)				8.9		8.9		43.1	43.1		43.1	
Actuated g/C Ratio				0.15		0.15		0.72	0.72		0.72	
Clearance Time (s)				4.0		4.0		4.0	4.0		4.0	
Vehicle Extension (s)				3.0		3.0		3.0	3.0		3.0	
Lane Grp Cap (vph)				509		234		2542	1137		2404	
v/s Ratio Prot				c0.08		0.00		0.04			c0.44	
v/s Ratio Perm									0.15			
v/c Ratio				0.53		0.03		0.05	0.21		0.61	
Uniform Delay, d1				23.6		21.8		2.5	2.8		4.3	
Progression Factor				1.00		1.00		0.73	1.12		1.00	
Incremental Delay, d2				1.0		0.0		0.0	0.4		1.2	
Delay (s)				24.6		21.9		1.8	3.6		5.4	
Level of Service				C		C		A	A		A	
Approach Delay (s)		0.0			24.2			3.1			5.4	
Approach LOS		A			C			A			A	
Intersection Summary												
HCM 2000 Control Delay			7.4	HCM 2000 Level of Service				A				
HCM 2000 Volume to Capacity ratio			0.60									
Actuated Cycle Length (s)			60.0	Sum of lost time (s)				8.0				
Intersection Capacity Utilization			56.9%	ICU Level of Service				B				
Analysis Period (min)			15									
c Critical Lane Group												

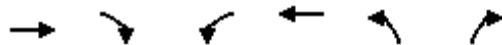
HCM Signalized Intersection Capacity Analysis
47: Greenville Rd & I-580 EB Ramps

BART to Livermore Extension Project
2040 Express Bus + Garage AM

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations	 							 			 		
Traffic Volume (vph)	35	0	139	0	0	0	0	407	73	0	891	30	
Future Volume (vph)	35	0	139	0	0	0	0	407	73	0	891	30	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)	4.0		4.0					4.0	4.0		4.0	4.0	
Lane Util. Factor	0.97		1.00					0.95	1.00		0.95	1.00	
Frt	1.00		0.85					1.00	0.85		1.00	0.85	
Flt Protected	0.95		1.00					1.00	1.00		1.00	1.00	
Satd. Flow (prot)	3433		1583					3539	1583		3539	1583	
Flt Permitted	0.95		1.00					1.00	1.00		1.00	1.00	
Satd. Flow (perm)	3433		1583					3539	1583		3539	1583	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	
Adj. Flow (vph)	38	0	151	0	0	0	0	442	79	0	968	33	
RTOR Reduction (vph)	0	0	124	0	0	0	0	0	19	0	0	8	
Lane Group Flow (vph)	38	0	27	0	0	0	0	442	60	0	968	25	
Turn Type	Prot		Prot					NA	Perm		NA	Perm	
Protected Phases	7		7					2			6		
Permitted Phases									2			6	
Actuated Green, G (s)	6.1		6.1					45.9	45.9		45.9	45.9	
Effective Green, g (s)	6.1		6.1					45.9	45.9		45.9	45.9	
Actuated g/C Ratio	0.10		0.10					0.76	0.76		0.76	0.76	
Clearance Time (s)	4.0		4.0					4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0		3.0					3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	349		160					2707	1210		2707	1210	
v/s Ratio Prot	0.01		c0.02					0.12			c0.27		
v/s Ratio Perm									0.04			0.02	
v/c Ratio	0.11		0.17					0.16	0.05		0.36	0.02	
Uniform Delay, d1	24.5		24.6					1.9	1.7		2.3	1.7	
Progression Factor	1.00		1.00					1.00	1.00		0.72	0.62	
Incremental Delay, d2	0.1		0.5					0.1	0.1		0.3	0.0	
Delay (s)	24.6		25.1					2.0	1.8		1.9	1.1	
Level of Service	C		C					A	A		A	A	
Approach Delay (s)		25.0			0.0			2.0			1.9		
Approach LOS		C			A			A			A		
Intersection Summary													
HCM 2000 Control Delay			4.5									HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio			0.34										
Actuated Cycle Length (s)			60.0									Sum of lost time (s)	8.0
Intersection Capacity Utilization			39.9%									ICU Level of Service	A
Analysis Period (min)			15										
c Critical Lane Group													

HCM Signalized Intersection Capacity Analysis
 48: Greenville Rd & Northfront Road/Altamont Pass Road

BART to Livermore Extension Project
 2040 Express Bus + Garage AM



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↑	↑	↑	↑	↑
Traffic Volume (vph)	6	651	652	507	91	61
Future Volume (vph)	6	651	652	507	91	61
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	1863	1583	1770	1863	1770	1583
Flt Permitted	1.00	1.00	0.75	1.00	0.95	1.00
Satd. Flow (perm)	1863	1583	1403	1863	1770	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	7	708	709	551	99	66
RTOR Reduction (vph)	0	250	0	0	0	54
Lane Group Flow (vph)	7	458	709	551	99	12
Turn Type	NA	Perm	Perm	NA	Prot	Perm
Protected Phases	4			8	2	
Permitted Phases		4	8			2
Actuated Green, G (s)	29.8	29.8	29.8	29.8	8.3	8.3
Effective Green, g (s)	29.8	29.8	29.8	29.8	8.3	8.3
Actuated g/C Ratio	0.65	0.65	0.65	0.65	0.18	0.18
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	1204	1023	906	1204	318	285
v/s Ratio Prot	0.00			0.30	c0.06	
v/s Ratio Perm		0.29	c0.51			0.01
v/c Ratio	0.01	0.45	0.78	0.46	0.31	0.04
Uniform Delay, d1	2.9	4.1	5.8	4.1	16.4	15.6
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.0	0.3	4.5	0.3	0.6	0.1
Delay (s)	2.9	4.4	10.3	4.4	17.0	15.7
Level of Service	A	A	B	A	B	B
Approach Delay (s)	4.4			7.7	16.5	
Approach LOS	A			A	B	

Intersection Summary

HCM 2000 Control Delay	7.3	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.68		
Actuated Cycle Length (s)	46.1	Sum of lost time (s)	8.0
Intersection Capacity Utilization	83.1%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
49: Greenville Rd & Southfront Rd

BART to Livermore Extension Project
2040 Express Bus + Garage AM



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	116	171	125	390	752	220
Future Volume (vph)	116	171	125	390	752	220
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.2	5.2	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.88	0.97	0.95	0.95	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	3433	2787	3433	3539	3539	1583
Flt Permitted	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (perm)	3433	2787	3433	3539	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	126	186	136	424	817	239
RTOR Reduction (vph)	0	165	0	0	0	118
Lane Group Flow (vph)	126	21	136	424	817	121
Turn Type	Prot	Perm	Prot	NA	NA	Perm
Protected Phases	8		1	6	2	
Permitted Phases		8				2
Actuated Green, G (s)	5.4	5.4	3.2	27.2	20.0	20.0
Effective Green, g (s)	4.8	4.8	3.2	28.9	21.7	21.7
Actuated g/C Ratio	0.11	0.11	0.07	0.67	0.51	0.51
Clearance Time (s)	4.6	4.6	4.0	5.7	5.7	5.7
Vehicle Extension (s)	5.0	5.0	6.0	2.5	2.5	2.5
Lane Grp Cap (vph)	384	311	256	2384	1790	800
v/s Ratio Prot	c0.04		c0.04	0.12	c0.23	
v/s Ratio Perm		0.01				0.08
v/c Ratio	0.33	0.07	0.53	0.18	0.46	0.15
Uniform Delay, d1	17.6	17.0	19.1	2.6	6.8	5.7
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.0	0.2	5.0	0.0	0.1	0.1
Delay (s)	18.6	17.2	24.1	2.6	6.9	5.7
Level of Service	B	B	C	A	A	A
Approach Delay (s)	17.8			7.8	6.7	
Approach LOS	B			A	A	

Intersection Summary

HCM 2000 Control Delay	8.8	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.44		
Actuated Cycle Length (s)	42.9	Sum of lost time (s)	13.2
Intersection Capacity Utilization	38.7%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
50: Greenville Rd & Patterson Pass Rd

BART to Livermore Extension Project
2040 Express Bus + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	39	6	73	252	420	308	19	144	1	6	339	49
Future Volume (vph)	39	6	73	252	420	308	19	144	1	6	339	49
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.86		1.00	0.94		1.00	1.00		1.00	0.98	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1606		1770	1745		1770	1861		1770	1828	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	1606		1770	1745		1770	1861		1770	1828	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	42	7	79	274	457	335	21	157	1	7	368	53
RTOR Reduction (vph)	0	61	0	0	30	0	0	0	0	0	6	0
Lane Group Flow (vph)	42	25	0	274	762	0	21	158	0	7	415	0
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												
Actuated Green, G (s)	2.1	18.5		21.6	38.0		1.4	26.0		0.7	25.3	
Effective Green, g (s)	2.1	18.5		21.6	38.0		1.4	26.0		0.7	25.3	
Actuated g/C Ratio	0.03	0.22		0.26	0.46		0.02	0.31		0.01	0.31	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	44	358		461	800		29	584		14	558	
v/s Ratio Prot	0.02	0.02		c0.15	c0.44		c0.01	0.08		0.00	c0.23	
v/s Ratio Perm												
v/c Ratio	0.95	0.07		0.59	0.95		0.72	0.27		0.50	0.74	
Uniform Delay, d1	40.3	25.4		26.8	21.5		40.5	21.3		40.9	25.8	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	117.3	0.1		2.1	21.0		61.8	1.1		25.4	8.7	
Delay (s)	157.6	25.4		28.8	42.5		102.3	22.4		66.3	34.6	
Level of Service	F	C		C	D		F	C		E	C	
Approach Delay (s)		68.8			39.0			31.8			35.1	
Approach LOS		E			D			C			D	

Intersection Summary

HCM 2000 Control Delay	39.5	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.87		
Actuated Cycle Length (s)	82.8	Sum of lost time (s)	16.0
Intersection Capacity Utilization	68.4%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
1: Dougherty Rd & Amador Valley Rd

BART to Livermore Extension Project
2040 Express Bus + Garage PM



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	390	469	825	2156	1141	309
Future Volume (vph)	390	469	825	2156	1141	309
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00	0.97	0.91	0.91	
Frt	1.00	0.85	1.00	1.00	0.97	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1770	1583	3433	5085	4923	
Flt Permitted	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	1770	1583	3433	5085	4923	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	424	510	897	2343	1240	336
RTOR Reduction (vph)	0	367	0	0	40	0
Lane Group Flow (vph)	424	143	897	2343	1536	0
Turn Type	Perm	Perm	Prot	NA	NA	
Protected Phases			5	2	6	
Permitted Phases	4	4				
Actuated Green, G (s)	30.8	30.8	32.7	77.2	40.5	
Effective Green, g (s)	30.8	30.8	32.7	77.2	40.5	
Actuated g/C Ratio	0.27	0.27	0.28	0.67	0.35	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	469	420	967	3384	1718	
v/s Ratio Prot			c0.26	0.46	c0.31	
v/s Ratio Perm	c0.24	0.09				
v/c Ratio	0.90	0.34	0.93	0.69	0.89	
Uniform Delay, d1	41.2	34.4	40.5	12.0	35.7	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	20.6	0.5	14.4	0.6	6.4	
Delay (s)	61.7	34.9	54.9	12.7	42.1	
Level of Service	E	C	D	B	D	
Approach Delay (s)	47.1			24.4	42.1	
Approach LOS	D			C	D	

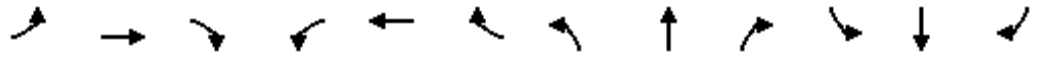
Intersection Summary

HCM 2000 Control Delay	32.9	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.91		
Actuated Cycle Length (s)	116.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	84.1%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 2: Hopyard Road/Dougherty Rd & Dublin Blvd

BART to Livermore Extension Project
 2040 Express Bus + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔↔	↑↑↑	↔↔	↔↔↔	↑↑↑	↔	↔↔↔	↑↑↑	↔↔	↔↔	↑↑↑	↔↔
Traffic Volume (vph)	97	1151	898	630	1061	952	838	2021	315	705	1227	39
Future Volume (vph)	97	1151	898	630	1061	952	838	2021	315	705	1227	39
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	6.0	5.0	5.0	5.5	5.0	5.0	5.5	5.0	5.0	5.5	
Lane Util. Factor	0.97	0.91	0.88	0.94	0.91	1.00	0.94	0.91	0.88	0.97	0.86	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	3433	5085	2787	4990	5085	1583	4990	5085	2787	3433	6379	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	3433	5085	2787	4990	5085	1583	4990	5085	2787	3433	6379	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	105	1251	976	685	1153	1035	911	2197	342	766	1334	42
RTOR Reduction (vph)	0	0	60	0	0	70	0	0	57	0	4	0
Lane Group Flow (vph)	105	1251	916	685	1153	965	911	2197	285	766	1372	0
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	
Protected Phases	5	2	3	1	6	7	3	8	1	7	4	
Permitted Phases			2			6			8			
Actuated Green, G (s)	17.1	35.5	55.2	19.0	37.9	51.9	19.7	45.0	64.0	14.0	39.3	
Effective Green, g (s)	17.1	35.5	55.2	19.0	37.9	51.9	19.7	45.0	64.0	14.0	39.3	
Actuated g/C Ratio	0.13	0.26	0.41	0.14	0.28	0.38	0.15	0.33	0.47	0.10	0.29	
Clearance Time (s)	5.0	6.0	5.0	5.0	5.5	5.0	5.0	5.5	5.0	5.0	5.5	
Vehicle Extension (s)	2.0	4.5	2.0	2.0	4.5	2.0	2.0	4.5	2.0	2.0	4.5	
Lane Grp Cap (vph)	434	1337	1139	702	1427	608	728	1695	1321	356	1856	
v/s Ratio Prot	0.03	c0.25	0.12	0.14	0.23	c0.16	0.18	c0.43	0.03	c0.22	0.22	
v/s Ratio Perm			0.21			0.45			0.07			
v/c Ratio	0.24	0.94	0.80	0.98	0.81	1.59	1.25	1.30	0.22	2.15	0.74	
Uniform Delay, d1	53.1	48.6	35.1	57.8	45.2	41.5	57.6	45.0	20.8	60.5	43.2	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.1	12.5	4.0	27.6	3.9	272.3	124.3	137.8	0.0	527.5	1.8	
Delay (s)	53.2	61.2	39.1	85.4	49.0	313.9	182.0	182.8	20.8	588.0	45.0	
Level of Service	D	E	D	F	D	F	F	F	C	F	D	
Approach Delay (s)		51.6			153.1			166.5			239.2	
Approach LOS		D			F			F			F	

Intersection Summary

HCM 2000 Control Delay	152.5	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.46		
Actuated Cycle Length (s)	135.0	Sum of lost time (s)	21.5
Intersection Capacity Utilization	123.4%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 3: Dougherty Rd/Hopyard Road & I-580 WB Ramps

BART to Livermore Extension Project
 2040 Express Bus + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↔↔		↔↔		↑↑↑			↑↑↑	↔
Traffic Volume (vph)	0	0	0	323	0	669	0	2532	0	0	1654	0
Future Volume (vph)	0	0	0	323	0	669	0	2532	0	0	1654	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0		4.0		4.0			4.0	
Lane Util. Factor				0.97		0.88		0.91			0.86	
Frt				1.00		0.85		1.00			1.00	
Flt Protected				0.95		1.00		1.00			1.00	
Satd. Flow (prot)				3433		2787		5085			4806	
Flt Permitted				0.95		1.00		1.00			1.00	
Satd. Flow (perm)				3433		2787		5085			4806	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	351	0	727	0	2752	0	0	1798	0
RTOR Reduction (vph)	0	0	0	0	0	17	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	351	0	710	0	2752	0	0	1798	0
Turn Type				Prot		Prot		NA			NA	Perm
Protected Phases				4		4		2			6	
Permitted Phases												6
Actuated Green, G (s)				31.1		31.1		68.1			68.1	
Effective Green, g (s)				32.5		32.5		69.5			69.5	
Actuated g/C Ratio				0.30		0.30		0.63			0.63	
Clearance Time (s)				5.4		5.4		5.4			5.4	
Vehicle Extension (s)				3.0		3.0		3.0			3.0	
Lane Grp Cap (vph)				1014		823		3212			3036	
v/s Ratio Prot				0.10		c0.25		c0.54			0.37	
v/s Ratio Perm												
v/c Ratio				0.35		0.86		0.86			0.59	
Uniform Delay, d1				30.4		36.6		16.3			11.9	
Progression Factor				1.00		1.00		0.89			1.00	
Incremental Delay, d2				0.2		9.3		0.3			0.9	
Delay (s)				30.6		45.9		14.7			12.8	
Level of Service				C		D		B			B	
Approach Delay (s)		0.0			40.9			14.7			12.8	
Approach LOS		A			D			B			B	

Intersection Summary

HCM 2000 Control Delay	19.1	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.86		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	79.0%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 4: Hopyard Rd/Dougherty Rd & I-580 EB Ramps

BART to Livermore Extension Project
 2040 Express Bus + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗		↖↗					↑↑↑	↖		↑↑↑	↖
Traffic Volume (vph)	1166	0	980	0	0	0	0	2640	0	0	1310	0
Future Volume (vph)	1166	0	980	0	0	0	0	2640	0	0	1310	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0					4.0			4.0	
Lane Util. Factor	0.97		0.88					0.91			0.86	
Frt	1.00		0.85					1.00			1.00	
Flt Protected	0.95		1.00					1.00			1.00	
Satd. Flow (prot)	3433		2787					5085			4806	
Flt Permitted	0.95		1.00					1.00			1.00	
Satd. Flow (perm)	3433		2787					5085			4806	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	1267	0	1065	0	0	0	0	2870	0	0	1424	0
RTOR Reduction (vph)	0	0	41	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	1267	0	1024	0	0	0	0	2870	0	0	1424	0
Turn Type	Prot		Prot					NA	Free		NA	Perm
Protected Phases	4		4					2			6	
Permitted Phases									Free			6
Actuated Green, G (s)	38.6		38.6					60.6			60.6	
Effective Green, g (s)	40.0		40.0					62.0			62.0	
Actuated g/C Ratio	0.36		0.36					0.56			0.56	
Clearance Time (s)	5.4		5.4					5.4			5.4	
Vehicle Extension (s)	3.0		3.0					3.0			3.0	
Lane Grp Cap (vph)	1248		1013					2866			2708	
v/s Ratio Prot	c0.37		0.37					c0.56			0.30	
v/s Ratio Perm												
v/c Ratio	1.02		1.01					1.00			0.53	
Uniform Delay, d1	35.0		35.0					24.0			14.9	
Progression Factor	1.00		1.00					1.00			1.77	
Incremental Delay, d2	29.3		31.0					17.1			0.6	
Delay (s)	64.3		66.0					41.1			27.0	
Level of Service	E		E					D			C	
Approach Delay (s)		65.1			0.0			41.1			27.0	
Approach LOS		E			A			D			C	

Intersection Summary

HCM 2000 Control Delay	46.5	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	1.01		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	90.9%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

5: Hopyard Rd & Owens Rd

BART to Livermore Extension Project

2040 Express Bus + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	385	276	252	536	296	366	243	978	302	484	1589	264
Future Volume (vph)	385	276	252	536	296	366	243	978	302	484	1589	264
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	2.7	2.7		2.7	2.7	2.7	4.0	2.3	2.3	4.0	2.3	
Lane Util. Factor	0.91	0.91		1.00	0.95	0.95	1.00	0.91	1.00	0.97	0.91	
Frt	1.00	0.95		1.00	0.96	0.85	1.00	1.00	0.85	1.00	0.98	
Flt Protected	0.95	0.99		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1610	3168		1770	1696	1504	1770	5085	1583	3433	4977	
Flt Permitted	0.95	0.99		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1610	3168		1770	1696	1504	1770	5085	1583	3433	4977	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	418	300	274	583	322	398	264	1063	328	526	1727	287
RTOR Reduction (vph)	0	57	0	0	11	24	0	0	231	0	19	0
Lane Group Flow (vph)	230	705	0	583	434	251	264	1063	97	526	1995	0
Turn Type	Split	NA		Split	NA	pm+ov	Prot	NA	Perm	Prot	NA	
Protected Phases	8	8		4	4	1	5	2		1	6	
Permitted Phases						4			2			
Actuated Green, G (s)	18.0	18.0		29.0	29.0	52.3	14.0	33.7	33.7	23.3	43.0	
Effective Green, g (s)	19.3	19.3		30.3	30.3	54.9	14.0	35.4	35.4	23.3	44.7	
Actuated g/C Ratio	0.16	0.16		0.25	0.25	0.46	0.12	0.29	0.29	0.19	0.37	
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	258	509		446	428	721	206	1500	466	666	1853	
v/s Ratio Prot	0.14	c0.22		c0.33	0.26	0.07	c0.15	0.21		0.15	c0.40	
v/s Ratio Perm						0.10			0.06			
v/c Ratio	0.89	1.38		1.31	1.01	0.35	1.28	0.71	0.21	0.79	1.08	
Uniform Delay, d1	49.3	50.4		44.9	44.9	21.0	53.0	37.7	31.8	46.0	37.6	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	29.5	185.1		153.7	46.9	0.3	158.5	2.9	1.0	6.2	45.0	
Delay (s)	78.8	235.5		198.5	91.8	21.3	211.5	40.6	32.8	52.2	82.6	
Level of Service	E	F		F	F	C	F	D	C	D	F	
Approach Delay (s)		199.1			124.7			66.3			76.3	
Approach LOS		F			F			E			E	

Intersection Summary

HCM 2000 Control Delay	102.3	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.22		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	11.7
Intersection Capacity Utilization	111.0%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
6: Hopyard Rd & Stoneridge Dr

BART to Livermore Extension Project
2040 Express Bus + Garage PM




































Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↑↑↑	↖	↖↗	↑↑↑	↖	↖↗	↑↑	↖	↖↗	↑↑↑	↖
Traffic Volume (vph)	272	1175	700	121	1368	197	620	863	89	267	925	207
Future Volume (vph)	272	1175	700	121	1368	197	620	863	89	267	925	207
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.91	1.00	0.97	0.91	1.00	0.94	0.95	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5085	1583	3433	5085	1583	4990	3539	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5085	1583	3433	5085	1583	4990	3539	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	296	1277	761	132	1487	214	674	938	97	290	1005	225
RTOR Reduction (vph)	0	0	158	0	0	155	0	0	68	0	0	126
Lane Group Flow (vph)	296	1277	603	132	1487	59	674	938	29	290	1005	99
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8			2			6
Actuated Green, G (s)	5.0	18.6	18.6	3.2	16.8	16.8	6.0	18.0	18.0	5.0	17.0	17.0
Effective Green, g (s)	5.0	18.6	18.6	3.2	16.8	16.8	6.0	18.0	18.0	5.0	17.0	17.0
Actuated g/C Ratio	0.08	0.31	0.31	0.05	0.28	0.28	0.10	0.30	0.30	0.08	0.28	0.28
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	282	1555	484	180	1405	437	492	1047	468	282	1421	442
v/s Ratio Prot	c0.09	0.25		0.04	0.29		c0.14	c0.27		0.08	0.20	
v/s Ratio Perm			c0.38			0.04			0.02			0.06
v/c Ratio	1.05	0.82	1.25	0.73	1.06	0.14	1.37	0.90	0.06	1.03	0.71	0.22
Uniform Delay, d1	27.9	19.6	21.1	28.4	22.0	16.5	27.4	20.5	15.3	27.9	19.7	16.8
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	67.2	3.6	127.4	14.3	41.1	0.1	179.1	10.0	0.1	61.1	1.6	0.3
Delay (s)	95.1	23.2	148.5	42.7	63.1	16.7	206.5	30.5	15.4	89.0	21.3	17.1
Level of Service	F	C	F	D	E	B	F	C	B	F	C	B
Approach Delay (s)		73.2			56.2			99.1			33.6	
Approach LOS		E			E			F			C	

Intersection Summary		
HCM 2000 Control Delay	66.8	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	1.17	E
Actuated Cycle Length (s)	60.8	Sum of lost time (s)
Intersection Capacity Utilization	79.0%	16.0
Analysis Period (min)	15	ICU Level of Service
		D

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
7: Hopyard Rd & Las Positas Blvd

BART to Livermore Extension Project
2040 Express Bus + Garage PM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 	 		 	 		 	  		  	 	
Traffic Volume (vph)	101	258	478	601	422	51	380	1002	266	73	1540	75
Future Volume (vph)	101	258	478	601	422	51	380	1002	266	73	1540	75
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.95	1.00	0.97	0.95	1.00	0.97	0.91	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	3433	3539	1583	3433	5085	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	3433	3539	1583	3433	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	110	280	520	653	459	55	413	1089	289	79	1674	82
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	53
Lane Group Flow (vph)	110	280	520	653	459	55	413	1089	289	79	1674	29
Turn Type	Prot	NA	Free	Prot	NA	Free	Prot	NA	Free	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1		6
Permitted Phases			Free			Free			Free			6
Actuated Green, G (s)	4.8	12.9	87.8	17.0	25.1	87.8	11.0	37.9	87.8	4.0	30.9	30.9
Effective Green, g (s)	4.8	12.9	87.8	17.0	25.1	87.8	11.0	37.9	87.8	4.0	30.9	30.9
Actuated g/C Ratio	0.05	0.15	1.00	0.19	0.29	1.00	0.13	0.43	1.00	0.05	0.35	0.35
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	187	519	1583	664	1011	1583	430	2195	1583	156	1789	557
v/s Ratio Prot	0.03	0.08		c0.19	c0.13		c0.12	0.21		0.02	c0.33	
v/s Ratio Perm			0.33			0.03			0.18			0.02
v/c Ratio	0.59	0.54	0.33	0.98	0.45	0.03	0.96	0.50	0.18	0.51	0.94	0.05
Uniform Delay, d1	40.5	34.7	0.0	35.3	25.7	0.0	38.2	18.0	0.0	40.9	27.5	18.8
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	4.7	1.1	0.6	30.6	0.3	0.0	33.2	0.2	0.3	2.6	9.7	0.0
Delay (s)	45.2	35.8	0.6	65.8	26.1	0.0	71.4	18.2	0.3	43.5	37.2	18.8
Level of Service	D	D	A	E	C	A	E	B	A	D	D	B
Approach Delay (s)		16.8			47.1			27.6			36.7	
Approach LOS		B			D			C			D	
Intersection Summary												
HCM 2000 Control Delay			32.8	HCM 2000 Level of Service				C				
HCM 2000 Volume to Capacity ratio			0.88									
Actuated Cycle Length (s)			87.8	Sum of lost time (s)				16.0				
Intersection Capacity Utilization			78.2%	ICU Level of Service				D				
Analysis Period (min)			15									
c	Critical Lane Group											

HCM Signalized Intersection Capacity Analysis

8: Willow Rd & Owens Rd

BART to Livermore Extension Project

2040 Express Bus + Garage PM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	88	825	190	125	686	82	184	79	0	192	67	119
Future Volume (vph)	88	825	190	125	686	82	184	79	0	192	67	119
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	5.3	4.0		5.3	4.0	4.0
Lane Util. Factor	0.97	0.91		0.97	0.91	1.00	1.00	0.95		1.00	1.00	1.00
Frt	1.00	0.97		1.00	1.00	0.85	1.00	1.00		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	4942		3433	5085	1583	1770	3539		1770	1863	1583
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.71	1.00		0.70	1.00	1.00
Satd. Flow (perm)	3433	4942		3433	5085	1583	1322	3539		1301	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	96	897	207	136	746	89	200	86	0	209	73	129
RTOR Reduction (vph)	0	24	0	0	0	43	0	0	0	0	0	100
Lane Group Flow (vph)	96	1080	0	136	746	46	200	86	0	209	73	29
Turn Type	Prot	NA		Prot	NA	Perm	Perm	NA	Perm	Perm	NA	Perm
Protected Phases	1	6		5	2			4			8	
Permitted Phases						2	4		4	8		8
Actuated Green, G (s)	16.0	61.6		9.7	55.3	55.3	23.7	23.7		23.7	23.7	23.7
Effective Green, g (s)	16.0	63.3		9.7	57.0	57.0	23.7	25.0		23.7	25.0	25.0
Actuated g/C Ratio	0.15	0.58		0.09	0.52	0.52	0.22	0.23		0.22	0.23	0.23
Clearance Time (s)	4.0	5.7		4.0	5.7	5.7	5.3	5.3		5.3	5.3	5.3
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	499	2843		302	2634	820	284	804		280	423	359
v/s Ratio Prot	0.03	c0.22		c0.04	0.15			0.02			0.04	
v/s Ratio Perm						0.03	0.15			c0.16		0.02
v/c Ratio	0.19	0.38		0.45	0.28	0.06	0.70	0.11		0.75	0.17	0.08
Uniform Delay, d1	41.3	12.7		47.6	15.0	13.2	39.9	33.7		40.3	34.2	33.5
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	0.2	0.4		1.1	0.3	0.1	7.7	0.1		10.3	0.2	0.1
Delay (s)	41.5	13.1		48.7	15.2	13.3	47.6	33.7		50.7	34.4	33.6
Level of Service	D	B		D	B	B	D	C		D	C	C
Approach Delay (s)		15.3			19.7			43.4			42.4	
Approach LOS		B			B			D			D	
Intersection Summary												
HCM 2000 Control Delay			23.5									C
HCM 2000 Volume to Capacity ratio			0.47									
Actuated Cycle Length (s)			110.0							12.0		
Intersection Capacity Utilization			51.0%									A
ICU Level of Service												
Analysis Period (min)			15									

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 9: Hacienda Dr & Dublin Blvd

BART to Livermore Extension Project
 2040 Express Bus + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	52	1124	170	237	605	27	384	653	556	39	691	218
Future Volume (vph)	52	1124	170	237	605	27	384	653	556	39	691	218
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	6.0	5.0	4.5	6.0		5.0	6.0	6.0	4.5	5.5	5.5
Lane Util. Factor	0.97	0.91	0.88	0.97	0.91		0.94	0.95	0.88	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5085	2787	3433	5053		4990	3539	2787	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5085	2787	3433	5053		4990	3539	2787	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	57	1222	185	258	658	29	417	710	604	42	751	237
RTOR Reduction (vph)	0	0	61	0	4	0	0	0	196	0	0	161
Lane Group Flow (vph)	57	1222	124	258	683	0	417	710	408	42	751	76
Turn Type	Prot	NA	pm+ov	Prot	NA		Prot	NA	Perm	Prot	NA	Perm
Protected Phases	5	2	3	1	6		3	8		7	NA	4
Permitted Phases			2						8			4
Actuated Green, G (s)	4.1	35.1	47.5	10.0	41.0		12.4	34.7	34.7	2.2	24.5	24.5
Effective Green, g (s)	4.1	35.1	47.5	10.0	41.0		12.4	34.7	34.7	2.2	24.5	24.5
Actuated g/C Ratio	0.04	0.34	0.46	0.10	0.40		0.12	0.34	0.34	0.02	0.24	0.24
Clearance Time (s)	4.5	6.0	5.0	4.5	6.0		5.0	6.0	6.0	4.5	5.5	5.5
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	136	1732	1420	333	2011		600	1192	938	73	1209	376
v/s Ratio Prot	0.02	c0.24	0.01	c0.08	0.14		c0.08	0.20		0.01	c0.15	
v/s Ratio Perm			0.03						0.15			0.05
v/c Ratio	0.42	0.71	0.09	0.77	0.34		0.69	0.60	0.44	0.58	0.62	0.20
Uniform Delay, d1	48.3	29.5	15.6	45.4	21.6		43.5	28.3	26.5	49.9	35.1	31.4
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	2.1	1.3	0.0	10.7	0.1		3.5	0.8	0.3	10.5	1.0	0.3
Delay (s)	50.4	30.8	15.6	56.1	21.7		47.0	29.1	26.9	60.4	36.1	31.7
Level of Service	D	C	B	E	C		D	C	C	E	D	C
Approach Delay (s)		29.6			31.1			32.6			36.1	
Approach LOS		C			C			C			D	

Intersection Summary

HCM 2000 Control Delay	32.2	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.69		
Actuated Cycle Length (s)	103.0	Sum of lost time (s)	21.0
Intersection Capacity Utilization	67.4%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 10: Hacienda Dr & Martinelli Blvd/Hacienda Crossings

BART to Livermore Extension Project
 2040 Express Bus + Garage PM




























Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗	↘	↖	↗		↖	↗	↘	↖	↗	↘
Traffic Volume (vph)	32	55	503	286	40	22	544	1570	467	56	1010	87
Future Volume (vph)	32	55	503	286	40	22	544	1570	467	56	1010	87
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	2.0	2.0	4.5	2.0		3.0	2.0	2.0	4.5	2.5	
Lane Util. Factor	1.00	0.91	0.91	0.97	1.00		0.94	0.91	1.00	0.97	0.86	
Frt	1.00	0.93	0.85	1.00	0.95		1.00	1.00	0.85	1.00	0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1770	1573	2882	3433	1763		4990	5085	1583	3433	6331	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1770	1573	2882	3433	1763		4990	5085	1583	3433	6331	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	35	60	547	311	43	24	591	1707	508	61	1098	95
RTOR Reduction (vph)	0	38	263	0	18	0	0	0	165	0	10	0
Lane Group Flow (vph)	35	77	229	311	49	0	591	1707	343	61	1183	0
Turn Type	Prot	NA	Perm	Prot	NA		Prot	NA	pm+ov	Prot	NA	
Protected Phases	5	2		1	6		3	8	1	7	4	
Permitted Phases			2						8			
Actuated Green, G (s)	3.6	17.5	17.5	13.8	27.7		13.6	56.5	70.3	6.2	49.1	
Effective Green, g (s)	3.1	19.5	19.5	13.3	29.7		14.6	58.5	74.3	5.7	50.6	
Actuated g/C Ratio	0.03	0.18	0.18	0.12	0.27		0.13	0.53	0.68	0.05	0.46	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	4.0	4.0	2.0	4.0		3.0	4.0	2.0	3.0	4.0	
Lane Grp Cap (vph)	49	278	510	415	476		662	2704	1098	177	2912	
v/s Ratio Prot	0.02	0.05		c0.09	0.03		c0.12	c0.34	0.04	0.02	c0.19	
v/s Ratio Perm			c0.08						0.17			
v/c Ratio	0.71	0.28	0.45	0.75	0.10		0.89	0.63	0.31	0.34	0.41	
Uniform Delay, d1	53.0	39.2	40.4	46.7	30.2		46.9	18.1	7.3	50.3	19.7	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.02	1.04	1.81	1.00	1.00	
Incremental Delay, d2	39.0	0.7	0.9	6.4	0.1		10.0	0.7	0.0	1.2	0.4	
Delay (s)	92.0	39.9	41.3	53.1	30.3		57.9	19.7	13.3	51.5	20.1	
Level of Service	F	D	D	D	C		E	B	B	D	C	
Approach Delay (s)		43.8			49.1			26.6			21.7	
Approach LOS		D			D			C			C	

Intersection Summary

HCM 2000 Control Delay	29.2	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.62		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	13.0
Intersection Capacity Utilization	67.7%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 11: Hacienda Dr & I-580 WB Ramps

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				 		 		   			   	
Traffic Volume (vph)	0	0	0	417	0	546	0	1776	809	0	956	798
Future Volume (vph)	0	0	0	417	0	546	0	1776	809	0	956	798
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				2.6		2.6		2.1			2.1	2.1
Lane Util. Factor				0.97		0.88		0.91			0.86	0.86
Frt				1.00		0.85		0.95			0.96	0.85
Flt Protected				0.95		1.00		1.00			1.00	1.00
Satd. Flow (prot)				3433		2787		4847			4593	1362
Flt Permitted				0.95		1.00		1.00			1.00	1.00
Satd. Flow (perm)				3433		2787		4847			4593	1362
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	453	0	593	0	1930	879	0	1039	867
RTOR Reduction (vph)	0	0	0	0	0	25	0	147	0	0	135	148
Lane Group Flow (vph)	0	0	0	453	0	568	0	2662	0	0	1338	285
Turn Type				Prot		Prot		NA			NA	Perm
Protected Phases				4		4		2			6	
Permitted Phases												6
Actuated Green, G (s)				12.7		12.7		34.3			34.3	34.3
Effective Green, g (s)				14.1		14.1		36.2			36.2	36.2
Actuated g/C Ratio				0.26		0.26		0.66			0.66	0.66
Clearance Time (s)				4.0		4.0		4.0			4.0	4.0
Vehicle Extension (s)				3.0		3.0		3.0			3.0	3.0
Lane Grp Cap (vph)				880		714		3190			3023	896
v/s Ratio Prot				0.13		c0.20		c0.55			0.29	
v/s Ratio Perm												0.21
v/c Ratio				0.51		0.80		0.83			0.44	0.32
Uniform Delay, d1				17.5		19.1		7.1			4.5	4.1
Progression Factor				1.00		1.00		0.81			0.62	1.29
Incremental Delay, d2				0.5		6.1		1.7			0.4	0.9
Delay (s)				18.0		25.2		7.4			3.3	6.1
Level of Service				B		C		A			A	A
Approach Delay (s)		0.0			22.1			7.4			3.9	
Approach LOS		A			C			A			A	
Intersection Summary												
HCM 2000 Control Delay			8.9									A
HCM 2000 Volume to Capacity ratio			0.82									
Actuated Cycle Length (s)			55.0									4.7
Intersection Capacity Utilization			78.2%									D
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis
 12: Hacienda Dr & I-580 EB Ramps

BART to Livermore Extension Project
 2040 Express Bus + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	904	0	465	0	0	0	0	1838	582	0	958	313
Future Volume (vph)	904	0	465	0	0	0	0	1838	582	0	958	313
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0					4.0	4.0		4.0	
Lane Util. Factor	0.97		0.88					0.86	0.86		0.91	
Frt	1.00		0.85					0.99	0.85		0.96	
Flt Protected	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (prot)	3433		2787					4741	1362		4897	
Flt Permitted	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (perm)	3433		2787					4741	1362		4897	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	983	0	505	0	0	0	0	1998	633	0	1041	340
RTOR Reduction (vph)	0	0	105	0	0	0	0	9	181	0	50	0
Lane Group Flow (vph)	983	0	400	0	0	0	0	2185	256	0	1331	0
Turn Type	Prot		Prot					NA	Perm		NA	
Protected Phases	4		4					2			6	
Permitted Phases									2			
Actuated Green, G (s)	36.1		36.1					62.6	62.6		62.6	
Effective Green, g (s)	37.5		37.5					64.5	64.5		64.5	
Actuated g/C Ratio	0.34		0.34					0.59	0.59		0.59	
Clearance Time (s)	5.4		5.4					5.9	5.9		5.9	
Vehicle Extension (s)	2.0		2.0					2.0	2.0		2.0	
Lane Grp Cap (vph)	1170		950					2779	798		2871	
v/s Ratio Prot	c0.29		0.14					c0.46			0.27	
v/s Ratio Perm									0.19			
v/c Ratio	0.84		0.42					0.79	0.32		0.46	
Uniform Delay, d1	33.5		27.9					17.5	11.6		12.9	
Progression Factor	1.00		1.00					1.00	1.00		0.76	
Incremental Delay, d2	5.4		0.1					2.3	1.1		0.5	
Delay (s)	38.8		28.0					19.8	12.7		10.3	
Level of Service	D		C					B	B		B	
Approach Delay (s)		35.2			0.0			18.6			10.3	
Approach LOS		D			A			B			B	

Intersection Summary			
HCM 2000 Control Delay	21.0	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.81		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	72.3%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 13: Hacienda Dr & Owens Rd

BART to Livermore Extension Project
 2040 Express Bus + Garage PM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	687	1000	56	149	371	875	27	726	273	616	513	279
Future Volume (vph)	687	1000	56	149	371	875	27	726	273	616	513	279
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	2.3	4.0	4.0	2.3	4.0	4.0	2.7	4.0	4.0	2.7
Lane Util. Factor	0.97	0.91	1.00	0.97	0.91	1.00	0.97	0.91	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5085	1583	3433	5085	1583	3433	5085	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5085	1583	3433	5085	1583	3433	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	747	1087	61	162	403	951	29	789	297	670	558	303
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	747	1087	61	162	403	951	29	789	297	670	558	303
Turn Type	Prot	NA	Free	Prot	NA	Free	Prot	NA	Free	Prot	NA	Free
Protected Phases	1	6		5	2		7	4		3	8	
Permitted Phases			Free			Free			Free			Free
Actuated Green, G (s)	33.4	38.5	115.0	9.5	14.6	115.0	2.4	23.7	115.0	24.3	45.6	115.0
Effective Green, g (s)	33.4	40.2	115.0	9.5	16.3	115.0	2.4	25.0	115.0	24.3	46.9	115.0
Actuated g/C Ratio	0.29	0.35	1.00	0.08	0.14	1.00	0.02	0.22	1.00	0.21	0.41	1.00
Clearance Time (s)	4.0	5.7		4.0	5.7		4.0	5.3		4.0	5.3	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	997	1777	1583	283	720	1583	71	1105	1583	725	2073	1583
v/s Ratio Prot	c0.22	0.21		0.05	0.08		0.01	c0.16		c0.20	0.11	
v/s Ratio Perm			0.04			c0.60			0.19			0.19
v/c Ratio	0.75	0.61	0.04	0.57	0.56	0.60	0.41	0.71	0.19	0.92	0.27	0.19
Uniform Delay, d1	37.0	30.9	0.0	50.8	46.0	0.0	55.6	41.7	0.0	44.4	22.6	0.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	3.1	0.6	0.0	2.8	0.9	1.7	3.8	3.9	0.3	17.5	0.3	0.3
Delay (s)	40.1	31.6	0.0	53.6	47.0	1.7	59.4	45.6	0.3	61.9	23.0	0.3
Level of Service	D	C	A	D	D	A	E	D	A	E	C	A
Approach Delay (s)		33.9			19.3			33.9			35.5	
Approach LOS		C			B			C			D	
Intersection Summary												
HCM 2000 Control Delay			30.7			HCM 2000 Level of Service		C				
HCM 2000 Volume to Capacity ratio			0.79									
Actuated Cycle Length (s)			115.0			Sum of lost time (s)		16.0				
Intersection Capacity Utilization			71.7%			ICU Level of Service		C				
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis
 14: Tassajara Rd & Dublin Blvd

BART to Livermore Extension Project
 2040 Express Bus + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	280	1127	465	287	366	25	393	921	654	41	801	150
Future Volume (vph)	280	1127	465	287	366	25	393	921	654	41	801	150
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	6.0	6.0	5.0	6.0		5.0	6.0	6.0	5.0	5.7	5.7
Lane Util. Factor	0.97	0.86	0.88	0.94	0.91		0.94	0.86	1.00	0.97	0.86	0.88
Frt	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	6408	2787	4990	5037		4990	6408	1583	3433	6408	2787
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	6408	2787	4990	5037		4990	6408	1583	3433	6408	2787
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	304	1225	505	312	398	27	427	1001	711	45	871	163
RTOR Reduction (vph)	0	0	280	0	5	0	0	0	227	0	0	130
Lane Group Flow (vph)	304	1225	225	312	420	0	427	1001	484	45	871	33
Turn Type	Prot	NA	Perm	Prot	NA		Prot	NA	Perm	Prot	NA	Perm
Protected Phases	5	2		1	6		3	8		7	NA	4
Permitted Phases			2						8			4
Actuated Green, G (s)	16.4	41.9	41.9	16.4	41.9		31.6	48.9	48.9	11.2	28.8	28.8
Effective Green, g (s)	16.4	41.9	41.9	16.4	41.9		31.6	48.9	48.9	11.2	28.8	28.8
Actuated g/C Ratio	0.12	0.30	0.30	0.12	0.30		0.23	0.35	0.35	0.08	0.21	0.21
Clearance Time (s)	5.0	6.0	6.0	5.0	6.0		5.0	6.0	6.0	5.0	5.7	5.7
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	401	1912	831	582	1503		1123	2231	551	273	1314	571
v/s Ratio Prot	c0.09	c0.19		0.06	0.08		c0.09	0.16		0.01	0.14	
v/s Ratio Perm			0.08						c0.31			0.01
v/c Ratio	0.76	0.64	0.27	0.54	0.28		0.38	0.45	0.88	0.16	0.66	0.06
Uniform Delay, d1	60.1	42.7	37.6	58.4	37.7		46.1	35.3	42.9	60.2	51.3	44.9
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	8.0	0.7	0.2	1.0	0.1		0.2	0.1	14.7	0.3	1.3	0.0
Delay (s)	68.1	43.5	37.8	59.4	37.8		46.3	35.5	57.6	60.5	52.6	44.9
Level of Service	E	D	D	E	D		D	D	E	E	D	D
Approach Delay (s)		45.7			46.9			45.0			51.8	
Approach LOS		D			D			D			D	

Intersection Summary			
HCM 2000 Control Delay	46.7	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.74		
Actuated Cycle Length (s)	140.4	Sum of lost time (s)	22.0
Intersection Capacity Utilization	83.5%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 15: Tassajara Rd & I-580 WB Ramps

BART to Livermore Extension Project
 2040 Express Bus + Garage PM






























Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↔↔		↔↔		↑↑	↔		↑↑↑	↔
Traffic Volume (vph)	0	0	0	570	0	226	0	1663	724	0	1317	641
Future Volume (vph)	0	0	0	570	0	226	0	1663	724	0	1317	641
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0		4.0		4.0	4.0		4.0	4.0
Lane Util. Factor				0.97		0.88		0.95	1.00		0.86	0.86
Frt				1.00		0.85		1.00	0.85		0.98	0.85
Flt Protected				0.95		1.00		1.00	1.00		1.00	1.00
Satd. Flow (prot)				3433		2787		3539	1583		4711	1362
Flt Permitted				0.95		1.00		1.00	1.00		1.00	1.00
Satd. Flow (perm)				3433		2787		3539	1583		4711	1362
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	620	0	246	0	1808	787	0	1432	697
RTOR Reduction (vph)	0	0	0	0	0	18	0	0	321	0	31	196
Lane Group Flow (vph)	0	0	0	620	0	228	0	1808	466	0	1617	285
Turn Type				Perm		Perm		NA	Perm		NA	Perm
Protected Phases								2			6	
Permitted Phases				8		8			2			6
Actuated Green, G (s)				14.4		14.4		32.6	32.6		32.6	32.6
Effective Green, g (s)				14.4		14.4		32.6	32.6		32.6	32.6
Actuated g/C Ratio				0.26		0.26		0.59	0.59		0.59	0.59
Clearance Time (s)				4.0		4.0		4.0	4.0		4.0	4.0
Vehicle Extension (s)				3.0		3.0		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)				898		729		2097	938		2792	807
v/s Ratio Prot								c0.51			0.34	
v/s Ratio Perm				c0.18		0.08			0.29			0.21
v/c Ratio				0.69		0.31		0.86	0.50		0.58	0.35
Uniform Delay, d1				18.3		16.3		9.3	6.5		6.9	5.8
Progression Factor				1.00		1.00		1.00	1.00		1.00	1.00
Incremental Delay, d2				2.3		0.2		5.0	1.9		0.9	1.2
Delay (s)				20.6		16.6		14.3	8.4		7.8	7.0
Level of Service				C		B		B	A		A	A
Approach Delay (s)		0.0			19.5			12.5			7.6	
Approach LOS		A			B			B			A	

Intersection Summary			
HCM 2000 Control Delay	11.7	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.81		
Actuated Cycle Length (s)	55.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	68.9%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 16: Santa Rita Rd & I-580 EB Ramps/Pimilco Dr































												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 			 		 		  			 	
Traffic Volume (vph)	438	82	257	141	0	318	0	1584	194	315	1128	0
Future Volume (vph)	438	82	257	141	0	318	0	1584	194	315	1128	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0		4.0		4.0		4.0	4.0	
Lane Util. Factor	0.97	1.00	1.00	0.97		0.88		0.86		1.00	0.95	
Frt	1.00	1.00	0.85	1.00		0.85		0.98		1.00	1.00	
Flt Protected	0.95	1.00	1.00	0.95		1.00		1.00		0.95	1.00	
Satd. Flow (prot)	3433	1863	1583	3433		2787		6303		1770	3539	
Flt Permitted	0.95	1.00	1.00	0.95		1.00		1.00		0.95	1.00	
Satd. Flow (perm)	3433	1863	1583	3433		2787		6303		1770	3539	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	476	89	279	153	0	346	0	1722	211	342	1226	0
RTOR Reduction (vph)	0	0	73	0	0	35	0	19	0	0	0	0
Lane Group Flow (vph)	476	89	206	153	0	311	0	1914	0	342	1226	0
Turn Type	Perm	NA	Perm	Prot		pm+ov		NA		Prot	NA	Perm
Protected Phases		4		3		1		2		1	6	
Permitted Phases	4		4			3						6
Actuated Green, G (s)	19.9	19.9	19.9	7.6		32.2		41.9		24.6	70.5	
Effective Green, g (s)	19.9	19.9	19.9	7.6		32.2		41.9		24.6	70.5	
Actuated g/C Ratio	0.18	0.18	0.18	0.07		0.29		0.38		0.22	0.64	
Clearance Time (s)	4.0	4.0	4.0	4.0		4.0		4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0		3.0		3.0		3.0	3.0	
Lane Grp Cap (vph)	621	337	286	237		815		2400		395	2268	
v/s Ratio Prot		0.05		c0.04		0.09		c0.30		c0.19	0.35	
v/s Ratio Perm	c0.14		0.13			0.03						
v/c Ratio	0.77	0.26	0.72	0.65		0.38		0.80		0.87	0.54	
Uniform Delay, d1	42.8	38.8	42.4	49.9		31.0		30.3		41.1	10.9	
Progression Factor	1.00	1.00	1.00	1.00		1.00		1.00		1.00	1.00	
Incremental Delay, d2	5.6	0.4	8.6	5.9		0.3		2.9		17.7	0.9	
Delay (s)	48.5	39.2	51.1	55.8		31.3		33.1		58.8	11.8	
Level of Service	D	D	D	E		C		C		E	B	
Approach Delay (s)		48.3			38.8			33.1			22.0	
Approach LOS		D			D			C			C	

Intersection Summary		
HCM 2000 Control Delay	32.8	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.80	C
Actuated Cycle Length (s)	110.0	Sum of lost time (s)
Intersection Capacity Utilization	66.1%	16.0
Analysis Period (min)	15	ICU Level of Service
		C

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
17: Santa Rita Rd & Valley Ave

BART to Livermore Extension Project
2040 Express Bus + Garage PM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 	 			 		 	 		 	 	
Traffic Volume (vph)	364	721	120	136	371	800	142	630	159	1420	1075	269
Future Volume (vph)	364	721	120	136	371	800	142	630	159	1420	1075	269
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.97	0.95		0.97	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.97		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	3433	3432		3433	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	3433	3432		3433	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	396	784	130	148	403	870	154	685	173	1543	1168	292
RTOR Reduction (vph)	0	0	95	0	0	0	0	18	0	0	0	127
Lane Group Flow (vph)	396	784	35	148	403	870	154	840	0	1543	1168	165
Turn Type	Prot	NA	Perm	Prot	NA	Free	Prot	NA		Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1		6
Permitted Phases			4			Free						6
Actuated Green, G (s)	14.0	23.0	23.0	8.0	17.0	120.0	9.4	28.0		45.0	63.6	63.6
Effective Green, g (s)	14.0	23.0	23.0	8.0	17.0	120.0	9.4	28.0		45.0	63.6	63.6
Actuated g/C Ratio	0.12	0.19	0.19	0.07	0.14	1.00	0.08	0.23		0.38	0.53	0.53
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	400	678	303	118	501	1583	268	800		1287	1875	838
v/s Ratio Prot	c0.12	c0.22		c0.08	0.11		0.04	c0.24		c0.45	0.33	
v/s Ratio Perm			0.02			0.55						0.10
v/c Ratio	0.99	1.16	0.11	1.25	0.80	0.55	0.57	1.05		1.20	0.62	0.20
Uniform Delay, d1	52.9	48.5	40.1	56.0	49.9	0.0	53.4	46.0		37.5	19.8	14.8
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	41.9	86.4	0.2	166.2	9.1	1.4	3.0	45.6		97.3	0.7	0.1
Delay (s)	94.8	134.9	40.3	222.2	59.0	1.4	56.3	91.6		134.8	20.4	14.9
Level of Service	F	F	D	F	E	A	E	F		F	C	B
Approach Delay (s)		113.4			40.7			86.2			78.6	
Approach LOS		F			D			F			E	
Intersection Summary												
HCM 2000 Control Delay			78.5			HCM 2000 Level of Service				E		
HCM 2000 Volume to Capacity ratio			1.16									
Actuated Cycle Length (s)			120.0			Sum of lost time (s)				16.0		
Intersection Capacity Utilization			103.8%			ICU Level of Service				G		
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis
18: Bernal Ave/Valley Ave & Stanley Blvd

BART to Livermore Extension Project
2040 Express Bus + Garage PM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	230	839	59	92	235	351	95	367	301	823	551	132
Future Volume (vph)	230	839	59	92	235	351	95	367	301	823	551	132
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.95	1.00	0.97	0.91	0.91	1.00	0.95	1.00	0.97	0.95	
Frt	1.00	1.00	0.85	1.00	0.94	0.85	1.00	1.00	0.85	1.00	0.97	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	3433	3539	1583	3433	3178	1441	1770	3539	1583	3433	3437	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	3433	3539	1583	3433	3178	1441	1770	3539	1583	3433	3437	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	250	912	64	100	255	382	103	399	327	895	599	143
RTOR Reduction (vph)	0	0	39	0	127	53	0	0	169	0	22	0
Lane Group Flow (vph)	250	912	25	100	311	146	103	399	158	895	720	0
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	
Protected Phases	7	4	5	3	8	1	5	2		1	6	
Permitted Phases			4			8			2			
Actuated Green, G (s)	10.3	25.6	33.3	3.0	18.3	43.7	7.7	15.4	15.4	25.4	33.1	
Effective Green, g (s)	10.3	25.6	33.3	3.0	18.3	43.7	7.7	15.4	15.4	25.4	33.1	
Actuated g/C Ratio	0.12	0.30	0.39	0.04	0.21	0.51	0.09	0.18	0.18	0.30	0.39	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	414	1060	691	120	681	804	159	638	285	1021	1332	
v/s Ratio Prot	c0.07	c0.26	0.00	0.03	0.10	0.05	0.06	0.11		c0.26	c0.21	
v/s Ratio Perm			0.01			0.05			0.10			
v/c Ratio	0.60	0.86	0.04	0.83	0.46	0.18	0.65	0.63	0.55	0.88	0.54	
Uniform Delay, d1	35.6	28.2	16.1	41.0	29.2	11.2	37.5	32.3	31.9	28.5	20.3	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	2.5	7.3	0.0	36.7	0.5	0.1	8.8	1.9	2.3	8.6	0.5	
Delay (s)	38.1	35.5	16.1	77.6	29.7	11.3	46.3	34.3	34.2	37.1	20.7	
Level of Service	D	D	B	E	C	B	D	C	C	D	C	
Approach Delay (s)		35.0			31.2			35.7			29.7	
Approach LOS		D			C			D			C	

Intersection Summary

HCM 2000 Control Delay	32.5	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.82		
Actuated Cycle Length (s)	85.4	Sum of lost time (s)	16.0
Intersection Capacity Utilization	75.3%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
19: Fallon Rd & Dublin Blvd/Croak Rd

BART to Livermore Extension Project
2040 Express Bus + Garage PM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	219	943	436	81	29	92	245	803	329	184	651	29
Future Volume (vph)	219	943	436	81	29	92	245	803	329	184	651	29
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.91	0.88	0.94	0.91	1.00	0.94	0.91	0.88	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5085	2787	4990	5085	1583	4990	5085	2787	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5085	2787	4990	5085	1583	4990	5085	2787	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	238	1025	474	88	32	100	266	873	358	200	708	32
RTOR Reduction (vph)	0	0	68	0	0	88	0	0	169	0	0	22
Lane Group Flow (vph)	238	1025	406	88	32	12	266	873	189	200	708	10
Turn Type	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4	5	3	8		5	2		1	6	
Permitted Phases			4			8			2			6
Actuated Green, G (s)	19.3	25.7	35.8	3.2	9.6	9.6	10.1	28.8	28.8	6.3	25.0	25.0
Effective Green, g (s)	19.3	25.7	35.8	3.2	9.6	9.6	10.1	28.8	28.8	6.3	25.0	25.0
Actuated g/C Ratio	0.24	0.32	0.45	0.04	0.12	0.12	0.13	0.36	0.36	0.08	0.31	0.31
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	828	1633	1386	199	610	189	629	1830	1003	270	1589	494
v/s Ratio Prot	0.07	c0.20	0.04	c0.02	0.01		0.05	c0.17		c0.06	0.14	
v/s Ratio Perm			0.11			0.01			0.07			0.01
v/c Ratio	0.29	0.63	0.29	0.44	0.05	0.06	0.42	0.48	0.19	0.74	0.45	0.02
Uniform Delay, d1	24.7	23.1	14.1	37.5	31.2	31.2	32.3	19.8	17.6	36.1	22.0	19.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.13	0.92	0.99	1.00	1.00	1.00
Incremental Delay, d2	0.2	0.8	0.1	1.6	0.0	0.1	0.4	0.8	0.4	10.4	0.9	0.1
Delay (s)	24.9	23.8	14.2	39.1	31.2	31.4	36.9	19.0	17.8	46.5	22.9	19.1
Level of Service	C	C	B	D	C	C	D	B	B	D	C	B
Approach Delay (s)		21.4			34.4			21.9			27.8	
Approach LOS		C			C			C			C	

Intersection Summary

HCM 2000 Control Delay	23.6	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.56		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	53.9%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

20: El Charro Rd/Fallon Rd & I-580 WB Ramps

BART to Livermore Extension Project
2040 Express Bus + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↖	↖	↖↖		↑↑↑	↖		↑↑↑	↖
Traffic Volume (vph)	0	0	0	591	0	543	0	923	245	0	853	405
Future Volume (vph)	0	0	0	591	0	543	0	923	245	0	853	405
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0	4.0	4.0		4.0	4.0		4.0	4.0
Lane Util. Factor				0.95	0.95	0.88		0.91	1.00		0.91	1.00
Frt				1.00	1.00	0.85		1.00	0.85		1.00	0.85
Flt Protected				0.95	0.95	1.00		1.00	1.00		1.00	1.00
Satd. Flow (prot)				1681	1681	2787		5085	1583		5085	1583
Flt Permitted				0.95	0.95	1.00		1.00	1.00		1.00	1.00
Satd. Flow (perm)				1681	1681	2787		5085	1583		5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	642	0	590	0	1003	266	0	927	440
RTOR Reduction (vph)	0	0	0	0	0	34	0	0	142	0	0	235
Lane Group Flow (vph)	0	0	0	327	315	556	0	1003	124	0	927	205
Turn Type				Perm	NA	Perm		NA	Perm		NA	Perm
Protected Phases					8			2			6	
Permitted Phases				8		8			2			6
Actuated Green, G (s)				13.9	13.9	13.9		18.6	18.6		18.6	18.6
Effective Green, g (s)				13.4	13.4	13.4		18.6	18.6		18.6	18.6
Actuated g/C Ratio				0.34	0.34	0.34		0.47	0.47		0.47	0.47
Clearance Time (s)				3.5	3.5	3.5		4.0	4.0		4.0	4.0
Vehicle Extension (s)				2.0	2.0	2.0		2.0	2.0		2.0	2.0
Lane Grp Cap (vph)				563	563	933		2364	736		2364	736
v/s Ratio Prot								c0.20			0.18	
v/s Ratio Perm				0.19	0.19	c0.20			0.08			0.13
v/c Ratio				0.58	0.56	0.60		0.42	0.17		0.39	0.28
Uniform Delay, d1				11.0	10.9	11.1		7.1	6.2		7.0	6.6
Progression Factor				1.00	1.00	1.00		1.00	1.00		1.06	3.62
Incremental Delay, d2				1.0	0.7	0.7		0.6	0.5		0.5	0.9
Delay (s)				12.0	11.6	11.7		7.7	6.7		7.9	24.7
Level of Service				B	B	B		A	A		A	C
Approach Delay (s)		0.0			11.8			7.5			13.3	
Approach LOS		A			B			A			B	

Intersection Summary

HCM 2000 Control Delay	10.9	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.50		
Actuated Cycle Length (s)	40.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	48.1%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 21: El Charro Rd & I-580 EB Ramps

BART to Livermore Extension Project
 2040 Express Bus + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↗↘		↗↘					↕↗	↗		↕↗	↗
Traffic Volume (vph)	335	0	469	0	0	0	0	1533	281	0	1515	0
Future Volume (vph)	335	0	469	0	0	0	0	1533	281	0	1515	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0					4.0	4.0		4.0	
Lane Util. Factor	0.97		0.88					0.91	0.91		0.91	
Frt	1.00		0.85					1.00	0.85		1.00	
Flt Protected	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (prot)	3433		2787					3379	1441		3390	
Flt Permitted	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (perm)	3433		2787					3379	1441		3390	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	364	0	510	0	0	0	0	1666	305	0	1647	0
RTOR Reduction (vph)	0	0	46	0	0	0	0	2	95	0	0	0
Lane Group Flow (vph)	364	0	464	0	0	0	0	1701	173	0	1647	0
Turn Type	Prot		Perm					NA	Perm		NA	Perm
Protected Phases	4							2			6	
Permitted Phases			4						2			6
Actuated Green, G (s)	11.4		11.4					35.6	35.6		35.6	
Effective Green, g (s)	11.4		11.4					35.6	35.6		35.6	
Actuated g/C Ratio	0.21		0.21					0.65	0.65		0.65	
Clearance Time (s)	4.0		4.0					4.0	4.0		4.0	
Vehicle Extension (s)	2.0		2.0					3.0	3.0		3.0	
Lane Grp Cap (vph)	711		577					2187	932		2194	
v/s Ratio Prot	0.11							c0.50			0.49	
v/s Ratio Perm			c0.17						0.12			
v/c Ratio	0.51		0.80					0.78	0.19		0.75	
Uniform Delay, d1	19.3		20.7					6.9	3.9		6.7	
Progression Factor	1.00		1.00					1.00	1.00		1.00	
Incremental Delay, d2	0.3		7.6					2.8	0.4		2.4	
Delay (s)	19.6		28.3					9.7	4.3		9.1	
Level of Service	B		C					A	A		A	
Approach Delay (s)		24.7			0.0			9.0			9.1	
Approach LOS		C			A			A			A	

Intersection Summary	
HCM 2000 Control Delay	12.1 HCM 2000 Level of Service B
HCM 2000 Volume to Capacity ratio	0.78
Actuated Cycle Length (s)	55.0 Sum of lost time (s) 8.0
Intersection Capacity Utilization	65.0% ICU Level of Service C
Analysis Period (min)	15

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 22: El Charro Rd & Stoneridge Dr/Jack London Blvd

BART to Livermore Extension Project
 2040 Express Bus + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↖↖	↑↑	↗	↖	↑↑	↗↗	↖	↑↑		↖↖↖	↑	↗↗
Traffic Volume (vph)	183	603	57	95	322	643	16	437	52	776	396	71
Future Volume (vph)	183	603	57	95	322	643	16	437	52	776	396	71
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	0.94	0.95	1.00	1.00	0.95	0.88	1.00	0.95		0.94	1.00	0.88
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.98		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	4491	3185	1425	1593	3185	2508	1593	3134		4491	1676	2508
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	4491	3185	1425	1593	3185	2508	1593	3134		4491	1676	2508
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	199	655	62	103	350	699	17	475	57	843	430	77
RTOR Reduction (vph)	0	0	47	0	0	73	0	13	0	0	0	41
Lane Group Flow (vph)	199	655	15	103	350	626	17	519	0	843	430	36
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Prot	NA		Prot	NA	Perm
Protected Phases	7	4		3	8	1	5	2		1	6	
Permitted Phases			4			8						6
Actuated Green, G (s)	6.0	16.7	16.7	4.6	15.3	33.7	0.8	15.1		18.4	32.7	32.7
Effective Green, g (s)	6.0	16.7	16.7	4.6	15.3	33.7	0.8	15.1		18.4	32.7	32.7
Actuated g/C Ratio	0.08	0.24	0.24	0.06	0.22	0.48	0.01	0.21		0.26	0.46	0.46
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	380	751	336	103	688	1193	18	668		1167	774	1158
v/s Ratio Prot	0.04	c0.21		c0.06	0.11	0.14	0.01	c0.17		c0.19	0.26	
v/s Ratio Perm			0.01			0.11						0.01
v/c Ratio	0.52	0.87	0.04	1.00	0.51	0.52	0.94	0.78		0.72	0.56	0.03
Uniform Delay, d1	31.0	26.0	20.9	33.1	24.4	13.0	35.0	26.3		23.9	13.8	10.4
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	1.3	10.9	0.1	88.7	0.6	0.4	183.9	5.7		2.2	0.9	0.0
Delay (s)	32.3	36.9	20.9	121.8	25.0	13.4	218.9	31.9		26.1	14.7	10.4
Level of Service	C	D	C	F	C	B	F	C		C	B	B
Approach Delay (s)		34.8			26.6			37.7			21.6	
Approach LOS		C			C			D			C	

Intersection Summary

HCM 2000 Control Delay	28.3	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.81		
Actuated Cycle Length (s)	70.8	Sum of lost time (s)	16.0
Intersection Capacity Utilization	69.4%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 23: Stanley Blvd & El Charro Rd

BART to Livermore Extension Project
 2040 Express Bus + Garage PM



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	381	2704	777	11	177	368
Future Volume (vph)	381	2704	777	11	177	368
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95	0.91	1.00	0.97	0.88
Frt	1.00	1.00	1.00	0.85	1.00	0.85
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1770	3539	5085	1583	3433	2787
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1770	3539	5085	1583	3433	2787
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	414	2939	845	12	192	400
RTOR Reduction (vph)	0	0	0	6	0	359
Lane Group Flow (vph)	414	2939	845	6	192	41
Turn Type	Prot	NA	NA	Perm	Prot	Perm
Protected Phases	7	4	8		6	
Permitted Phases				8		6
Actuated Green, G (s)	32.0	96.1	60.1	60.1	11.9	11.9
Effective Green, g (s)	32.0	96.1	60.1	60.1	11.9	11.9
Actuated g/C Ratio	0.28	0.83	0.52	0.52	0.10	0.10
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	488	2931	2634	820	352	285
v/s Ratio Prot	0.23	c0.83	0.17		c0.06	
v/s Ratio Perm				0.00		0.01
v/c Ratio	0.85	1.00	0.32	0.01	0.55	0.14
Uniform Delay, d1	39.7	10.0	16.2	13.5	49.5	47.4
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	12.9	17.3	0.1	0.0	1.7	0.2
Delay (s)	52.6	27.2	16.2	13.5	51.2	47.6
Level of Service	D	C	B	B	D	D
Approach Delay (s)		30.4	16.2		48.8	
Approach LOS		C	B		D	

Intersection Summary

HCM 2000 Control Delay	30.1	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.99		
Actuated Cycle Length (s)	116.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	86.5%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
24: Airway Blvd/Driveway & N Canyons Pkwy

BART to Livermore Extension Project
2040 Express Bus + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑	↑	↑↑	↑	↑		↑	↑↑		↑	
Traffic Volume (vph)	0	845	550	951	80	0	53	0	748	0	0	0
Future Volume (vph)	0	845	550	951	80	0	53	0	748	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		2.0	2.0	2.0	2.0			4.2	2.0			
Lane Util. Factor		0.95	1.00	0.97	1.00			1.00	0.88			
Frt		1.00	0.85	1.00	1.00			1.00	0.85			
Flt Protected		1.00	1.00	0.95	1.00			0.95	1.00			
Satd. Flow (prot)		3539	1583	3433	1863			1770	2787			
Flt Permitted		1.00	1.00	0.95	1.00			0.95	1.00			
Satd. Flow (perm)		3539	1583	3433	1863			1770	2787			
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	918	598	1034	87	0	58	0	813	0	0	0
RTOR Reduction (vph)	0	0	252	0	0	0	0	0	475	0	0	0
Lane Group Flow (vph)	0	918	346	1034	87	0	0	58	338	0	0	0
Turn Type		NA	Perm	Prot	NA	Perm	Split	NA	pm+ov			
Protected Phases		2		1	6		8	8	1	4	4	
Permitted Phases			2			6			8			
Actuated Green, G (s)		62.1	62.1	34.7	100.8			11.2	45.9			
Effective Green, g (s)		64.1	64.1	36.7	102.8			11.0	49.9			
Actuated g/C Ratio		0.53	0.53	0.31	0.86			0.09	0.42			
Clearance Time (s)		4.0	4.0	4.0	4.0			4.0	4.0			
Vehicle Extension (s)		3.0	3.0	3.0	3.0			3.0	3.0			
Lane Grp Cap (vph)		1890	845	1049	1595			162	1205			
v/s Ratio Prot		c0.26		c0.30	0.05			0.03	c0.09			
v/s Ratio Perm			0.22						0.04			
v/c Ratio		0.49	0.41	0.99	0.05			0.36	0.28			
Uniform Delay, d1		17.6	16.7	41.4	1.3			51.2	23.2			
Progression Factor		1.00	1.00	1.00	1.00			1.00	1.00			
Incremental Delay, d2		0.9	1.5	24.1	0.1			1.4	0.1			
Delay (s)		18.5	18.1	65.5	1.4			52.5	23.3			
Level of Service		B	B	E	A			D	C			
Approach Delay (s)		18.3			60.5			25.3			0.0	
Approach LOS		B			E			C			A	

Intersection Summary

HCM 2000 Control Delay	33.5	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.66		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	12.2
Intersection Capacity Utilization	67.9%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
25: Airway Blvd & I-580 WB Ramps

BART to Livermore Extension Project
2040 Express Bus + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↙	↖	↗		↑↑	↗		↑↑↑	
Traffic Volume (vph)	0	0	0	145	39	183	0	685	384	0	905	699
Future Volume (vph)	0	0	0	145	39	183	0	685	384	0	905	699
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0	4.0	4.0		4.0	4.0		4.0	
Lane Util. Factor				0.95	0.95	0.88		0.95	1.00		0.91	
Frt				1.00	1.00	0.85		1.00	0.85		0.93	
Flt Protected				0.95	0.97	1.00		1.00	1.00		1.00	
Satd. Flow (prot)				1681	1715	2787		3539	1583		4753	
Flt Permitted				0.95	0.97	1.00		1.00	1.00		1.00	
Satd. Flow (perm)				1681	1715	2787		3539	1583		4753	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	158	42	199	0	745	417	0	984	760
RTOR Reduction (vph)	0	0	0	0	0	168	0	0	113	0	164	0
Lane Group Flow (vph)	0	0	0	84	116	31	0	745	304	0	1580	0
Turn Type				Split	NA	Perm		NA	Perm		NA	
Protected Phases				8	8			2			6	
Permitted Phases						8			2			
Actuated Green, G (s)				10.9	10.9	10.9		49.8	49.8		49.8	
Effective Green, g (s)				10.9	10.9	10.9		51.1	51.1		51.1	
Actuated g/C Ratio				0.16	0.16	0.16		0.73	0.73		0.73	
Clearance Time (s)				4.0	4.0	4.0		5.3	5.3		5.3	
Vehicle Extension (s)				2.0	2.0	2.0		4.0	4.0		4.0	
Lane Grp Cap (vph)				261	267	433		2583	1155		3469	
v/s Ratio Prot				0.05	c0.07			0.21			c0.33	
v/s Ratio Perm						0.01			0.19			
v/c Ratio				0.32	0.43	0.07		0.29	0.26		0.46	
Uniform Delay, d1				26.3	26.8	25.2		3.2	3.2		3.8	
Progression Factor				1.00	1.00	1.00		0.34	0.25		1.00	
Incremental Delay, d2				0.3	0.4	0.0		0.2	0.5		0.4	
Delay (s)				26.5	27.2	25.3		1.3	1.3		4.3	
Level of Service				C	C	C		A	A		A	
Approach Delay (s)		0.0			26.1			1.3			4.3	
Approach LOS		A			C			A			A	

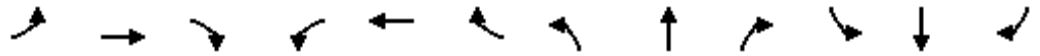
Intersection Summary

HCM 2000 Control Delay	5.9	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.45		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	48.2%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 26: Airway Blvd & I-580 EB Ramps/Kitty Hawk Rd

BART to Livermore Extension Project
 2040 Express Bus + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔↔	↑	↔	↔	↑	↔	↔	↕↕		↔	↕↕	
Traffic Volume (vph)	564	185	353	65	94	122	54	460	158	124	393	478
Future Volume (vph)	564	185	353	65	94	122	54	460	158	124	393	478
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.4	4.4	4.4	4.5	2.7		4.0	2.7	
Lane Util. Factor	0.97	1.00	1.00	1.00	1.00	1.00	1.00	0.95		1.00	0.95	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.96		1.00	0.92	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	3433	1863	1583	1770	1863	1583	1770	3403		1770	3248	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	3433	1863	1583	1770	1863	1583	1770	3403		1770	3248	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	613	201	384	71	102	133	59	500	172	135	427	520
RTOR Reduction (vph)	0	0	298	0	0	89	0	20	0	0	136	0
Lane Group Flow (vph)	613	201	86	71	102	44	59	652	0	135	811	0
Turn Type	Split	NA	Perm	Split	NA	pm+ov	Prot	NA		Prot	NA	
Protected Phases	7	7		8	8	1	5	2		1	6	
Permitted Phases			7			8						
Actuated Green, G (s)	31.5	31.5	31.5	14.6	14.6	29.6	11.0	62.9		15.0	66.9	
Effective Green, g (s)	31.5	31.5	31.5	14.2	14.2	28.8	10.5	64.2		15.0	68.2	
Actuated g/C Ratio	0.22	0.22	0.22	0.10	0.10	0.21	0.08	0.46		0.11	0.49	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Vehicle Extension (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	3.5		2.0	4.0	
Lane Grp Cap (vph)	772	419	356	179	188	375	132	1560		189	1582	
v/s Ratio Prot	c0.18	0.11		0.04	c0.05	0.01	0.03	c0.19		c0.08	c0.25	
v/s Ratio Perm			0.05			0.02						
v/c Ratio	0.79	0.48	0.24	0.40	0.54	0.12	0.45	0.42		0.71	0.51	
Uniform Delay, d1	51.2	47.1	44.5	58.9	59.8	45.3	62.0	25.4		60.4	24.5	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		0.99	0.94	
Incremental Delay, d2	5.3	0.3	0.1	0.5	1.7	0.1	0.9	0.8		9.3	1.1	
Delay (s)	56.5	47.4	44.6	59.4	61.5	45.3	62.8	26.2		68.9	24.2	
Level of Service	E	D	D	E	E	D	E	C		E	C	
Approach Delay (s)		51.1			54.0			29.2			29.7	
Approach LOS		D			D			C			C	

Intersection Summary		
HCM 2000 Control Delay	39.6	HCM 2000 Level of Service D
HCM 2000 Volume to Capacity ratio	0.61	
Actuated Cycle Length (s)	140.0	Sum of lost time (s) 15.6
Intersection Capacity Utilization	71.4%	ICU Level of Service C
Analysis Period (min)	15	

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 27: Collier Canyon Rd & N Canyons Pkwy/Portola Ave

BART to Livermore Extension Project
 2040 Express Bus + Garage PM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	426	849	195	39	205	12	57	5	192	131	14	185
Future Volume (vph)	426	849	195	39	205	12	57	5	192	131	14	185
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	2.7	2.7	4.0	2.7	2.7	4.0	3.0		4.0	4.6	4.6
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.85		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	1770	1590		1770	1863	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	1770	1590		1770	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	463	923	212	42	223	13	62	5	209	142	15	201
RTOR Reduction (vph)	0	0	122	0	0	9	0	160	0	0	0	149
Lane Group Flow (vph)	463	923	90	42	223	4	62	54	0	142	15	52
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA		Prot	NA	Perm
Protected Phases	1	6		5	2		3	8		7		4
Permitted Phases			6			2						4
Actuated Green, G (s)	14.3	30.2	30.2	3.2	19.1	19.1	4.7	14.5		10.1	19.9	19.9
Effective Green, g (s)	14.3	31.5	31.5	3.2	20.4	20.4	4.7	15.5		10.1	19.3	19.3
Actuated g/C Ratio	0.19	0.43	0.43	0.04	0.28	0.28	0.06	0.21		0.14	0.26	0.26
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	663	1506	673	76	975	436	112	333		241	485	412
v/s Ratio Prot	c0.13	c0.26		0.02	0.06		0.04	c0.03		c0.08	0.01	
v/s Ratio Perm			0.06			0.00						0.03
v/c Ratio	0.70	0.61	0.13	0.55	0.23	0.01	0.55	0.16		0.59	0.03	0.13
Uniform Delay, d1	27.8	16.5	12.9	34.7	20.7	19.5	33.6	23.9		30.0	20.4	20.9
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	3.2	0.7	0.1	8.4	0.1	0.0	5.8	0.2		3.7	0.0	0.1
Delay (s)	31.1	17.3	13.0	43.1	20.8	19.5	39.4	24.2		33.7	20.4	21.1
Level of Service	C	B	B	D	C	B	D	C		C	C	C
Approach Delay (s)		20.7			24.1			27.6			26.0	
Approach LOS		C			C			C			C	

Intersection Summary		
HCM 2000 Control Delay	22.6	HCM 2000 Level of Service C
HCM 2000 Volume to Capacity ratio	0.55	
Actuated Cycle Length (s)	74.0	Sum of lost time (s) 15.3
Intersection Capacity Utilization	59.5%	ICU Level of Service B
Analysis Period (min)	15	

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 28: Isabel Ave/Campus Hill Dr & Portola Ave

BART to Livermore Extension Project
 2040 Express Bus + Garage PM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	3	712	473	385	138	124	174	394	161	129	228	1
Future Volume (vph)	3	712	473	385	138	124	174	394	161	129	228	1
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	5.8	5.8
Lane Util. Factor	1.00	0.95	0.88	0.94	0.95		0.97	0.95	1.00	1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	0.93		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3539	2787	4990	3288		3433	3539	1583	1770	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	3539	2787	4990	3288		3433	3539	1583	1770	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	3	774	514	418	150	135	189	428	175	140	248	1
RTOR Reduction (vph)	0	0	323	0	73	0	0	0	139	0	0	1
Lane Group Flow (vph)	3	774	191	418	212	0	189	428	36	140	248	0
Turn Type	Prot	NA	Perm	Prot	NA		Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4						2			6
Actuated Green, G (s)	1.5	31.0	31.0	9.2	38.7		9.2	16.8	16.8	11.4	19.4	19.4
Effective Green, g (s)	1.5	32.3	32.3	9.2	40.0		9.2	18.1	18.1	11.4	18.5	18.5
Actuated g/C Ratio	0.02	0.37	0.37	0.11	0.46		0.11	0.21	0.21	0.13	0.21	0.21
Clearance Time (s)	4.0	5.3	5.3	4.0	5.3		4.0	5.3	5.3	4.0	4.9	4.9
Vehicle Extension (s)	2.0	3.0	3.0	2.0	3.0		2.0	3.0	3.0	2.0	3.0	3.0
Lane Grp Cap (vph)	30	1313	1034	527	1511		363	736	329	231	752	336
v/s Ratio Prot	0.00	c0.22		c0.08	0.06		0.06	c0.12		c0.08	0.07	
v/s Ratio Perm			0.07						0.02			0.00
v/c Ratio	0.10	0.59	0.18	0.79	0.14		0.52	0.58	0.11	0.61	0.33	0.00
Uniform Delay, d1	42.1	22.0	18.5	38.0	13.6		36.8	31.0	27.9	35.7	29.0	27.0
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.5	0.7	0.1	7.5	0.0		0.6	1.2	0.1	3.1	0.3	0.0
Delay (s)	42.6	22.7	18.5	45.5	13.6		37.4	32.2	28.1	38.7	29.3	27.0
Level of Service	D	C	B	D	B		D	C	C	D	C	C
Approach Delay (s)		21.1			32.6			32.5			32.7	
Approach LOS		C			C			C			C	
Intersection Summary												
HCM 2000 Control Delay			27.9	HCM 2000 Level of Service				C				
HCM 2000 Volume to Capacity ratio			0.63									
Actuated Cycle Length (s)			87.0	Sum of lost time (s)				17.8				
Intersection Capacity Utilization			59.5%	ICU Level of Service				B				
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis
29: Isabel Ave & I-580 WB Ramps

BART to Livermore Extension Project
2040 Express Bus + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↔↔		↔		↑↑↑	↔		↑↑↑	↔
Traffic Volume (vph)	0	0	0	681	0	433	0	434	0	0	675	504
Future Volume (vph)	0	0	0	681	0	433	0	434	0	0	675	504
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0		4.0		4.8			4.8	4.8
Lane Util. Factor				0.97		1.00		0.91			0.91	1.00
Frt				1.00		0.85		1.00			1.00	0.85
Flt Protected				0.95		1.00		1.00			1.00	1.00
Satd. Flow (prot)				3433		1583		5085			5085	1583
Flt Permitted				0.95		1.00		1.00			1.00	1.00
Satd. Flow (perm)				3433		1583		5085			5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	740	0	471	0	472	0	0	734	548
RTOR Reduction (vph)	0	0	0	0	0	215	0	0	0	0	0	224
Lane Group Flow (vph)	0	0	0	740	0	256	0	472	0	0	734	324
Turn Type				Prot		Prot		NA	Free		NA	Prot
Protected Phases				8		8		2			6	6
Permitted Phases									Free			
Actuated Green, G (s)				19.8		19.8		42.2			42.2	42.2
Effective Green, g (s)				19.8		19.8		41.4			41.4	41.4
Actuated g/C Ratio				0.28		0.28		0.59			0.59	0.59
Clearance Time (s)				4.0		4.0		4.0			4.0	4.0
Vehicle Extension (s)				2.0		2.0		4.0			4.0	4.0
Lane Grp Cap (vph)				971		447		3007			3007	936
v/s Ratio Prot				c0.22		0.16		0.09			0.14	c0.20
v/s Ratio Perm												
v/c Ratio				0.76		0.57		0.16			0.24	0.35
Uniform Delay, d1				22.9		21.5		6.4			6.8	7.3
Progression Factor				1.00		1.00		0.90			1.00	1.00
Incremental Delay, d2				3.2		1.1		0.1			0.2	1.0
Delay (s)				26.2		22.6		5.9			7.0	8.4
Level of Service				C		C		A			A	A
Approach Delay (s)		0.0			24.8			5.9			7.6	
Approach LOS		A			C			A			A	



















Intersection Summary

HCM 2000 Control Delay	14.3	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.48		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	8.8
Intersection Capacity Utilization	42.5%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

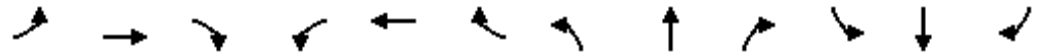
HCM Signalized Intersection Capacity Analysis
 30: Isabel Ave & I-580 EB Ramps

BART to Livermore Extension Project
 2040 Express Bus + Garage PM

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations													
Traffic Volume (vph)	192	0	391	0	0	0	0	711	705	0	917	660	
Future Volume (vph)	192	0	391	0	0	0	0	711	705	0	917	660	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)	4.0		4.0					4.0	4.0		4.0	4.0	
Lane Util. Factor	0.97		0.88					0.91	1.00		0.91	1.00	
Frt	1.00		0.85					1.00	0.85		1.00	0.85	
Flt Protected	0.95		1.00					1.00	1.00		1.00	1.00	
Satd. Flow (prot)	3433		2787					5085	1583		5085	1583	
Flt Permitted	0.95		1.00					1.00	1.00		1.00	1.00	
Satd. Flow (perm)	3433		2787					5085	1583		5085	1583	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	
Adj. Flow (vph)	209	0	425	0	0	0	0	773	766	0	997	717	
RTOR Reduction (vph)	0	0	162	0	0	0	0	0	0	0	0	0	
Lane Group Flow (vph)	209	0	263	0	0	0	0	773	766	0	997	717	
Turn Type	Prot		Perm					NA	Free		NA	Free	
Protected Phases	4							2			6		
Permitted Phases			4						Free			Free	
Actuated Green, G (s)	10.8		10.8					50.2	70.0		50.2	70.0	
Effective Green, g (s)	10.8		10.8					51.2	70.0		51.2	70.0	
Actuated g/C Ratio	0.15		0.15					0.73	1.00		0.73	1.00	
Clearance Time (s)	4.0		4.0					5.0			5.0		
Vehicle Extension (s)	2.0		2.0					4.0			4.0		
Lane Grp Cap (vph)	529		429					3719	1583		3719	1583	
v/s Ratio Prot	0.06							0.15			0.20		
v/s Ratio Perm			0.09						c0.48			0.45	
v/c Ratio	0.40		0.61					0.21	0.48		0.27	0.45	
Uniform Delay, d1	26.7		27.7					3.0	0.0		3.1	0.0	
Progression Factor	1.00		1.00					1.00	1.00		0.60	1.00	
Incremental Delay, d2	0.2		1.8					0.1	1.1		0.2	0.9	
Delay (s)	26.8		29.5					3.1	1.1		2.0	0.9	
Level of Service	C		C					A	A		A	A	
Approach Delay (s)		28.6			0.0			2.1			1.6		
Approach LOS		C			A			A			A		
Intersection Summary													
HCM 2000 Control Delay			6.2									HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio			0.55										
Actuated Cycle Length (s)			70.0									Sum of lost time (s)	8.0
Intersection Capacity Utilization			38.1%									ICU Level of Service	A
Analysis Period (min)			15										
c Critical Lane Group													

HCM Signalized Intersection Capacity Analysis
 31: Isabel Ave & Airway Blvd

BART to Livermore Extension Project
 2040 Express Bus + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↙	↑	↗	↙	↑	↗	↙	↑↑↑	↗	↙↗	↑↑↑	↗
Traffic Volume (vph)	0	169	363	149	140	57	426	1227	74	377	1292	10
Future Volume (vph)	0	169	363	149	140	57	426	1227	74	377	1292	10
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.2	5.6	5.2	5.2	5.6	4.0	4.0	4.0	4.0	4.0	5.0
Lane Util. Factor		1.00	1.00	1.00	1.00	1.00	1.00	0.91	1.00	0.97	0.91	1.00
Frt		1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1863	1583	1770	1863	1583	1770	5085	1583	3433	5085	1583
Flt Permitted		1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)		1863	1583	1770	1863	1583	1770	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	184	395	162	152	62	463	1334	80	410	1404	11
RTOR Reduction (vph)	0	0	66	0	0	35	0	0	48	0	0	8
Lane Group Flow (vph)	0	184	329	162	152	27	463	1334	32	410	1404	4
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4	5	3	8	1	5	2		1	NA	6
Permitted Phases			4			8			2			6
Actuated Green, G (s)		14.3	35.4	8.4	27.3	41.3	21.1	36.5	36.5	14.0	29.4	29.4
Effective Green, g (s)		13.7	34.2	7.8	26.7	40.1	22.1	37.5	37.5	15.0	30.4	29.4
Actuated g/C Ratio		0.15	0.37	0.08	0.29	0.43	0.24	0.41	0.41	0.16	0.33	0.32
Clearance Time (s)		4.6	5.0	4.6	4.6	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Extension (s)		3.0	3.0	3.0	3.0	3.0	3.0	5.0	5.0	3.0	5.0	5.0
Lane Grp Cap (vph)		276	585	149	538	686	423	2063	642	557	1672	503
v/s Ratio Prot		c0.10	0.12	c0.09	0.08	0.01	c0.26	0.26		0.12	c0.28	
v/s Ratio Perm			0.08			0.01			0.02			0.00
v/c Ratio		0.67	0.56	1.09	0.28	0.04	1.09	0.65	0.05	0.74	0.84	0.01
Uniform Delay, d1		37.2	23.1	42.3	25.4	15.1	35.2	22.1	16.7	36.8	28.7	21.5
Progression Factor		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2		6.0	1.2	99.0	0.3	0.0	71.8	1.0	0.1	5.0	4.3	0.0
Delay (s)		43.2	24.4	141.3	25.7	15.1	106.9	23.1	16.7	41.8	33.1	21.5
Level of Service		D	C	F	C	B	F	C	B	D	C	C
Approach Delay (s)		30.4			73.8			43.5			35.0	
Approach LOS		C			E			D			C	

Intersection Summary		
HCM 2000 Control Delay	41.0	HCM 2000 Level of Service D
HCM 2000 Volume to Capacity ratio	0.93	
Actuated Cycle Length (s)	92.4	Sum of lost time (s) 20.0
Intersection Capacity Utilization	81.0%	ICU Level of Service D
Analysis Period (min)	15	

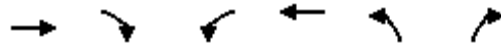
c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

32: Isabel Ave & Jack London Blvd

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	118	907	329	281	180	297	144	1430	615	485	1289	56
Future Volume (vph)	118	907	329	281	180	297	144	1430	615	485	1289	56
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.97	0.91	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	3433	5085	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	3433	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	128	986	358	305	196	323	157	1554	668	527	1401	61
RTOR Reduction (vph)	0	0	145	0	0	30	0	0	202	0	0	39
Lane Group Flow (vph)	128	986	213	305	196	293	157	1554	466	527	1401	22
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8	1	5	2		1	NA	6
Permitted Phases			4			8			2			6
Actuated Green, G (s)	9.3	36.1	36.1	22.7	49.5	69.8	10.6	39.7	39.7	20.3	49.4	49.4
Effective Green, g (s)	9.3	36.1	36.1	22.7	49.5	69.8	10.6	39.7	39.7	20.3	49.4	49.4
Actuated g/C Ratio	0.07	0.26	0.26	0.16	0.35	0.50	0.08	0.28	0.28	0.15	0.35	0.35
Clearance Time (s)	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	228	912	408	286	1251	849	259	1441	448	497	1794	558
v/s Ratio Prot	0.04	c0.28		c0.17	0.06	0.05	0.05	c0.31		c0.15	0.28	
v/s Ratio Perm			0.13			0.14			0.29			0.01
v/c Ratio	0.56	1.08	0.52	1.07	0.16	0.35	0.61	1.08	1.04	1.06	0.78	0.04
Uniform Delay, d1	63.4	51.9	44.5	58.6	31.0	21.3	62.7	50.1	50.1	59.9	40.5	29.7
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	3.1	54.2	1.2	71.9	0.1	0.2	4.0	47.9	53.3	57.3	2.3	0.0
Delay (s)	66.5	106.2	45.7	130.6	31.0	21.5	66.7	98.1	103.5	117.2	42.7	29.7
Level of Service	E	F	D	F	C	C	E	F	F	F	D	C
Approach Delay (s)		88.0			64.1			97.5			62.1	
Approach LOS		F			E			F			E	
Intersection Summary												
HCM 2000 Control Delay			80.7			HCM 2000 Level of Service			F			
HCM 2000 Volume to Capacity ratio			1.07									
Actuated Cycle Length (s)			140.0			Sum of lost time (s)			21.2			
Intersection Capacity Utilization			99.8%			ICU Level of Service			F			
Analysis Period (min)			15									
c	Critical Lane Group											

HCM Signalized Intersection Capacity Analysis
 33: Isabel Ave Connector & Stanley Blvd



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑	↑	↑↓	↑↑	↑↓	↑↓
Traffic Volume (vph)	2141	817	825	557	148	906
Future Volume (vph)	2141	817	825	557	148	906
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	2.3	2.3	4.0	2.3	2.5	2.5
Lane Util. Factor	0.95	1.00	0.97	0.95	0.97	0.88
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	3539	1583	3433	3539	3433	2787
Flt Permitted	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (perm)	3539	1583	3433	3539	3433	2787
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	2327	888	897	605	161	985
RTOR Reduction (vph)	0	0	0	0	0	2
Lane Group Flow (vph)	2327	888	897	605	161	983
Turn Type	NA	pm+ov	Prot	NA	Prot	pm+ov
Protected Phases	2	8	1	6	8	1
Permitted Phases		2				8
Actuated Green, G (s)	58.1	69.3	20.0	82.1	11.2	31.2
Effective Green, g (s)	59.8	72.7	20.0	83.8	12.7	34.2
Actuated g/C Ratio	0.59	0.72	0.20	0.83	0.13	0.34
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Grp Cap (vph)	2089	1172	677	2927	430	1009
v/s Ratio Prot	c0.66	0.10	c0.26	0.17	0.05	c0.21
v/s Ratio Perm		0.46				0.15
v/c Ratio	1.11	0.76	1.32	0.21	0.37	0.97
Uniform Delay, d1	20.8	8.8	40.6	1.8	40.7	33.1
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	58.6	2.5	156.4	0.0	0.2	22.0
Delay (s)	79.4	11.4	197.0	1.8	40.9	55.1
Level of Service	E	B	F	A	D	E
Approach Delay (s)	60.6			118.4	53.1	
Approach LOS	E			F	D	

Intersection Summary			
HCM 2000 Control Delay	73.9	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.14		
Actuated Cycle Length (s)	101.3	Sum of lost time (s)	8.8
Intersection Capacity Utilization	99.4%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
34: Murrieta Blvd/Driveway & Portola Ave

BART to Livermore Extension Project
2040 Express Bus + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗		↖	↗		↖	↗	↗		↗	
Traffic Volume (vph)	0	1179	166	245	662	1	178	5	404	4	7	0
Future Volume (vph)	0	1179	166	245	662	1	178	5	404	4	7	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.8		4.0	5.8		5.2	5.2	5.2		4.0	
Lane Util. Factor		0.95		1.00	0.95		0.95	0.95	1.00		1.00	
Frt		0.98		1.00	1.00		1.00	1.00	0.85		1.00	
Flt Protected		1.00		0.95	1.00		0.95	0.95	1.00		0.98	
Satd. Flow (prot)		3474		1770	3538		1681	1689	1583		1832	
Flt Permitted		1.00		0.95	1.00		0.95	0.95	1.00		0.98	
Satd. Flow (perm)		3474		1770	3538		1681	1689	1583		1832	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	1282	180	266	720	1	193	5	439	4	8	0
RTOR Reduction (vph)	0	9	0	0	0	0	0	0	235	0	0	0
Lane Group Flow (vph)	0	1453	0	266	721	0	100	98	204	0	12	0
Turn Type	Prot	NA		Prot	NA		Split	NA	Perm		Split	NA
Protected Phases	5	2		1	6		8	8			4	4
Permitted Phases									8			
Actuated Green, G (s)		45.6		16.3	65.9		15.7	15.7	15.7		0.7	
Effective Green, g (s)		44.7		16.3	65.0		15.1	15.1	15.1		0.7	
Actuated g/C Ratio		0.47		0.17	0.68		0.16	0.16	0.16		0.01	
Clearance Time (s)		4.9		4.0	4.9		4.6	4.6	4.6		4.0	
Vehicle Extension (s)		2.0		2.0	2.0		2.0	2.0	2.0		2.0	
Lane Grp Cap (vph)		1620		301	2400		264	266	249		13	
v/s Ratio Prot		c0.42		c0.15	0.20		0.06	0.06			c0.01	
v/s Ratio Perm									c0.13			
v/c Ratio		0.90		0.88	0.30		0.38	0.37	0.82		0.92	
Uniform Delay, d1		23.4		38.8	6.2		36.1	36.1	39.0		47.5	
Progression Factor		1.00		1.00	1.00		1.00	1.00	1.00		1.00	
Incremental Delay, d2		6.8		24.3	0.0		0.3	0.3	17.7		205.3	
Delay (s)		30.2		63.1	6.2		36.5	36.4	56.7		252.8	
Level of Service		C		E	A		D	D	E		F	
Approach Delay (s)		30.2			21.6			50.4			252.8	
Approach LOS		C			C			D			F	

Intersection Summary

HCM 2000 Control Delay	32.5	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.88		
Actuated Cycle Length (s)	95.8	Sum of lost time (s)	19.0
Intersection Capacity Utilization	78.7%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
35: Murrieta Blvd & Jack London Blvd

BART to Livermore Extension Project
2040 Express Bus + Garage PM



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	348	1145	505	275	354	150
Future Volume (vph)	348	1145	505	275	354	150
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00	1.00	0.95	0.91	
Frt	1.00	0.85	1.00	1.00	0.96	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1770	1583	1770	3539	4858	
Flt Permitted	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	1770	1583	1770	3539	4858	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	378	1245	549	299	385	163
RTOR Reduction (vph)	0	405	0	0	64	0
Lane Group Flow (vph)	378	840	549	299	484	0
Turn Type	Prot	Perm	Prot	NA	NA	
Protected Phases	4		5	2	6	
Permitted Phases		4				
Actuated Green, G (s)	56.0	56.0	36.0	55.4	15.4	
Effective Green, g (s)	56.0	56.0	36.0	55.4	15.4	
Actuated g/C Ratio	0.47	0.47	0.30	0.46	0.13	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	830	742	533	1642	626	
v/s Ratio Prot	0.21		c0.31	0.08	c0.10	
v/s Ratio Perm		c0.53				
v/c Ratio	0.46	1.13	1.03	0.18	0.77	
Uniform Delay, d1	21.4	31.7	41.7	18.7	50.3	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.4	75.9	46.9	0.1	5.9	
Delay (s)	21.8	107.6	88.6	18.8	56.2	
Level of Service	C	F	F	B	E	
Approach Delay (s)	87.7			64.0	56.2	
Approach LOS	F			E	E	

Intersection Summary

HCM 2000 Control Delay	75.3	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.05		
Actuated Cycle Length (s)	119.4	Sum of lost time (s)	12.0
Intersection Capacity Utilization	87.8%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

36: Murrieta Blvd & Stanley Blvd

BART to Livermore Extension Project
2040 Express Bus + Garage PM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	317	1492	806	80	1049	216	292	337	19	234	362	202
Future Volume (vph)	317	1492	806	80	1049	216	292	337	19	234	362	202
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	5.8	5.8	4.0	5.8	4.9	4.9	5.8		4.9	5.8	4.9
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.97	0.95		1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	3433	3510		1770	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	3433	3510		1770	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	345	1622	876	87	1140	235	317	366	21	254	393	220
RTOR Reduction (vph)	0	0	209	0	0	55	0	4	0	0	0	120
Lane Group Flow (vph)	345	1622	667	87	1140	180	317	383	0	254	393	100
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Prot	NA		Prot	NA	Perm
Protected Phases	1	6		5	2	3	7	4		3	8	
Permitted Phases			6			2						8
Actuated Green, G (s)	12.0	53.3	53.3	4.0	45.3	60.3	13.5	17.4		15.0	18.9	18.9
Effective Green, g (s)	12.0	52.4	52.4	4.0	44.4	58.5	12.6	16.5		14.1	18.0	18.9
Actuated g/C Ratio	0.11	0.49	0.49	0.04	0.41	0.54	0.12	0.15		0.13	0.17	0.18
Clearance Time (s)	4.0	4.9	4.9	4.0	4.9	4.0	4.0	4.9		4.0	4.9	4.9
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	383	1725	771	65	1461	861	402	538		232	592	278
v/s Ratio Prot	c0.10	c0.46		c0.05	0.32	0.03	0.09	0.11		c0.14	c0.11	
v/s Ratio Perm			0.42			0.09						0.06
v/c Ratio	0.90	0.94	0.87	1.34	0.78	0.21	0.79	0.71		1.09	0.66	0.36
Uniform Delay, d1	47.2	26.1	24.4	51.8	27.3	12.6	46.2	43.2		46.7	41.9	39.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	23.5	10.6	10.0	226.1	2.8	0.1	9.9	4.4		86.7	2.8	0.8
Delay (s)	70.6	36.7	34.4	277.8	30.1	12.7	56.0	47.7		133.4	44.7	39.8
Level of Service	E	D	C	F	C	B	E	D		F	D	D
Approach Delay (s)		40.1			42.0			51.4			69.5	
Approach LOS		D			D			D			E	
Intersection Summary												
HCM 2000 Control Delay			46.3			HCM 2000 Level of Service				D		
HCM 2000 Volume to Capacity ratio			0.95									
Actuated Cycle Length (s)			107.5	Sum of lost time (s)				20.5				
Intersection Capacity Utilization			85.6%	ICU Level of Service				E				
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

37: Livermore Ave & I-580 WB Ramps

BART to Livermore Extension Project

2040 Express Bus + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	718	23	32	580	451	0	0	113	0
Future Volume (vph)	0	0	0	718	23	32	580	451	0	0	113	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)					4.0		4.0	4.0			4.0	
Lane Util. Factor					0.95		0.97	1.00			0.95	
Frt					0.99		1.00	1.00			1.00	
Flt Protected					0.96		0.95	1.00			1.00	
Satd. Flow (prot)					1681		3433	1863			3539	
Flt Permitted					0.96		0.95	1.00			1.00	
Satd. Flow (perm)					1681		3433	1863			3539	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	780	25	35	630	490	0	0	123	0
RTOR Reduction (vph)	0	0	0	0	1	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	0	839	0	630	490	0	0	123	0
Turn Type				Split	NA		Prot	NA			NA	
Protected Phases				8	8		5	2			6	
Permitted Phases												
Actuated Green, G (s)					78.4		29.3	51.9			19.1	
Effective Green, g (s)					78.4		28.8	53.6			20.8	
Actuated g/C Ratio					0.56		0.21	0.38			0.15	
Clearance Time (s)					4.0		3.5	5.7			5.7	
Vehicle Extension (s)					2.0		2.0	2.5			2.5	
Lane Grp Cap (vph)					941		706	713			525	
v/s Ratio Prot					c0.50		c0.18	c0.26			0.03	
v/s Ratio Perm												
v/c Ratio					0.89		0.89	0.69			0.23	
Uniform Delay, d1					27.1		54.1	36.2			52.6	
Progression Factor					1.00		0.58	0.53			1.00	
Incremental Delay, d2					10.4		1.5	0.5			1.0	
Delay (s)					37.4		32.8	19.8			53.6	
Level of Service					D		C	B			D	
Approach Delay (s)		0.0			37.4			27.1			53.6	
Approach LOS		A			D			C			D	

Intersection Summary

HCM 2000 Control Delay	32.8	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.87		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	111.0%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 38: Livermore Ave & I-580 EB Ramps

BART to Livermore Extension Project
 2040 Express Bus + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔	↗					↕		↘	↕	
Traffic Volume (vph)	237	10	1355	0	0	0	0	811	208	111	717	0
Future Volume (vph)	237	10	1355	0	0	0	0	811	208	111	717	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0					3.0		5.0	3.0	
Lane Util. Factor		0.95	0.95					0.95		1.00	0.95	
Frt		0.89	0.85					0.97		1.00	1.00	
Flt Protected		0.99	1.00					1.00		0.95	1.00	
Satd. Flow (prot)		1556	1504					3431		1770	3539	
Flt Permitted		0.99	1.00					1.00		0.95	1.00	
Satd. Flow (perm)		1556	1504					3431		1770	3539	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	258	11	1473	0	0	0	0	882	226	121	779	0
RTOR Reduction (vph)	0	60	60	0	0	0	0	16	0	0	0	0
Lane Group Flow (vph)	0	931	691	0	0	0	0	1092	0	121	779	0
Turn Type	Prot	NA	Perm					NA		Prot	NA	
Protected Phases	7	4						2		1	6	
Permitted Phases			4									
Actuated Green, G (s)		69.4	69.4					47.0		11.6	62.6	
Effective Green, g (s)		69.4	69.4					48.0		10.6	63.6	
Actuated g/C Ratio		0.50	0.50					0.34		0.08	0.45	
Clearance Time (s)		4.0	4.0					4.0		4.0	4.0	
Vehicle Extension (s)		2.0	2.0					2.5		2.0	2.5	
Lane Grp Cap (vph)		771	745					1176		134	1607	
v/s Ratio Prot								c0.32		c0.07	0.22	
v/s Ratio Perm		0.60	0.46									
v/c Ratio		1.21	0.93					0.93		0.90	0.48	
Uniform Delay, d1		35.3	33.0					44.3		64.2	26.7	
Progression Factor		1.00	1.00					1.00		0.80	1.47	
Incremental Delay, d2		105.4	17.3					13.9		35.2	0.7	
Delay (s)		140.7	50.2					58.2		86.6	40.0	
Level of Service		F	D					E		F	D	
Approach Delay (s)		101.7			0.0			58.2			46.3	
Approach LOS		F			A			E			D	
























Intersection Summary

HCM 2000 Control Delay	75.5	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.08		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	111.0%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
39: Livermore Ave & Portola Ave

BART to Livermore Extension Project
2040 Express Bus + Garage PM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	731	652	183	17	312	66	199	649	93	250	1032	480
Future Volume (vph)	731	652	183	17	312	66	199	649	93	250	1032	480
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	2.7	4.0	4.0	2.7	4.0	4.0	4.9		4.0	4.9	4.9
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	1.00	0.95		1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.98		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	1770	3473		1770	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	1770	3473		1770	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	795	709	199	18	339	72	216	705	101	272	1122	522
RTOR Reduction (vph)	0	0	127	0	0	61	0	8	0	0	0	65
Lane Group Flow (vph)	795	709	72	18	339	11	216	798	0	272	1122	457
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA		Prot	NA	pm+ov
Protected Phases	3	8		7	4		1	6		5	2	3
Permitted Phases			8			4						2
Actuated Green, G (s)	30.0	45.4	45.4	4.4	19.8	19.8	16.1	33.8		26.3	44.0	74.0
Effective Green, g (s)	30.0	46.7	45.4	4.4	21.1	19.8	16.1	32.9		26.3	43.1	72.2
Actuated g/C Ratio	0.24	0.37	0.36	0.03	0.17	0.16	0.13	0.26		0.21	0.34	0.57
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	818	1312	570	61	593	248	226	907		369	1211	907
v/s Ratio Prot	c0.23	c0.20		0.01	c0.10		c0.12	0.23		0.15	c0.32	0.12
v/s Ratio Perm			0.05			0.01						0.17
v/c Ratio	0.97	0.54	0.13	0.30	0.57	0.05	0.96	0.88		0.74	0.93	0.50
Uniform Delay, d1	47.5	31.2	27.0	59.2	48.2	45.0	54.5	44.6		46.6	39.9	16.1
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	24.6	0.5	0.1	2.7	1.3	0.1	47.1	9.7		7.5	12.0	0.4
Delay (s)	72.1	31.6	27.1	61.9	49.6	45.1	101.6	54.3		54.1	51.9	16.5
Level of Service	E	C	C	E	D	D	F	D		D	D	B
Approach Delay (s)		50.0			49.3			64.3			42.6	
Approach LOS		D			D			E			D	
Intersection Summary												
HCM 2000 Control Delay			50.0									D
HCM 2000 Volume to Capacity ratio			0.89									
Actuated Cycle Length (s)			125.9							16.5		
Intersection Capacity Utilization			83.1%									E
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis
40: First St/Springtown Blvd & I-580 WB Ramps

BART to Livermore Extension Project
2040 Express Bus + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations			↗↗			↗	↗↗	↑			↖↖	↖
Traffic Volume (vph)	0	0	262	0	0	0	385	1439	0	0	421	181
Future Volume (vph)	0	0	262	0	0	0	385	1439	0	0	421	181
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)			4.5				4.5	4.0			4.5	4.5
Lane Util. Factor			0.88				0.97	1.00			0.95	1.00
Frt			0.85				1.00	1.00			1.00	0.85
Flt Protected			1.00				0.95	1.00			1.00	1.00
Satd. Flow (prot)			2787				3433	1863			3539	1583
Flt Permitted			1.00				0.95	1.00			1.00	1.00
Satd. Flow (perm)			2787				3433	1863			3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	285	0	0	0	418	1564	0	0	458	197
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	9
Lane Group Flow (vph)	0	0	285	0	0	0	418	1564	0	0	458	188
Turn Type			Over			Free	Prot	NA			NA	Perm
Protected Phases			5				5	2			6	
Permitted Phases						Free						6
Actuated Green, G (s)			21.0				21.0	140.0			111.0	111.0
Effective Green, g (s)			20.5				20.5	140.0			110.5	110.5
Actuated g/C Ratio			0.15				0.15	1.00			0.79	0.79
Clearance Time (s)			4.0				4.0	4.0			4.0	4.0
Vehicle Extension (s)			2.0				2.0	0.2			4.0	4.0
Lane Grp Cap (vph)			408				502	1863			2793	1249
v/s Ratio Prot			0.10				0.12	c0.84			0.13	
v/s Ratio Perm												0.12
v/c Ratio			0.70				0.83	0.84			0.16	0.15
Uniform Delay, d1			56.8				58.1	0.0			3.6	3.5
Progression Factor			1.00				0.82	1.00			1.00	1.00
Incremental Delay, d2			4.2				1.1	0.5			0.1	0.3
Delay (s)			61.0				48.9	0.5			3.7	3.8
Level of Service			E				D	A			A	A
Approach Delay (s)		61.0			0.0			10.7			3.7	
Approach LOS		E			A			B			A	

Intersection Summary		
HCM 2000 Control Delay	14.0	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.90	B
Actuated Cycle Length (s)	140.0	Sum of lost time (s)
Intersection Capacity Utilization	79.1%	9.0
Analysis Period (min)	15	ICU Level of Service
		D

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

41: First St & I-580 EB Ramps

BART to Livermore Extension Project
2040 Express Bus + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕	↗↘					↕↕	↗	↘	↕↕	
Traffic Volume (vph)	537	3	681	0	0	0	0	1687	447	97	1163	0
Future Volume (vph)	537	3	681	0	0	0	0	1687	447	97	1163	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0					5.0	5.0	5.0	5.0	
Lane Util. Factor		1.00	0.88					0.95	1.00	1.00	0.95	
Frt		1.00	0.85					1.00	0.85	1.00	1.00	
Flt Protected		0.95	1.00					1.00	1.00	0.95	1.00	
Satd. Flow (prot)		1774	2787					3539	1583	1770	3539	
Flt Permitted		0.95	1.00					1.00	1.00	0.95	1.00	
Satd. Flow (perm)		1774	2787					3539	1583	1770	3539	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	584	3	740	0	0	0	0	1834	486	105	1264	0
RTOR Reduction (vph)	0	0	80	0	0	0	0	0	142	0	0	0
Lane Group Flow (vph)	0	587	660	0	0	0	0	1834	344	105	1264	0
Turn Type	Perm	NA	Perm					NA	Perm	Prot	NA	
Protected Phases		4						2		1	6	
Permitted Phases	4		4						2			
Actuated Green, G (s)		46.5	46.5					72.5	72.5	9.0	85.5	
Effective Green, g (s)		46.0	46.0					72.0	72.0	8.0	85.0	
Actuated g/C Ratio		0.33	0.33					0.51	0.51	0.06	0.61	
Clearance Time (s)		3.5	3.5					4.5	4.5	4.0	4.5	
Vehicle Extension (s)		2.5	2.5					4.0	4.0	2.0	4.0	
Lane Grp Cap (vph)		582	915					1820	814	101	2148	
v/s Ratio Prot								c0.52		c0.06	0.36	
v/s Ratio Perm		0.33	0.24						0.22			
v/c Ratio		1.01	0.72					1.01	0.42	1.04	0.59	
Uniform Delay, d1		47.0	41.4					34.0	21.1	66.0	16.8	
Progression Factor		1.00	1.00					1.00	1.00	0.93	0.95	
Incremental Delay, d2		39.4	2.7					23.0	1.6	100.3	1.2	
Delay (s)		86.4	44.0					57.0	22.7	161.5	17.2	
Level of Service		F	D					E	C	F	B	
Approach Delay (s)		62.8			0.0			49.8			28.3	
Approach LOS		E			A			D			C	

Intersection Summary

HCM 2000 Control Delay	47.4	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	1.01		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	14.0
Intersection Capacity Utilization	93.6%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

42: 1st St & Mines Rd

BART to Livermore Extension Project
2040 Express Bus + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	71	250	78	432	243	304	82	1550	940	376	1147	53
Future Volume (vph)	71	250	78	432	243	304	82	1550	940	376	1147	53
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	0.97	1.00	1.00	1.00	0.91	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	1863	1583	3433	1863	1583	1770	5085	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	1863	1583	3433	1863	1583	1770	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	77	272	85	470	264	330	89	1685	1022	409	1247	58
RTOR Reduction (vph)	0	0	72	0	0	33	0	0	162	0	0	29
Lane Group Flow (vph)	77	272	13	470	264	297	89	1685	860	409	1247	29
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8	1	5	2		1	NA	6
Permitted Phases			4			8			2			6
Actuated Green, G (s)	5.6	16.8	16.8	14.0	25.2	37.2	8.8	52.8	52.8	12.0	56.0	56.0
Effective Green, g (s)	5.6	16.8	16.8	14.0	25.2	37.2	8.8	52.8	52.8	12.0	56.0	56.0
Actuated g/C Ratio	0.05	0.15	0.15	0.13	0.23	0.33	0.08	0.47	0.47	0.11	0.50	0.50
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	88	280	238	430	420	584	139	2405	748	369	2551	794
v/s Ratio Prot	0.04	c0.15		c0.14	0.14	0.05	0.05	0.33		c0.12	c0.25	
v/s Ratio Perm			0.01			0.13			c0.54			0.02
v/c Ratio	0.88	0.97	0.05	1.09	0.63	0.51	0.64	0.70	1.15	1.11	0.49	0.04
Uniform Delay, d1	52.7	47.2	40.6	48.8	39.0	29.9	49.9	23.2	29.4	49.8	18.4	14.1
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	56.5	45.7	0.1	70.9	2.9	0.7	9.7	0.9	82.3	79.4	0.1	0.0
Delay (s)	109.2	92.9	40.7	119.7	41.9	30.6	59.5	24.1	111.7	129.2	18.5	14.1
Level of Service	F	F	D	F	D	C	E	C	F	F	B	B
Approach Delay (s)		85.5			72.8			57.3			44.8	
Approach LOS		F			E			E			D	























Intersection Summary

HCM 2000 Control Delay	58.5	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.09		
Actuated Cycle Length (s)	111.6	Sum of lost time (s)	16.0
Intersection Capacity Utilization	92.1%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group























HCM Unsignalized Intersection Capacity Analysis
43: Vasco Rd & I-580 WB Ramps

BART to Livermore Extension Project
2040 Express Bus + Garage PM

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations								  			  		
Traffic Volume (veh/h)	0	0	0	0	0	156	0	2457	0	0	589	0	
Future Volume (Veh/h)	0	0	0	0	0	156	0	2457	0	0	589	0	
Sign Control		Stop			Stop			Free			Free		
Grade		0%			0%			0%			0%		
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	
Hourly flow rate (vph)	0	0	0	0	0	170	0	2671	0	0	640	0	
Pedestrians													
Lane Width (ft)													
Walking Speed (ft/s)													
Percent Blockage													
Right turn flare (veh)													
Median type							None						
Median storage (veh)													
Upstream signal (ft)												524	
pX, platoon unblocked													
vC, conflicting volume	1700	3311	213	2884	3311	890	640				2671		
vC1, stage 1 conf vol													
vC2, stage 2 conf vol													
vCu, unblocked vol	1700	3311	213	2884	3311	890	640				2671		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1				4.1		
tC, 2 stage (s)													
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2				2.2		
p0 queue free %	100	100	100	100	100	40	100				100		
cM capacity (veh/h)	24	8	792	7	8	286	940				153		
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	NB 4	SB 1	SB 2	SB 3	SB 4			
Volume Total	0	170	890	890	890	0	213	213	213	0			
Volume Left	0	0	0	0	0	0	0	0	0	0			
Volume Right	0	170	0	0	0	0	0	0	0	0			
cSH	1700	286	1700	1700	1700	1700	1700	1700	1700	1700			
Volume to Capacity	0.00	0.60	0.52	0.52	0.52	0.00	0.13	0.13	0.13	0.00			
Queue Length 95th (ft)	0	89	0	0	0	0	0	0	0	0			
Control Delay (s)	0.0	34.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
Lane LOS	A	D											
Approach Delay (s)	0.0	34.5	0.0					0.0					
Approach LOS	A	D											
Intersection Summary													
Average Delay			1.7										
Intersection Capacity Utilization			63.8%	ICU Level of Service					B				
Analysis Period (min)			15										

HCM Unsignalized Intersection Capacity Analysis
44: Vasco Rd & I-580 EB Ramps

BART to Livermore Extension Project
2040 Express Bus + Garage PM

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations								  			  		
Traffic Volume (veh/h)	0	0	0	0	0	0	0	2830	0	64	730	0	
Future Volume (Veh/h)	0	0	0	0	0	0	0	2830	0	64	730	0	
Sign Control		Stop			Stop			Free			Free		
Grade		0%			0%			0%			0%		
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	
Hourly flow rate (vph)	0	0	0	0	0	0	0	3076	0	70	793	0	
Pedestrians													
Lane Width (ft)													
Walking Speed (ft/s)													
Percent Blockage													
Right turn flare (veh)													
Median type							None						
Median storage veh													
Upstream signal (ft)													
pX, platoon unblocked													
vC, conflicting volume	1958	4009	264	3480	4009	1025	793					3076	
vC1, stage 1 conf vol													
vC2, stage 2 conf vol													
vCu, unblocked vol	1958	4009	264	3480	4009	1025	793					3076	
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1					4.1	
tC, 2 stage (s)													
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2					2.2	
p0 queue free %	100	100	100	100	100	100	100					34	
cM capacity (veh/h)	18	1	734	1	1	232	824					105	
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	NB 4	SB 1	SB 2	SB 3	SB 4			
Volume Total	0	0	1025	1025	1025	0	70	264	264	264			
Volume Left	0	0	0	0	0	0	70	0	0	0			
Volume Right	0	0	0	0	0	0	0	0	0	0			
cSH	1700	1700	1700	1700	1700	1700	105	1700	1700	1700			
Volume to Capacity	0.00	0.00	0.60	0.60	0.60	0.00	0.66	0.16	0.16	0.16			
Queue Length 95th (ft)	0	0	0	0	0	0	84	0	0	0			
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	90.0	0.0	0.0	0.0			
Lane LOS	A	A					F						
Approach Delay (s)	0.0	0.0	0.0				7.3						
Approach LOS	A	A											
Intersection Summary													
Average Delay			1.6										
Intersection Capacity Utilization			58.0%	ICU Level of Service									B
Analysis Period (min)			15										

HCM Signalized Intersection Capacity Analysis
45: Vasco Rd & East Ave

BART to Livermore Extension Project
2040 Express Bus + Garage PM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	774	38	121	132	398	286	110	405	12	15	379	463
Future Volume (vph)	774	38	121	132	398	286	110	405	12	15	379	463
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	0.95		0.97	1.00	1.00
Frt	1.00	0.89		1.00	0.94		1.00	1.00		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	3134		1770	3317		1770	3524		3433	1863	1583
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1770	3134		1770	3317		1770	3524		3433	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	841	41	132	143	433	311	120	440	13	16	412	503
RTOR Reduction (vph)	0	71	0	0	109	0	0	1	0	0	0	386
Lane Group Flow (vph)	841	102	0	143	635	0	120	452	0	16	412	117
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												6
Actuated Green, G (s)	51.0	56.8		14.2	20.0		7.0	33.8		1.6	28.4	28.4
Effective Green, g (s)	51.0	56.8		14.2	20.0		7.0	33.8		1.6	28.4	28.4
Actuated g/C Ratio	0.42	0.46		0.12	0.16		0.06	0.28		0.01	0.23	0.23
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	737	1454		205	541		101	973		44	432	367
v/s Ratio Prot	c0.48	0.03		0.08	c0.19		c0.07	0.13		0.00	c0.22	
v/s Ratio Perm												0.07
v/c Ratio	1.14	0.07		0.70	1.17		1.19	0.46		0.36	0.95	0.32
Uniform Delay, d1	35.7	18.2		52.0	51.2		57.7	36.8		59.9	46.4	39.0
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	79.3	0.0		9.9	96.6		148.7	0.4		5.1	31.5	0.5
Delay (s)	115.0	18.2		61.9	147.8		206.4	37.1		64.9	77.8	39.5
Level of Service	F	B		E	F		F	D		E	E	D
Approach Delay (s)		98.5			133.9			72.6			56.9	
Approach LOS		F			F			E			E	
Intersection Summary												
HCM 2000 Control Delay			92.0				HCM 2000 Level of Service			F		
HCM 2000 Volume to Capacity ratio			1.10									
Actuated Cycle Length (s)			122.4			Sum of lost time (s)			16.0			
Intersection Capacity Utilization			102.4%			ICU Level of Service			G			
Analysis Period (min)			15									

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
46: Greenville Rd & I-580 WB Ramps

BART to Livermore Extension Project
2040 Express Bus + Garage PM
























Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↔↔		↗		↕↕	↗		↕↕	
Traffic Volume (vph)	0	0	0	105	0	32	0	1315	573	0	163	25
Future Volume (vph)	0	0	0	105	0	32	0	1315	573	0	163	25
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0		4.0		4.0	4.0		4.0	
Lane Util. Factor				0.97		1.00		0.95	1.00		0.95	
Frt				1.00		0.85		1.00	0.85		0.98	
Flt Protected				0.95		1.00		1.00	1.00		1.00	
Satd. Flow (prot)				3433		1583		3539	1583		3469	
Flt Permitted				0.95		1.00		1.00	1.00		1.00	
Satd. Flow (perm)				3433		1583		3539	1583		3469	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	114	0	35	0	1429	623	0	177	27
RTOR Reduction (vph)	0	0	0	0	0	33	0	0	80	0	3	0
Lane Group Flow (vph)	0	0	0	114	0	3	0	1429	543	0	201	0
Turn Type				Prot		Prot		NA	Perm		NA	
Protected Phases				3		3		2			6	
Permitted Phases									2			
Actuated Green, G (s)				10.0		10.0		122.0	122.0		122.0	
Effective Green, g (s)				10.0		10.0		122.0	122.0		122.0	
Actuated g/C Ratio				0.07		0.07		0.87	0.87		0.87	
Clearance Time (s)				4.0		4.0		4.0	4.0		4.0	
Vehicle Extension (s)				3.0		3.0		3.0	3.0		3.0	
Lane Grp Cap (vph)				245		113		3083	1379		3022	
v/s Ratio Prot				c0.03		0.00		c0.40			0.06	
v/s Ratio Perm									0.34			
v/c Ratio				0.47		0.02		0.46	0.39		0.07	
Uniform Delay, d1				62.4		60.5		1.9	1.8		1.2	
Progression Factor				1.00		1.00		0.69	0.43		1.00	
Incremental Delay, d2				1.4		0.1		0.5	0.8		0.0	
Delay (s)				63.8		60.5		1.8	1.5		1.3	
Level of Service				E		E		A	A		A	
Approach Delay (s)		0.0			63.1			1.7			1.3	
Approach LOS		A			E			A			A	

Intersection Summary			
HCM 2000 Control Delay	5.5	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.46		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	46.4%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
47: Greenville Rd & I-580 EB Ramps

BART to Livermore Extension Project
2040 Express Bus + Garage PM

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations	 							 			 		
Traffic Volume (vph)	145	0	92	0	0	0	0	1375	405	0	201	63	
Future Volume (vph)	145	0	92	0	0	0	0	1375	405	0	201	63	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)	4.0		4.0					4.0	4.0		4.0	4.0	
Lane Util. Factor	0.97		1.00					0.95	1.00		0.95	1.00	
Frt	1.00		0.85					1.00	0.85		1.00	0.85	
Flt Protected	0.95		1.00					1.00	1.00		1.00	1.00	
Satd. Flow (prot)	3433		1583					3539	1583		3539	1583	
Flt Permitted	0.95		1.00					1.00	1.00		1.00	1.00	
Satd. Flow (perm)	3433		1583					3539	1583		3539	1583	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	
Adj. Flow (vph)	158	0	100	0	0	0	0	1495	440	0	218	68	
RTOR Reduction (vph)	0	0	92	0	0	0	0	0	62	0	0	10	
Lane Group Flow (vph)	158	0	8	0	0	0	0	1495	378	0	218	58	
Turn Type	Prot		Prot					NA	Perm		NA	Perm	
Protected Phases	7		7					2			6		
Permitted Phases									2			6	
Actuated Green, G (s)	11.8		11.8					120.2	120.2		120.2	120.2	
Effective Green, g (s)	11.8		11.8					120.2	120.2		120.2	120.2	
Actuated g/C Ratio	0.08		0.08					0.86	0.86		0.86	0.86	
Clearance Time (s)	4.0		4.0					4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0		3.0					3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	289		133					3038	1359		3038	1359	
v/s Ratio Prot	c0.05		0.01					c0.42			0.06		
v/s Ratio Perm									0.24			0.04	
v/c Ratio	0.55		0.06					0.49	0.28		0.07	0.04	
Uniform Delay, d1	61.5		59.0					2.4	1.8		1.5	1.5	
Progression Factor	1.00		1.00					0.75	0.50		0.60	0.09	
Incremental Delay, d2	2.1		0.2					0.5	0.4		0.0	0.1	
Delay (s)	63.6		59.2					2.3	1.4		0.9	0.2	
Level of Service	E		E					A	A		A	A	
Approach Delay (s)		61.9			0.0			2.1			0.8		
Approach LOS		E			A			A			A		
Intersection Summary													
HCM 2000 Control Delay			8.2									HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio			0.50										
Actuated Cycle Length (s)			140.0									Sum of lost time (s)	8.0
Intersection Capacity Utilization			48.8%									ICU Level of Service	A
Analysis Period (min)			15										

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 48: Greenville Rd & Northfront Road/Altamont Pass Road

BART to Livermore Extension Project
 2040 Express Bus + Garage PM



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↑	↑	↑	↑	↑
Traffic Volume (vph)	555	177	2	73	267	1163
Future Volume (vph)	555	177	2	73	267	1163
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	1863	1583	1770	1863	1770	1583
Flt Permitted	1.00	1.00	0.11	1.00	0.95	1.00
Satd. Flow (perm)	1863	1583	213	1863	1770	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	603	192	2	79	290	1264
RTOR Reduction (vph)	0	86	0	0	0	25
Lane Group Flow (vph)	603	106	2	79	290	1239
Turn Type	NA	Perm	Perm	NA	Prot	Perm
Protected Phases	4			8	2	
Permitted Phases		4	8			2
Actuated Green, G (s)	35.0	35.0	35.0	35.0	77.0	77.0
Effective Green, g (s)	35.0	35.0	35.0	35.0	77.0	77.0
Actuated g/C Ratio	0.29	0.29	0.29	0.29	0.64	0.64
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	543	461	62	543	1135	1015
v/s Ratio Prot	c0.32			0.04	0.16	
v/s Ratio Perm		0.07	0.01			c0.78
v/c Ratio	1.11	0.23	0.03	0.15	0.26	1.22
Uniform Delay, d1	42.5	32.3	30.4	31.4	9.2	21.5
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	72.6	0.3	0.2	0.1	0.1	108.4
Delay (s)	115.1	32.5	30.6	31.6	9.3	129.9
Level of Service	F	C	C	C	A	F
Approach Delay (s)	95.1			31.5	107.4	
Approach LOS	F			C	F	

Intersection Summary

HCM 2000 Control Delay	100.9	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.19		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	107.9%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
49: Greenville Rd & Southfront Rd

BART to Livermore Extension Project
2040 Express Bus + Garage PM



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	407	106	233	1282	152	141
Future Volume (vph)	407	106	233	1282	152	141
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.2	5.2	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.88	0.97	0.95	0.95	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	3433	2787	3433	3539	3539	1583
Flt Permitted	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (perm)	3433	2787	3433	3539	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	442	115	253	1393	165	153
RTOR Reduction (vph)	0	91	0	0	0	84
Lane Group Flow (vph)	442	24	253	1393	165	69
Turn Type	Prot	Perm	Prot	NA	NA	Perm
Protected Phases	8		1	6	2	
Permitted Phases		8				2
Actuated Green, G (s)	15.3	15.3	10.4	44.4	30.0	30.0
Effective Green, g (s)	14.7	14.7	10.4	46.1	31.7	31.7
Actuated g/C Ratio	0.21	0.21	0.15	0.66	0.45	0.45
Clearance Time (s)	4.6	4.6	4.0	5.7	5.7	5.7
Vehicle Extension (s)	5.0	5.0	6.0	2.5	2.5	2.5
Lane Grp Cap (vph)	720	585	510	2330	1602	716
v/s Ratio Prot	c0.13		0.07	c0.39	0.05	
v/s Ratio Perm		0.01				0.04
v/c Ratio	0.61	0.04	0.50	0.60	0.10	0.10
Uniform Delay, d1	25.1	22.0	27.4	6.7	11.0	11.0
Progression Factor	1.00	1.00	1.00	1.00	0.70	0.57
Incremental Delay, d2	2.2	0.1	2.1	1.1	0.1	0.3
Delay (s)	27.3	22.1	29.5	7.9	7.8	6.5
Level of Service	C	C	C	A	A	A
Approach Delay (s)	26.2			11.2	7.2	
Approach LOS	C			B	A	

Intersection Summary

HCM 2000 Control Delay	14.0	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.64		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	13.2
Intersection Capacity Utilization	54.7%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
50: Greenville Rd & Patterson Pass Rd

BART to Livermore Extension Project
2040 Express Bus + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	43	556	67	6	12	8	65	480	336	412	216	39
Future Volume (vph)	43	556	67	6	12	8	65	480	336	412	216	39
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.98		1.00	0.94		1.00	0.94		1.00	0.98	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1833		1770	1748		1770	1748		1770	1820	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	1833		1770	1748		1770	1748		1770	1820	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	47	604	73	7	13	9	71	522	365	448	235	42
RTOR Reduction (vph)	0	4	0	0	7	0	0	27	0	0	6	0
Lane Group Flow (vph)	47	673	0	7	15	0	71	860	0	448	271	0
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												
Actuated Green, G (s)	7.0	23.0		0.7	16.7		6.8	33.9		14.0	41.1	
Effective Green, g (s)	7.0	23.0		0.7	16.7		6.8	33.9		14.0	41.1	
Actuated g/C Ratio	0.08	0.26		0.01	0.19		0.08	0.39		0.16	0.47	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	141	481		14	333		137	676		282	853	
v/s Ratio Prot	c0.03	c0.37		0.00	0.01		0.04	c0.49		c0.25	0.15	
v/s Ratio Perm												
v/c Ratio	0.33	1.40		0.50	0.04		0.52	1.27		1.59	0.32	
Uniform Delay, d1	38.1	32.3		43.3	28.9		38.8	26.8		36.8	14.5	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	1.4	191.5		25.4	0.1		3.3	133.9		281.1	1.0	
Delay (s)	39.5	223.8		68.7	29.0		42.1	160.7		317.9	15.5	
Level of Service	D	F		E	C		D	F		F	B	
Approach Delay (s)		211.9			38.6			151.9			202.4	
Approach LOS		F			D			F			F	

Intersection Summary

HCM 2000 Control Delay	183.4	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.37		
Actuated Cycle Length (s)	87.6	Sum of lost time (s)	16.0
Intersection Capacity Utilization	111.9%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
1: Dougherty Rd & Amador Valley Rd

BART to Livermore Extension Project
2040 Enhanced Bus + Garage AM



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	100	788	465	826	2171	132
Future Volume (vph)	100	788	465	826	2171	132
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00	0.97	0.91	0.91	
Frt	1.00	0.85	1.00	1.00	0.99	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1770	1583	3433	5085	5042	
Flt Permitted	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	1770	1583	3433	5085	5042	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	109	857	505	898	2360	143
RTOR Reduction (vph)	0	161	0	0	6	0
Lane Group Flow (vph)	109	696	505	898	2497	0
Turn Type	Perm	Perm	Prot	NA	NA	
Protected Phases			5	2	6	
Permitted Phases	4	4				
Actuated Green, G (s)	41.0	41.0	15.0	71.0	52.0	
Effective Green, g (s)	41.0	41.0	15.0	71.0	52.0	
Actuated g/C Ratio	0.34	0.34	0.12	0.59	0.43	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	604	540	429	3008	2184	
v/s Ratio Prot			c0.15	0.18	c0.50	
v/s Ratio Perm	0.06	c0.44				
v/c Ratio	0.18	1.29	1.18	0.30	1.14	
Uniform Delay, d1	27.7	39.5	52.5	12.2	34.0	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.1	143.2	101.6	0.1	70.6	
Delay (s)	27.9	182.7	154.1	12.2	104.6	
Level of Service	C	F	F	B	F	
Approach Delay (s)	165.3			63.3	104.6	
Approach LOS	F			E	F	

Intersection Summary

HCM 2000 Control Delay	104.7	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.20		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	100.3%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

2: Hopyard Road/Dougherty Rd & Dublin Blvd

BART to Livermore Extension Project
2040 Enhanced Bus + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔↔	↑↑↑	↔↔	↔↔↔	↑↑↑	↔	↔↔↔	↑↑↑	↔↔	↔↔	↑↑↑	↔↔
Traffic Volume (vph)	54	509	531	344	916	484	750	1065	133	945	2199	111
Future Volume (vph)	54	509	531	344	916	484	750	1065	133	945	2199	111
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	6.0	5.0	5.0	5.5	5.0	5.0	5.5	5.0	5.0	5.5	
Lane Util. Factor	0.97	0.91	0.88	0.94	0.91	1.00	0.94	0.91	0.88	0.97	0.86	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	3433	5085	2787	4990	5085	1583	4990	5085	2787	3433	6362	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	3433	5085	2787	4990	5085	1583	4990	5085	2787	3433	6362	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	59	553	577	374	996	526	815	1158	145	1027	2390	121
RTOR Reduction (vph)	0	0	63	0	0	81	0	0	60	0	5	0
Lane Group Flow (vph)	59	553	514	374	996	445	815	1158	85	1027	2506	0
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	
Protected Phases	5	2	3	1	6	7	3	8	1	7	4	
Permitted Phases			2			6			8			
Actuated Green, G (s)	12.0	32.4	49.4	15.4	36.3	62.0	17.0	45.0	60.4	25.7	53.7	
Effective Green, g (s)	12.0	32.4	49.4	15.4	36.3	62.0	17.0	45.0	60.4	25.7	53.7	
Actuated g/C Ratio	0.09	0.23	0.35	0.11	0.26	0.44	0.12	0.32	0.43	0.18	0.38	
Clearance Time (s)	5.0	6.0	5.0	5.0	5.5	5.0	5.0	5.5	5.0	5.0	5.5	
Vehicle Extension (s)	2.0	4.5	2.0	2.0	4.5	2.0	2.0	4.5	2.0	2.0	4.5	
Lane Grp Cap (vph)	294	1176	983	548	1318	701	605	1634	1202	630	2440	
v/s Ratio Prot	0.02	0.11	c0.06	0.07	c0.20	0.12	c0.16	0.23	0.01	c0.30	c0.39	
v/s Ratio Perm			0.12			0.16			0.02			
v/c Ratio	0.20	0.47	0.52	0.68	0.76	0.63	1.35	0.71	0.07	1.63	1.03	
Uniform Delay, d1	59.5	46.4	36.0	59.9	47.8	30.2	61.5	41.7	23.3	57.1	43.1	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	0.84	0.75	0.82	1.00	1.00	
Incremental Delay, d2	0.1	1.4	0.2	2.8	4.1	1.4	164.9	1.3	0.0	290.8	25.5	
Delay (s)	59.7	47.7	36.2	62.7	51.8	31.6	216.5	32.4	19.2	347.9	68.7	
Level of Service	E	D	D	E	D	C	F	C	B	F	E	
Approach Delay (s)		42.7			48.4			102.4			149.7	
Approach LOS		D			D			F			F	

Intersection Summary

HCM 2000 Control Delay	101.7	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.06		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	21.5
Intersection Capacity Utilization	95.7%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
3: Dougherty Rd/Hopyard Road & I-580 WB Ramps

BART to Livermore Extension Project
2040 Enhanced Bus + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↔↔		↔↔		↑↑↑			↑↑↑	↔
Traffic Volume (vph)	0	0	0	390	0	637	0	1689	0	0	2201	0
Future Volume (vph)	0	0	0	390	0	637	0	1689	0	0	2201	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0		4.0		4.0			4.0	
Lane Util. Factor				0.97		0.88		0.91			0.86	
Frt				1.00		0.85		1.00			1.00	
Flt Protected				0.95		1.00		1.00			1.00	
Satd. Flow (prot)				3433		2787		5085			4806	
Flt Permitted				0.95		1.00		1.00			1.00	
Satd. Flow (perm)				3433		2787		5085			4806	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	424	0	692	0	1836	0	0	2392	0
RTOR Reduction (vph)	0	0	0	0	0	24	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	424	0	668	0	1836	0	0	2392	0
Turn Type				Prot		Prot		NA			NA	Perm
Protected Phases				4		4		2			6	
Permitted Phases												6
Actuated Green, G (s)				39.0		39.0		90.2			90.2	
Effective Green, g (s)				40.4		40.4		91.6			91.6	
Actuated g/C Ratio				0.29		0.29		0.65			0.65	
Clearance Time (s)				5.4		5.4		5.4			5.4	
Vehicle Extension (s)				3.0		3.0		3.0			3.0	
Lane Grp Cap (vph)				990		804		3327			3144	
v/s Ratio Prot				0.12		c0.24		0.36			c0.50	
v/s Ratio Perm												
v/c Ratio				0.43		0.83		0.55			0.76	
Uniform Delay, d1				40.4		46.6		13.1			16.7	
Progression Factor				1.00		1.00		0.97			0.45	
Incremental Delay, d2				0.3		7.3		0.6			0.7	
Delay (s)				40.7		53.9		13.3			8.2	
Level of Service				D		D		B			A	
Approach Delay (s)		0.0			48.9			13.3			8.2	
Approach LOS		A			D			B			A	

Intersection Summary

HCM 2000 Control Delay	18.4	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.78		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	61.6%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 4: Hopyard Rd/Dougherty Rd & I-580 EB Ramps

BART to Livermore Extension Project
 2040 Enhanced Bus + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗		↖↗					↑↑↑	↖		↑↑↑	↖
Traffic Volume (vph)	895	0	1425	0	0	0	0	896	0	0	1795	0
Future Volume (vph)	895	0	1425	0	0	0	0	896	0	0	1795	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0					4.0			4.0	
Lane Util. Factor	0.97		0.88					0.91			0.86	
Frt	1.00		0.85					1.00			1.00	
Flt Protected	0.95		1.00					1.00			1.00	
Satd. Flow (prot)	3433		2787					5085			4806	
Flt Permitted	0.95		1.00					1.00			1.00	
Satd. Flow (perm)	3433		2787					5085			4806	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	973	0	1549	0	0	0	0	974	0	0	1951	0
RTOR Reduction (vph)	0	0	9	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	973	0	1540	0	0	0	0	974	0	0	1951	0
Turn Type	Prot		Prot					NA	Free		NA	Perm
Protected Phases	4		4					2			6	
Permitted Phases									Free			6
Actuated Green, G (s)	72.6		72.6					56.6			56.6	
Effective Green, g (s)	74.0		74.0					58.0			58.0	
Actuated g/C Ratio	0.53		0.53					0.41			0.41	
Clearance Time (s)	5.4		5.4					5.4			5.4	
Vehicle Extension (s)	3.0		3.0					3.0			3.0	
Lane Grp Cap (vph)	1814		1473					2106			1991	
v/s Ratio Prot	0.28		c0.55					0.19			c0.41	
v/s Ratio Perm												
v/c Ratio	0.54		1.05					0.46			0.98	
Uniform Delay, d1	21.7		33.0					29.7			40.4	
Progression Factor	1.00		1.00					1.00			1.07	
Incremental Delay, d2	0.3		36.3					0.7			12.7	
Delay (s)	22.0		69.3					30.4			55.9	
Level of Service	C		E					C			E	
Approach Delay (s)		51.1			0.0			30.4			55.9	
Approach LOS		D			A			C			E	

Intersection Summary

HCM 2000 Control Delay	49.1	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	1.02		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	91.2%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
5: Hopyard Rd & Owens Rd

BART to Livermore Extension Project
2040 Enhanced Bus + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↗	↔↗		↗	↗	↗	↗	↑↑↑	↗	↗↗	↑↑↗	
Traffic Volume (vph)	207	92	50	119	124	222	142	826	158	918	1791	561
Future Volume (vph)	207	92	50	119	124	222	142	826	158	918	1791	561
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	2.7	2.7		2.7	2.7	2.7	4.0	2.3	2.3	4.0	2.3	
Lane Util. Factor	0.91	0.91		1.00	0.95	0.95	1.00	0.91	1.00	0.97	0.91	
Frt	1.00	0.97		1.00	0.95	0.85	1.00	1.00	0.85	1.00	0.96	
Flt Protected	0.95	0.98		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1610	3219		1770	1675	1504	1770	5085	1583	3433	4903	
Flt Permitted	0.95	0.98		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1610	3219		1770	1675	1504	1770	5085	1583	3433	4903	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	225	100	54	129	135	241	154	898	172	998	1947	610
RTOR Reduction (vph)	0	25	0	0	22	55	0	0	121	0	63	0
Lane Group Flow (vph)	124	230	0	129	188	111	154	898	51	998	2494	0
Turn Type	Split	NA		Split	NA	pm+ov	Prot	NA	Perm	Prot	NA	
Protected Phases	8	8		4	4	1	5	2		1	6	
Permitted Phases						4			2			
Actuated Green, G (s)	7.0	7.0		9.0	9.0	42.0	9.0	25.0	25.0	33.0	49.0	
Effective Green, g (s)	8.3	8.3		10.3	10.3	44.6	9.0	26.7	26.7	33.0	50.7	
Actuated g/C Ratio	0.09	0.09		0.11	0.11	0.50	0.10	0.30	0.30	0.37	0.56	
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	148	296		202	191	790	177	1508	469	1258	2762	
v/s Ratio Prot	c0.08	0.07		0.07	c0.11	0.05	c0.09	0.18		0.29	c0.51	
v/s Ratio Perm						0.02			0.03			
v/c Ratio	0.84	0.78		0.64	0.98	0.14	0.87	0.60	0.11	0.79	0.90	
Uniform Delay, d1	40.2	39.9		38.1	39.8	12.3	39.9	27.0	23.0	25.5	17.5	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	31.8	12.0		6.5	60.0	0.1	34.1	1.7	0.5	3.5	5.4	
Delay (s)	72.0	51.9		44.6	99.7	12.4	74.0	28.8	23.5	29.0	22.9	
Level of Service	E	D		D	F	B	E	C	C	C	C	
Approach Delay (s)		58.5			56.9			33.7			24.6	
Approach LOS		E			E			C			C	

Intersection Summary

HCM 2000 Control Delay	31.7	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.90		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	11.7
Intersection Capacity Utilization	86.1%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
6: Hopyard Rd & Stoneridge Dr

BART to Livermore Extension Project
2040 Enhanced Bus + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	205	786	468	71	997	131	632	800	73	297	1026	285
Future Volume (vph)	205	786	468	71	997	131	632	800	73	297	1026	285
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.91	1.00	0.97	0.91	1.00	0.94	0.95	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5085	1583	3433	5085	1583	4990	3539	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5085	1583	3433	5085	1583	4990	3539	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	223	854	509	77	1084	142	687	870	79	323	1115	310
RTOR Reduction (vph)	0	0	200	0	0	101	0	0	56	0	0	126
Lane Group Flow (vph)	223	854	309	77	1084	41	687	870	23	323	1115	184
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8			2			6
Actuated Green, G (s)	4.0	19.2	19.2	2.4	17.6	17.6	8.0	18.0	18.0	6.0	16.0	16.0
Effective Green, g (s)	4.0	19.2	19.2	2.4	17.6	17.6	8.0	18.0	18.0	6.0	16.0	16.0
Actuated g/C Ratio	0.06	0.31	0.31	0.04	0.29	0.29	0.13	0.29	0.29	0.10	0.26	0.26
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	222	1584	493	133	1452	452	648	1034	462	334	1320	411
v/s Ratio Prot	c0.06	0.17		0.02	c0.21		c0.14	c0.25		0.09	0.22	
v/s Ratio Perm			0.19			0.03			0.01			0.12
v/c Ratio	1.00	0.54	0.63	0.58	0.75	0.09	1.06	0.84	0.05	0.97	0.84	0.45
Uniform Delay, d1	28.8	17.5	18.1	29.1	20.0	16.1	26.8	20.5	15.7	27.7	21.6	19.1
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	61.6	0.4	2.5	6.0	2.1	0.1	52.4	6.3	0.0	40.0	5.1	0.8
Delay (s)	90.4	17.9	20.6	35.1	22.1	16.2	79.2	26.8	15.7	67.7	26.8	19.9
Level of Service	F	B	C	D	C	B	E	C	B	E	C	B
Approach Delay (s)		29.0			22.2			48.2			33.1	
Approach LOS		C			C			D			C	

Intersection Summary

HCM 2000 Control Delay	33.7	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.88		
Actuated Cycle Length (s)	61.6	Sum of lost time (s)	16.0
Intersection Capacity Utilization	70.3%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
7: Hopyard Rd & Las Positas Blvd

BART to Livermore Extension Project
2040 Enhanced Bus + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↗↘	↑↑	↗	↗↘	↑↑	↗	↗↘	↑↑↑	↗	↗↘	↑↑↑	↗
Traffic Volume (vph)	152	489	406	354	450	53	454	1175	392	115	1076	95
Future Volume (vph)	152	489	406	354	450	53	454	1175	392	115	1076	95
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.95	1.00	0.97	0.95	1.00	0.97	0.91	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	3433	3539	1583	3433	5085	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	3433	3539	1583	3433	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	165	532	441	385	489	58	493	1277	426	125	1170	103
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	73
Lane Group Flow (vph)	165	532	441	385	489	58	493	1277	426	125	1170	30
Turn Type	Prot	NA	Free	Prot	NA	Free	Prot	NA	Free	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1		6
Permitted Phases			Free			Free			Free			6
Actuated Green, G (s)	6.9	14.5	69.4	8.0	15.6	69.4	11.0	27.7	69.4	3.2	19.9	19.9
Effective Green, g (s)	6.9	14.5	69.4	8.0	15.6	69.4	11.0	27.7	69.4	3.2	19.9	19.9
Actuated g/C Ratio	0.10	0.21	1.00	0.12	0.22	1.00	0.16	0.40	1.00	0.05	0.29	0.29
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	341	739	1583	395	795	1583	544	2029	1583	158	1458	453
v/s Ratio Prot	0.05	c0.15		c0.11	0.14		c0.14	0.25		0.04	c0.23	
v/s Ratio Perm			c0.28			0.04			0.27			0.02
v/c Ratio	0.48	0.72	0.28	0.97	0.62	0.04	0.91	0.63	0.27	0.79	0.80	0.07
Uniform Delay, d1	29.6	25.6	0.0	30.6	24.2	0.0	28.7	16.7	0.0	32.8	22.9	18.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.1	3.4	0.4	38.3	1.4	0.0	18.6	0.6	0.4	23.1	3.3	0.1
Delay (s)	30.6	28.9	0.4	68.9	25.6	0.0	47.3	17.3	0.4	55.8	26.2	18.1
Level of Service	C	C	A	E	C	A	D	B	A	E	C	B
Approach Delay (s)		18.1			41.9			20.8			28.3	
Approach LOS		B			D			C			C	

Intersection Summary

HCM 2000 Control Delay	25.6	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.83		
Actuated Cycle Length (s)	69.4	Sum of lost time (s)	16.0
Intersection Capacity Utilization	70.7%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
8: Willow Rd & Owens Rd

BART to Livermore Extension Project
2040 Enhanced Bus + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	100	494	211	121	331	81	114	101	0	164	105	94
Future Volume (vph)	100	494	211	121	331	81	114	101	0	164	105	94
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	5.3	4.0		5.3	4.0	4.0
Lane Util. Factor	0.97	0.91		0.97	0.91	1.00	1.00	0.95		1.00	1.00	1.00
Frt	1.00	0.96		1.00	1.00	0.85	1.00	1.00		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	4857		3433	5085	1583	1770	3539		1770	1863	1583
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.68	1.00		0.68	1.00	1.00
Satd. Flow (perm)	3433	4857		3433	5085	1583	1273	3539		1271	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	109	537	229	132	360	88	124	110	0	178	114	102
RTOR Reduction (vph)	0	106	0	0	0	51	0	0	0	0	0	77
Lane Group Flow (vph)	109	660	0	132	360	37	124	110	0	178	114	25
Turn Type	Prot	NA		Prot	NA	Perm	Perm	NA	Perm	Perm	NA	Perm
Protected Phases	1	6		5	2			4			8	
Permitted Phases						2	4		4	8		8
Actuated Green, G (s)	3.6	17.2		4.4	18.0	18.0	10.0	10.0		10.0	10.0	10.0
Effective Green, g (s)	3.6	18.9		4.4	19.7	19.7	10.0	11.3		10.0	11.3	11.3
Actuated g/C Ratio	0.08	0.41		0.09	0.42	0.42	0.21	0.24		0.21	0.24	0.24
Clearance Time (s)	4.0	5.7		4.0	5.7	5.7	5.3	5.3		5.3	5.3	5.3
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	265	1969		324	2149	669	273	858		272	451	383
v/s Ratio Prot	0.03	c0.14		c0.04	0.07			0.03			0.06	
v/s Ratio Perm						0.02	0.10			c0.14		0.02
v/c Ratio	0.41	0.34		0.41	0.17	0.06	0.45	0.13		0.65	0.25	0.06
Uniform Delay, d1	20.5	9.5		19.9	8.4	8.0	15.9	13.8		16.7	14.2	13.6
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	1.0	0.1		0.8	0.0	0.0	1.2	0.1		5.6	0.3	0.1
Delay (s)	21.5	9.6		20.7	8.4	8.0	17.1	13.9		22.3	14.5	13.7
Level of Service	C	A		C	A	A	B	B		C	B	B
Approach Delay (s)		11.1			11.1			15.6			17.8	
Approach LOS		B			B			B			B	

Intersection Summary

HCM 2000 Control Delay	12.9	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.42		
Actuated Cycle Length (s)	46.6	Sum of lost time (s)	12.0
Intersection Capacity Utilization	43.5%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
9: Hacienda Dr & Dublin Blvd

BART to Livermore Extension Project
2040 Enhanced Bus + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↕↕↕	↖↗	↖↗	↕↕↕		↖↗↖	↕↕	↖↗	↖↗	↕↕↕	↖↗
Traffic Volume (vph)	84	384	124	289	853	75	218	714	128	10	386	140
Future Volume (vph)	84	384	124	289	853	75	218	714	128	10	386	140
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	6.0	5.0	4.5	6.0		5.0	6.0	6.0	4.5	5.5	5.5
Lane Util. Factor	0.97	0.91	0.88	0.97	0.91		0.94	0.95	0.88	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5085	2787	3433	5023		4990	3539	2787	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5085	2787	3433	5023		4990	3539	2787	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	91	417	135	314	927	82	237	776	139	11	420	152
RTOR Reduction (vph)	0	0	55	0	7	0	0	0	100	0	0	132
Lane Group Flow (vph)	91	417	80	314	1002	0	237	776	39	11	420	20
Turn Type	Prot	NA	pm+ov	Prot	NA		Prot	NA	Perm	Prot	NA	Perm
Protected Phases	5	2	3	1	6		3	8		7		4
Permitted Phases			2						8			4
Actuated Green, G (s)	9.1	59.1	82.8	18.0	68.0		23.7	39.3	39.3	2.6	18.2	18.2
Effective Green, g (s)	9.1	59.1	82.8	18.0	68.0		23.7	39.3	39.3	2.6	18.2	18.2
Actuated g/C Ratio	0.06	0.42	0.59	0.13	0.49		0.17	0.28	0.28	0.02	0.13	0.13
Clearance Time (s)	4.5	6.0	5.0	4.5	6.0		5.0	6.0	6.0	4.5	5.5	5.5
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	223	2146	1648	441	2439		844	993	782	63	661	205
v/s Ratio Prot	0.03	0.08	0.01	c0.09	c0.20		0.05	c0.22		0.00	c0.08	
v/s Ratio Perm			0.02						0.01			0.01
v/c Ratio	0.41	0.19	0.05	0.71	0.41		0.28	0.78	0.05	0.17	0.64	0.10
Uniform Delay, d1	62.9	25.5	12.0	58.5	23.1		50.7	46.4	36.7	67.6	57.8	53.7
Progression Factor	1.00	1.00	1.00	1.00	1.00		0.79	0.77	0.43	1.00	1.00	1.00
Incremental Delay, d2	1.2	0.2	0.0	5.4	0.5		0.2	4.0	0.0	1.3	2.0	0.2
Delay (s)	64.1	25.7	12.0	63.9	23.6		40.3	39.7	15.8	69.0	59.8	53.9
Level of Service	E	C	B	E	C		D	D	B	E	E	D
Approach Delay (s)		28.2			33.2			36.9			58.4	
Approach LOS		C			C			D			E	

Intersection Summary		
HCM 2000 Control Delay	37.5	HCM 2000 Level of Service D
HCM 2000 Volume to Capacity ratio	0.60	
Actuated Cycle Length (s)	140.0	Sum of lost time (s) 21.0
Intersection Capacity Utilization	62.1%	ICU Level of Service B
Analysis Period (min)	15	

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 10: Hacienda Dr & Martinelli Blvd/Hacienda Crossings

BART to Livermore Extension Project
 2040 Enhanced Bus + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗	↖↗	↖↗	↗		↖↗↘	↖↗↘	↖	↖↗	↖↗↘	
Traffic Volume (vph)	16	10	226	107	13	10	261	1017	110	17	737	55
Future Volume (vph)	16	10	226	107	13	10	261	1017	110	17	737	55
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	2.0	2.0	4.5	2.0		3.0	2.0	2.0	4.5	2.5	
Lane Util. Factor	1.00	0.91	0.91	0.97	1.00		0.94	0.91	1.00	0.97	0.86	
Frt	1.00	0.90	0.85	1.00	0.93		1.00	1.00	0.85	1.00	0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1770	1519	2882	3433	1740		4990	5085	1583	3433	6341	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1770	1519	2882	3433	1740		4990	5085	1583	3433	6341	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	17	11	246	116	14	11	284	1105	120	18	801	60
RTOR Reduction (vph)	0	23	199	0	9	0	0	0	25	0	4	0
Lane Group Flow (vph)	17	14	22	116	16	0	284	1105	95	18	857	0
Turn Type	Prot	NA	Perm	Prot	NA		Prot	NA	pm+ov	Prot	NA	
Protected Phases	5	2		1	6		3	8	1	7	4	
Permitted Phases			2						8			
Actuated Green, G (s)	4.8	12.0	12.0	11.5	18.7		13.3	95.9	107.4	4.6	87.2	
Effective Green, g (s)	4.3	14.0	14.0	11.0	20.7		14.3	97.9	111.4	4.1	88.7	
Actuated g/C Ratio	0.03	0.10	0.10	0.08	0.15		0.10	0.70	0.80	0.03	0.63	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	4.0	4.0	2.0	4.0		3.0	4.0	2.0	3.0	4.0	
Lane Grp Cap (vph)	54	151	288	269	257		509	3555	1282	100	4017	
v/s Ratio Prot	0.01	c0.01		c0.03	0.01		c0.06	c0.22	0.01	0.01	c0.14	
v/s Ratio Perm			0.01						0.05			
v/c Ratio	0.31	0.09	0.08	0.43	0.06		0.56	0.31	0.07	0.18	0.21	
Uniform Delay, d1	66.4	57.2	57.1	61.5	51.3		59.8	8.1	3.1	66.3	10.9	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.02	1.13	2.33	0.79	0.16	
Incremental Delay, d2	3.3	0.4	0.2	0.4	0.1		1.2	0.2	0.0	0.8	0.1	
Delay (s)	69.7	57.6	57.3	61.9	51.4		62.3	9.3	7.2	53.3	1.9	
Level of Service	E	E	E	E	D		E	A	A	D	A	
Approach Delay (s)		58.1			60.1			19.1			2.9	
Approach LOS		E			E			B			A	

Intersection Summary

HCM 2000 Control Delay	19.9	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.33		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	13.0
Intersection Capacity Utilization	45.1%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 11: Hacienda Dr & I-580 WB Ramps

BART to Livermore Extension Project
 2040 Enhanced Bus + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↔↔		↔↔		↑↑↑			↑↑↑	↔
Traffic Volume (vph)	0	0	0	245	0	449	0	1252	284	0	759	416
Future Volume (vph)	0	0	0	245	0	449	0	1252	284	0	759	416
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				2.6		2.6		2.1			2.1	2.1
Lane Util. Factor				0.97		0.88		0.91			0.86	0.86
Frt				1.00		0.85		0.97			0.97	0.85
Flt Protected				0.95		1.00		1.00			1.00	1.00
Satd. Flow (prot)				3433		2787		4944			4651	1362
Flt Permitted				0.95		1.00		1.00			1.00	1.00
Satd. Flow (perm)				3433		2787		4944			4651	1362
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	266	0	488	0	1361	309	0	825	452
RTOR Reduction (vph)	0	0	0	0	0	68	0	42	0	0	51	72
Lane Group Flow (vph)	0	0	0	266	0	420	0	1628	0	0	1000	154
Turn Type				Prot		Prot		NA			NA	Perm
Protected Phases				4		4		2			6	
Permitted Phases												6
Actuated Green, G (s)				16.1		16.1		45.9			45.9	45.9
Effective Green, g (s)				17.5		17.5		47.8			47.8	47.8
Actuated g/C Ratio				0.25		0.25		0.68			0.68	0.68
Clearance Time (s)				4.0		4.0		4.0			4.0	4.0
Vehicle Extension (s)				3.0		3.0		3.0			3.0	3.0
Lane Grp Cap (vph)				858		696		3376			3175	930
v/s Ratio Prot				0.08		c0.15		c0.33			0.22	
v/s Ratio Perm												0.11
v/c Ratio				0.31		0.60		0.48			0.32	0.17
Uniform Delay, d1				21.3		23.2		5.2			4.5	4.0
Progression Factor				1.00		1.00		0.67			0.47	0.73
Incremental Delay, d2				0.2		1.5		0.4			0.3	0.4
Delay (s)				21.5		24.7		4.0			2.4	3.3
Level of Service				C		C		A			A	A
Approach Delay (s)		0.0			23.6			4.0			2.5	
Approach LOS		A			C			A			A	

Intersection Summary			
HCM 2000 Control Delay	7.5	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.51		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	4.7
Intersection Capacity Utilization	52.9%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 12: Hacienda Dr & I-580 EB Ramps

BART to Livermore Extension Project
 2040 Enhanced Bus + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗		↖↗					↖↗↘	↖		↖↗↘	
Traffic Volume (vph)	819	0	1171	0	0	0	0	679	300	0	1059	199
Future Volume (vph)	819	0	1171	0	0	0	0	679	300	0	1059	199
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0					4.0	4.0		4.0	
Lane Util. Factor	0.97		0.88					0.86	0.86		0.91	
Frt	1.00		0.85					0.98	0.85		0.98	
Flt Protected	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (prot)	3433		2787					4719	1362		4965	
Flt Permitted	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (perm)	3433		2787					4719	1362		4965	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	890	0	1273	0	0	0	0	738	326	0	1151	216
RTOR Reduction (vph)	0	0	23	0	0	0	0	24	134	0	40	0
Lane Group Flow (vph)	890	0	1250	0	0	0	0	815	91	0	1327	0
Turn Type	Prot		Prot					NA	Perm		NA	
Protected Phases	4		4					2			6	
Permitted Phases									2			
Actuated Green, G (s)	32.3		32.3					26.4	26.4		26.4	
Effective Green, g (s)	33.7		33.7					28.3	28.3		28.3	
Actuated g/C Ratio	0.48		0.48					0.40	0.40		0.40	
Clearance Time (s)	5.4		5.4					5.9	5.9		5.9	
Vehicle Extension (s)	2.0		2.0					2.0	2.0		2.0	
Lane Grp Cap (vph)	1652		1341					1907	550		2007	
v/s Ratio Prot	0.26		c0.45					0.17			c0.27	
v/s Ratio Perm									0.07			
v/c Ratio	0.54		0.93					0.43	0.17		0.66	
Uniform Delay, d1	12.7		17.1					15.0	13.3		17.0	
Progression Factor	1.00		1.00					1.00	1.00		0.86	
Incremental Delay, d2	0.2		11.6					0.7	0.6		1.7	
Delay (s)	12.9		28.7					15.7	14.0		16.3	
Level of Service	B		C					B	B		B	
Approach Delay (s)		22.2			0.0			15.3			16.3	
Approach LOS		C			A			B			B	


































Intersection Summary

HCM 2000 Control Delay	18.9	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.81		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	72.5%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
13: Hacienda Dr & Owens Rd

BART to Livermore Extension Project
2040 Enhanced Bus + Garage AM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 	  		 	  		 	  		  		
Traffic Volume (vph)	194	289	27	134	415	457	26	323	124	657	922	624
Future Volume (vph)	194	289	27	134	415	457	26	323	124	657	922	624
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	2.3	4.0	4.0	2.3	4.0	4.0	2.7	4.0	4.0	2.7
Lane Util. Factor	0.97	0.91	1.00	0.97	0.91	1.00	0.97	0.91	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5085	1583	3433	5085	1583	3433	5085	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5085	1583	3433	5085	1583	3433	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	211	314	29	146	451	497	28	351	135	714	1002	678
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	211	314	29	146	451	497	28	351	135	714	1002	678
Turn Type	Prot	NA	Free	Prot	NA	Free	Prot	NA	Free	Prot	NA	Free
Protected Phases	1	6		5	2		7	4		3	8	
Permitted Phases			Free			Free			Free			Free
Actuated Green, G (s)	14.2	19.7	115.0	10.4	15.9	115.0	4.2	32.0	115.0	33.9	61.7	115.0
Effective Green, g (s)	14.2	21.4	115.0	10.4	17.6	115.0	4.2	33.3	115.0	33.9	63.0	115.0
Actuated g/C Ratio	0.12	0.19	1.00	0.09	0.15	1.00	0.04	0.29	1.00	0.29	0.55	1.00
Clearance Time (s)	4.0	5.7		4.0	5.7		4.0	5.3		4.0	5.3	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	423	946	1583	310	778	1583	125	1472	1583	1011	2785	1583
v/s Ratio Prot	0.06	0.06		0.04	c0.09		0.01	0.07		c0.21	0.20	
v/s Ratio Perm			0.02			0.31			0.09			c0.43
v/c Ratio	0.50	0.33	0.02	0.47	0.58	0.31	0.22	0.24	0.09	0.71	0.36	0.43
Uniform Delay, d1	47.1	40.6	0.0	49.7	45.3	0.0	53.8	31.2	0.0	36.1	14.6	0.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.9	0.2	0.0	1.1	1.1	0.5	0.9	0.4	0.1	2.3	0.4	0.8
Delay (s)	48.0	40.8	0.0	50.8	46.3	0.5	54.7	31.6	0.1	38.4	15.0	0.8
Level of Service	D	D	A	D	D	A	D	C	A	D	B	A
Approach Delay (s)		41.4			26.1			24.6			18.0	
Approach LOS		D			C			C			B	

Intersection Summary

HCM 2000 Control Delay	23.5	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.58		
Actuated Cycle Length (s)	115.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	51.9%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
14: Tassajara Rd & Dublin Blvd

BART to Livermore Extension Project
2040 Enhanced Bus + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	103	204	139	645	1327	68	272	485	169	36	1133	342
Future Volume (vph)	103	204	139	645	1327	68	272	485	169	36	1133	342
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	6.0	6.0	5.0	6.0		5.0	6.0	6.0	5.0	5.7	5.7
Lane Util. Factor	0.97	0.86	0.88	0.94	0.91		0.94	0.86	1.00	0.97	0.86	0.88
Frt	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	6408	2787	4990	5048		4990	6408	1583	3433	6408	2787
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	6408	2787	4990	5048		4990	6408	1583	3433	6408	2787
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	112	222	151	701	1442	74	296	527	184	39	1232	372
RTOR Reduction (vph)	0	0	110	0	4	0	0	0	138	0	0	266
Lane Group Flow (vph)	112	222	41	701	1512	0	296	527	46	39	1232	106
Turn Type	Prot	NA	Perm	Prot	NA		Prot	NA	Perm	Prot	NA	Perm
Protected Phases	5	2		1	6		3	8		7	NA	4
Permitted Phases			2						8			4
Actuated Green, G (s)	16.0	40.2	40.2	24.8	49.0		18.1	36.8	36.8	22.8	41.8	41.8
Effective Green, g (s)	16.0	40.2	40.2	24.8	49.0		18.1	36.8	36.8	22.8	41.8	41.8
Actuated g/C Ratio	0.11	0.27	0.27	0.17	0.33		0.12	0.25	0.25	0.16	0.29	0.29
Clearance Time (s)	5.0	6.0	6.0	5.0	6.0		5.0	6.0	6.0	5.0	5.7	5.7
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	374	1757	764	844	1687		616	1608	397	533	1827	794
v/s Ratio Prot	0.03	0.03		c0.14	c0.30		c0.06	0.08		c0.01	c0.19	
v/s Ratio Perm			0.01						0.03			0.04
v/c Ratio	0.30	0.13	0.05	0.83	0.90		0.48	0.33	0.12	0.07	0.67	0.13
Uniform Delay, d1	60.1	40.0	39.2	58.9	46.4		59.9	44.8	42.4	52.9	46.4	38.9
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.5	0.0	0.0	7.0	6.6		0.6	0.1	0.1	0.1	1.0	0.1
Delay (s)	60.6	40.0	39.2	65.8	53.0		60.5	44.9	42.5	52.9	47.4	39.0
Level of Service	E	D	D	E	D		E	D	D	D	D	D
Approach Delay (s)		44.5			57.1			49.0			45.6	
Approach LOS		D			E			D			D	

Intersection Summary

HCM 2000 Control Delay	50.9	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.76		
Actuated Cycle Length (s)	146.6	Sum of lost time (s)	22.0
Intersection Capacity Utilization	88.3%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 15: Tassajara Rd & I-580 WB Ramps

BART to Livermore Extension Project
 2040 Enhanced Bus + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↔↔		↔↔		↑↑	↔		↑↑↔	↔
Traffic Volume (vph)	0	0	0	590	0	296	0	1187	476	0	1031	935
Future Volume (vph)	0	0	0	590	0	296	0	1187	476	0	1031	935
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0		4.0		4.0	4.0		4.0	4.0
Lane Util. Factor				0.97		0.88		0.95	1.00		0.86	0.86
Frt				1.00		0.85		1.00	0.85		0.95	0.85
Flt Protected				0.95		1.00		1.00	1.00		1.00	1.00
Satd. Flow (prot)				3433		2787		3539	1583		4581	1362
Flt Permitted				0.95		1.00		1.00	1.00		1.00	1.00
Satd. Flow (perm)				3433		2787		3539	1583		4581	1362
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	641	0	322	0	1290	517	0	1121	1016
RTOR Reduction (vph)	0	0	0	0	0	68	0	0	196	0	103	193
Lane Group Flow (vph)	0	0	0	641	0	254	0	1290	321	0	1526	315
Turn Type				Perm		Perm		NA	Perm		NA	Perm
Protected Phases								2			6	
Permitted Phases				8		8			2			6
Actuated Green, G (s)				18.6		18.6		43.4	43.4		43.4	43.4
Effective Green, g (s)				18.6		18.6		43.4	43.4		43.4	43.4
Actuated g/C Ratio				0.27		0.27		0.62	0.62		0.62	0.62
Clearance Time (s)				4.0		4.0		4.0	4.0		4.0	4.0
Vehicle Extension (s)				3.0		3.0		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)				912		740		2194	981		2840	844
v/s Ratio Prot								c0.36			0.33	
v/s Ratio Perm				c0.19		0.09			0.20			0.23
v/c Ratio				0.70		0.34		0.59	0.33		0.54	0.37
Uniform Delay, d1				23.2		20.8		8.0	6.3		7.6	6.6
Progression Factor				1.00		1.00		1.00	1.00		1.00	1.00
Incremental Delay, d2				2.5		0.3		1.2	0.9		0.7	1.3
Delay (s)				25.7		21.0		9.1	7.2		8.3	7.8
Level of Service				C		C		A	A		A	A
Approach Delay (s)		0.0			24.1			8.6			8.2	
Approach LOS		A			C			A			A	

Intersection Summary			
HCM 2000 Control Delay	11.5	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.62		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	56.3%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 16: Santa Rita Rd & I-580 EB Ramps/Pimilco Dr

BART to Livermore Extension Project
 2040 Enhanced Bus + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	566	117	744	186	0	188	0	883	119	183	1340	0
Future Volume (vph)	566	117	744	186	0	188	0	883	119	183	1340	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0		4.0		4.0		4.0	4.0	
Lane Util. Factor	0.97	1.00	1.00	0.97		0.88		0.86		1.00	0.95	
Frt	1.00	1.00	0.85	1.00		0.85		0.98		1.00	1.00	
Flt Protected	0.95	1.00	1.00	0.95		1.00		1.00		0.95	1.00	
Satd. Flow (prot)	3433	1863	1583	3433		2787		6294		1770	3539	
Flt Permitted	0.95	1.00	1.00	0.95		1.00		1.00		0.95	1.00	
Satd. Flow (perm)	3433	1863	1583	3433		2787		6294		1770	3539	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	615	127	809	202	0	204	0	960	129	199	1457	0
RTOR Reduction (vph)	0	0	0	0	0	71	0	40	0	0	0	0
Lane Group Flow (vph)	615	127	809	202	0	133	0	1049	0	199	1457	0
Turn Type	Perm	NA	Free	Prot		pm+ov		NA		Prot	NA	Perm
Protected Phases		4		3		1		2		1	6	
Permitted Phases	4		Free			3						6
Actuated Green, G (s)	14.9	14.9	60.0	4.6		13.0		16.1		8.4	28.5	
Effective Green, g (s)	14.9	14.9	60.0	4.6		13.0		16.1		8.4	28.5	
Actuated g/C Ratio	0.25	0.25	1.00	0.08		0.22		0.27		0.14	0.48	
Clearance Time (s)	4.0	4.0		4.0		4.0		4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0		3.0		3.0		3.0	3.0	
Lane Grp Cap (vph)	852	462	1583	263		603		1688		247	1681	
v/s Ratio Prot		0.07		0.06		0.03		0.17		0.11	c0.41	
v/s Ratio Perm	c0.18		c0.51			0.02						
v/c Ratio	0.72	0.27	0.51	0.77		0.22		0.62		0.81	0.87	
Uniform Delay, d1	20.7	18.2	0.0	27.2		19.3		19.3		25.0	14.1	
Progression Factor	1.00	1.00	1.00	1.00		1.00		1.00		1.00	1.00	
Incremental Delay, d2	3.0	0.3	1.2	12.6		0.2		1.7		17.2	6.3	
Delay (s)	23.7	18.5	1.2	39.8		19.5		21.0		42.2	20.4	
Level of Service	C	B	A	D		B		C		D	C	
Approach Delay (s)		11.5			29.6			21.0			23.0	
Approach LOS		B			C			C			C	

Intersection Summary		
HCM 2000 Control Delay	19.3	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.91	B
Actuated Cycle Length (s)	60.0	Sum of lost time (s)
Intersection Capacity Utilization	59.9%	16.0
Analysis Period (min)	15	ICU Level of Service
		B

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 17: Santa Rita Rd & Valley Ave

BART to Livermore Extension Project
 2040 Enhanced Bus + Garage AM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	216	250	82	194	418	993	113	553	81	601	895	177
Future Volume (vph)	216	250	82	194	418	993	113	553	81	601	895	177
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.97	0.95		0.97	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.98		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	3433	3471		3433	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	3433	3471		3433	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	235	272	89	211	454	1079	123	601	88	653	973	192
RTOR Reduction (vph)	0	0	73	0	0	0	0	15	0	0	0	112
Lane Group Flow (vph)	235	272	16	211	454	1079	123	674	0	653	973	80
Turn Type	Prot	NA	Perm	Prot	NA	Free	Prot	NA		Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1		6
Permitted Phases			4			Free						6
Actuated Green, G (s)	8.6	12.8	12.8	10.1	14.3	71.9	3.1	17.9		15.1	29.9	29.9
Effective Green, g (s)	8.6	12.8	12.8	10.1	14.3	71.9	3.1	17.9		15.1	29.9	29.9
Actuated g/C Ratio	0.12	0.18	0.18	0.14	0.20	1.00	0.04	0.25		0.21	0.42	0.42
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	410	630	281	248	703	1583	148	864		720	1471	658
v/s Ratio Prot	0.07	0.08		0.12	0.13		0.04	0.19		c0.19	0.27	
v/s Ratio Perm			0.01			c0.68						0.05
v/c Ratio	0.57	0.43	0.06	0.85	0.65	0.68	0.83	0.78		0.91	0.66	0.12
Uniform Delay, d1	29.9	26.3	24.5	30.2	26.5	0.0	34.1	25.2		27.7	16.9	12.9
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	1.9	0.5	0.1	23.3	2.0	2.4	31.0	4.6		15.1	1.1	0.1
Delay (s)	31.9	26.8	24.6	53.5	28.5	2.4	65.1	29.8		42.8	18.1	13.0
Level of Service	C	C	C	D	C	A	E	C		D	B	B
Approach Delay (s)		28.5			15.4			35.1			26.4	
Approach LOS		C			B			D			C	
Intersection Summary												
HCM 2000 Control Delay			24.2			HCM 2000 Level of Service				C		
HCM 2000 Volume to Capacity ratio			0.90									
Actuated Cycle Length (s)			71.9			Sum of lost time (s)			16.0			
Intersection Capacity Utilization			66.1%			ICU Level of Service				C		
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis
18: Bernal Ave/Valley Ave & Stanley Blvd

BART to Livermore Extension Project
2040 Enhanced Bus + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	216	203	55	247	897	954	174	479	102	142	364	125
Future Volume (vph)	216	203	55	247	897	954	174	479	102	142	364	125
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.95	1.00	0.97	0.91	0.91	1.00	0.95	1.00	0.97	0.95	0.95
Frt	1.00	1.00	0.85	1.00	0.96	0.85	1.00	1.00	0.85	1.00	0.96	0.96
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	3433	3238	1441	1770	3539	1583	3433	3404	3404
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	3433	3238	1441	1770	3539	1583	3433	3404	3404
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	235	221	60	268	975	1037	189	521	111	154	396	136
RTOR Reduction (vph)	0	0	30	0	47	28	0	0	88	0	38	0
Lane Group Flow (vph)	235	221	30	268	1343	594	189	521	23	154	494	0
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	NA
Protected Phases	7	4	5	3	8	1	5	2		1	6	
Permitted Phases			4			8			2			
Actuated Green, G (s)	7.0	33.0	44.6	11.0	37.0	46.9	11.6	18.1	18.1	9.9	16.4	16.4
Effective Green, g (s)	7.0	33.0	44.6	11.0	37.0	46.9	11.6	18.1	18.1	9.9	16.4	16.4
Actuated g/C Ratio	0.08	0.38	0.51	0.12	0.42	0.53	0.13	0.21	0.21	0.11	0.19	0.19
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	273	1327	874	429	1361	833	233	727	325	386	634	634
v/s Ratio Prot	c0.07	0.06	0.00	0.08	c0.41	0.08	c0.11	c0.15		0.04	0.15	0.15
v/s Ratio Perm			0.01			0.33			0.01			
v/c Ratio	0.86	0.17	0.03	0.62	0.99	0.71	0.81	0.72	0.07	0.40	0.78	0.78
Uniform Delay, d1	40.0	18.3	10.9	36.5	25.3	15.5	37.1	32.6	28.2	36.3	34.1	34.1
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	23.1	0.1	0.0	2.8	21.1	2.9	18.9	3.4	0.1	0.7	6.0	6.0
Delay (s)	63.1	18.4	10.9	39.4	46.3	18.4	56.0	35.9	28.3	37.0	40.1	40.1
Level of Service	E	B	B	D	D	B	E	D	C	D	D	D
Approach Delay (s)		37.9			37.9			39.5			39.4	39.4
Approach LOS		D			D			D			D	D

Intersection Summary

HCM 2000 Control Delay	38.4	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.90		
Actuated Cycle Length (s)	88.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	78.1%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 19: Fallon Rd & Dublin Blvd/Croak Rd

BART to Livermore Extension Project
 2040 Enhanced Bus + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↑↑↑	↖↗	↖↗↘	↑↑↑	↖	↖↗↘	↑↑↑	↖↗	↖↗	↑↑↑	↖
Traffic Volume (vph)	48	81	92	355	1305	417	837	275	44	82	714	326
Future Volume (vph)	48	81	92	355	1305	417	837	275	44	82	714	326
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.91	0.88	0.94	0.91	1.00	0.94	0.91	0.88	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5085	2787	4990	5085	1583	4990	5085	2787	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5085	2787	4990	5085	1583	4990	5085	2787	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	52	88	100	386	1418	453	910	299	48	89	776	354
RTOR Reduction (vph)	0	0	42	0	0	229	0	0	33	0	0	133
Lane Group Flow (vph)	52	88	58	386	1418	224	910	299	15	89	776	221
Turn Type	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4	5	3	8		5	2		1	6	
Permitted Phases			4			8			2			6
Actuated Green, G (s)	2.4	9.6	28.3	31.3	38.5	38.5	18.7	28.7	28.7	4.4	14.4	14.4
Effective Green, g (s)	2.4	9.6	28.3	31.3	38.5	38.5	18.7	28.7	28.7	4.4	14.4	14.4
Actuated g/C Ratio	0.03	0.11	0.31	0.35	0.43	0.43	0.21	0.32	0.32	0.05	0.16	0.16
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	91	542	876	1735	2175	677	1036	1621	888	167	813	253
v/s Ratio Prot	c0.02	0.02	0.01	0.08	c0.28		c0.18	0.06		0.03	c0.15	
v/s Ratio Perm			0.01			0.14			0.01			0.14
v/c Ratio	0.57	0.16	0.07	0.22	0.65	0.33	0.88	0.18	0.02	0.53	0.95	0.87
Uniform Delay, d1	43.3	36.5	21.6	20.7	20.4	17.2	34.5	22.2	21.0	41.8	37.5	36.9
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	8.4	0.1	0.0	0.1	0.7	0.3	8.6	0.3	0.0	3.2	22.3	31.8
Delay (s)	51.7	36.7	21.6	20.8	21.1	17.4	43.1	22.4	21.0	45.0	59.7	68.7
Level of Service	D	D	C	C	C	B	D	C	C	D	E	E
Approach Delay (s)		33.7			20.3			37.4			61.3	
Approach LOS		C			C			D			E	

Intersection Summary

HCM 2000 Control Delay	35.3	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.76		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	71.3%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 20: El Charro Rd/Fallon Rd & I-580 WB Ramps

BART to Livermore Extension Project
 2040 Enhanced Bus + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↙	↖	↗		↑↑↑	↗		↑↑↑	↗
Traffic Volume (vph)	0	0	0	158	0	611	0	859	478	0	651	399
Future Volume (vph)	0	0	0	158	0	611	0	859	478	0	651	399
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0	4.0	4.0		4.0	4.0		4.0	4.0
Lane Util. Factor				0.95	0.95	0.88		0.91	1.00		0.91	1.00
Frt				1.00	1.00	0.85		1.00	0.85		1.00	0.85
Flt Protected				0.95	0.95	1.00		1.00	1.00		1.00	1.00
Satd. Flow (prot)				1681	1681	2787		5085	1583		5085	1583
Flt Permitted				0.95	0.95	1.00		1.00	1.00		1.00	1.00
Satd. Flow (perm)				1681	1681	2787		5085	1583		5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	172	0	664	0	934	520	0	708	434
RTOR Reduction (vph)	0	0	0	0	0	120	0	0	193	0	0	161
Lane Group Flow (vph)	0	0	0	88	84	544	0	934	327	0	708	273
Turn Type				Perm	NA	Perm		NA	Perm		NA	Perm
Protected Phases					8			2			6	
Permitted Phases				8		8			2			6
Actuated Green, G (s)				18.5	18.5	18.5		44.0	44.0		44.0	44.0
Effective Green, g (s)				18.0	18.0	18.0		44.0	44.0		44.0	44.0
Actuated g/C Ratio				0.26	0.26	0.26		0.63	0.63		0.63	0.63
Clearance Time (s)				3.5	3.5	3.5		4.0	4.0		4.0	4.0
Vehicle Extension (s)				2.0	2.0	2.0		2.0	2.0		2.0	2.0
Lane Grp Cap (vph)				432	432	716		3196	995		3196	995
v/s Ratio Prot								0.18			0.14	
v/s Ratio Perm				0.05	0.05	c0.20			c0.21			0.17
v/c Ratio				0.20	0.19	0.76		0.29	0.33		0.22	0.27
Uniform Delay, d1				20.4	20.3	24.0		5.9	6.1		5.6	5.8
Progression Factor				1.00	1.00	1.00		0.88	1.09		1.00	1.00
Incremental Delay, d2				0.1	0.1	4.3		0.2	0.7		0.2	0.7
Delay (s)				20.5	20.4	28.3		5.4	7.4		5.8	6.5
Level of Service				C	C	C		A	A		A	A
Approach Delay (s)		0.0			26.7			6.1			6.1	
Approach LOS		A			C			A			A	

Intersection Summary			
HCM 2000 Control Delay	11.1	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.45		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	44.6%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

21: El Charro Rd & I-580 EB Ramps

BART to Livermore Extension Project
2040 Enhanced Bus + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	279	0	619	0	0	0	0	1355	430	0	458	0
Future Volume (vph)	279	0	619	0	0	0	0	1355	430	0	458	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0					4.0	4.0		4.0	
Lane Util. Factor	0.97		0.88					0.91	0.91		0.91	
Frt	1.00		0.85					0.99	0.85		1.00	
Flt Protected	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (prot)	3433		2787					3372	1441		3390	
Flt Permitted	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (perm)	3433		2787					3372	1441		3390	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	303	0	673	0	0	0	0	1473	467	0	498	0
RTOR Reduction (vph)	0	0	572	0	0	0	0	3	109	0	0	0
Lane Group Flow (vph)	303	0	101	0	0	0	0	1526	302	0	498	0
Turn Type	Prot		Perm					NA	Perm		NA	Perm
Protected Phases	4							2			6	
Permitted Phases			4						2			6
Actuated Green, G (s)	10.5		10.5					51.5	51.5		51.5	
Effective Green, g (s)	10.5		10.5					51.5	51.5		51.5	
Actuated g/C Ratio	0.15		0.15					0.74	0.74		0.74	
Clearance Time (s)	4.0		4.0					4.0	4.0		4.0	
Vehicle Extension (s)	2.0		2.0					3.0	3.0		3.0	
Lane Grp Cap (vph)	514		418					2480	1060		2494	
v/s Ratio Prot	c0.09							c0.45			0.15	
v/s Ratio Perm			0.04						0.21			
v/c Ratio	0.59		0.24					0.62	0.29		0.20	
Uniform Delay, d1	27.7		26.2					4.5	3.1		2.9	
Progression Factor	1.00		1.00					1.00	1.00		0.92	
Incremental Delay, d2	1.1		0.1					1.2	0.7		0.2	
Delay (s)	28.9		26.3					5.6	3.8		2.8	
Level of Service	C		C					A	A		A	
Approach Delay (s)		27.1			0.0			5.2			2.8	
Approach LOS		C			A			A			A	

Intersection Summary

HCM 2000 Control Delay	11.1	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.61		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	56.6%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 22: El Charro Rd & Stoneridge Dr/Jack London Blvd

BART to Livermore Extension Project
 2040 Enhanced Bus + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔↔↔	↑↑	↗	↖	↑↑	↗↗	↖	↑↑		↖↖↖	↑	↗↗
Traffic Volume (vph)	93	131	15	64	646	816	31	541	28	324	206	109
Future Volume (vph)	93	131	15	64	646	816	31	541	28	324	206	109
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	0.94	0.95	1.00	1.00	0.95	0.88	1.00	0.95		0.94	1.00	0.88
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	4491	3185	1425	1593	3185	2508	1593	3162		4491	1676	2508
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	4491	3185	1425	1593	3185	2508	1593	3162		4491	1676	2508
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	101	142	16	70	702	887	34	588	30	352	224	118
RTOR Reduction (vph)	0	0	12	0	0	51	0	4	0	0	0	63
Lane Group Flow (vph)	101	142	4	70	702	836	34	614	0	352	224	55
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Prot	NA		Prot	NA	Perm
Protected Phases	7	4		3	8	1	5	2		1	6	
Permitted Phases			4			8						6
Actuated Green, G (s)	2.9	20.7	20.7	6.8	24.6	46.3	3.1	22.3		21.7	40.9	40.9
Effective Green, g (s)	2.9	20.7	20.7	6.8	24.6	46.3	3.1	22.3		21.7	40.9	40.9
Actuated g/C Ratio	0.03	0.24	0.24	0.08	0.28	0.53	0.04	0.25		0.25	0.47	0.47
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	148	753	337	123	895	1327	56	805		1113	783	1172
v/s Ratio Prot	0.02	0.04		c0.04	c0.22	c0.16	0.02	c0.19		0.08	0.13	
v/s Ratio Perm			0.00			0.18						0.02
v/c Ratio	0.68	0.19	0.01	0.57	0.78	0.63	0.61	0.76		0.32	0.29	0.05
Uniform Delay, d1	41.8	26.7	25.6	38.9	29.0	14.6	41.6	30.2		26.8	14.3	12.7
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	12.2	0.1	0.0	5.9	4.6	1.0	17.2	4.3		0.2	0.2	0.0
Delay (s)	54.1	26.8	25.6	44.9	33.6	15.5	58.8	34.5		27.0	14.5	12.7
Level of Service	D	C	C	D	C	B	E	C		C	B	B
Approach Delay (s)		37.4			24.4			35.7			20.5	
Approach LOS		D			C			D			C	

Intersection Summary

HCM 2000 Control Delay	26.9	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.73		
Actuated Cycle Length (s)	87.5	Sum of lost time (s)	16.0
Intersection Capacity Utilization	62.7%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 23: Stanley Blvd & El Charro Rd

BART to Livermore Extension Project
 2040 Enhanced Bus + Garage AM



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	↖	↑↑	↑↑↑	↑	↙↘	↙↘
Traffic Volume (vph)	397	461	2777	113	25	111
Future Volume (vph)	397	461	2777	113	25	111
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95	0.91	1.00	0.97	0.88
Frt	1.00	1.00	1.00	0.85	1.00	0.85
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1770	3539	5085	1583	3433	2787
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1770	3539	5085	1583	3433	2787
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	432	501	3018	123	27	121
RTOR Reduction (vph)	0	0	0	27	0	114
Lane Group Flow (vph)	432	501	3018	96	27	7
Turn Type	Prot	NA	NA	Perm	Prot	Perm
Protected Phases	7	4	8		6	
Permitted Phases				8		6
Actuated Green, G (s)	27.0	96.0	65.0	65.0	6.6	6.6
Effective Green, g (s)	27.0	96.0	65.0	65.0	6.6	6.6
Actuated g/C Ratio	0.24	0.87	0.59	0.59	0.06	0.06
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	432	3071	2988	930	204	166
v/s Ratio Prot	c0.24	0.14	c0.59		c0.01	
v/s Ratio Perm				0.06		0.00
v/c Ratio	1.00	0.16	1.01	0.10	0.13	0.04
Uniform Delay, d1	41.8	1.1	22.8	10.0	49.3	49.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	43.3	0.0	19.0	0.0	0.3	0.1
Delay (s)	85.1	1.1	41.8	10.1	49.6	49.1
Level of Service	F	A	D	B	D	D
Approach Delay (s)		40.0	40.5		49.2	
Approach LOS		D	D		D	

Intersection Summary

HCM 2000 Control Delay	40.7	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.95		
Actuated Cycle Length (s)	110.6	Sum of lost time (s)	12.0
Intersection Capacity Utilization	89.0%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 24: Airway Blvd/Driveway & N Canyons Pkwy

BART to Livermore Extension Project
 2040 Enhanced Bus + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑	↑	↑↑	↑	↑		↑	↑↑		↑	
Traffic Volume (vph)	0	94	53	716	1007	0	992	0	972	0	0	0
Future Volume (vph)	0	94	53	716	1007	0	992	0	972	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		2.0	2.0	2.0	2.0			4.2	2.0			
Lane Util. Factor		0.95	1.00	0.97	1.00			1.00	0.88			
Frt		1.00	0.85	1.00	1.00			1.00	0.85			
Flt Protected		1.00	1.00	0.95	1.00			0.95	1.00			
Satd. Flow (prot)		3539	1583	3433	1863			1770	2787			
Flt Permitted		1.00	1.00	0.95	1.00			0.95	1.00			
Satd. Flow (perm)		3539	1583	3433	1863			1770	2787			
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	102	58	778	1095	0	1078	0	1057	0	0	0
RTOR Reduction (vph)	0	0	52	0	0	0	0	0	73	0	0	0
Lane Group Flow (vph)	0	102	6	778	1095	0	0	1078	984	0	0	0
Turn Type		NA	Perm	Prot	NA	Perm	Split	NA	pm+ov			
Protected Phases		2		1	6		8	8	1	4	4	
Permitted Phases			2			6			8			
Actuated Green, G (s)		10.2	10.2	34.8	49.0			63.0	97.8			
Effective Green, g (s)		12.2	12.2	36.8	51.0			62.8	101.8			
Actuated g/C Ratio		0.10	0.10	0.31	0.42			0.52	0.85			
Clearance Time (s)		4.0	4.0	4.0	4.0			4.0	4.0			
Vehicle Extension (s)		3.0	3.0	3.0	3.0			3.0	3.0			
Lane Grp Cap (vph)		359	160	1052	791			926	2410			
v/s Ratio Prot		0.03		0.23	c0.59			c0.61	0.13			
v/s Ratio Perm			0.00						0.23			
v/c Ratio		0.28	0.04	0.74	1.38			1.16	0.41			
Uniform Delay, d1		49.9	48.6	37.3	34.5			28.6	2.1			
Progression Factor		1.00	1.00	1.00	1.00			1.00	1.00			
Incremental Delay, d2		2.0	0.4	2.8	180.8			85.7	0.1			
Delay (s)		51.8	49.0	40.1	215.3			114.3	2.2			
Level of Service		D	D	D	F			F	A			
Approach Delay (s)		50.8			142.5			58.8			0.0	
Approach LOS		D			F			E			A	

Intersection Summary

HCM 2000 Control Delay	96.1	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.33		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	12.2
Intersection Capacity Utilization	114.8%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
25: Airway Blvd & I-580 WB Ramps

BART to Livermore Extension Project
2040 Enhanced Bus + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↙	↖	↗		↕	↗		↕	↘
Traffic Volume (vph)	0	0	0	66	43	815	0	1256	343	0	295	553
Future Volume (vph)	0	0	0	66	43	815	0	1256	343	0	295	553
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0	4.0	4.0		4.0	4.0		4.0	
Lane Util. Factor				0.95	0.95	0.88		0.95	1.00		0.91	
Frt				1.00	1.00	0.85		1.00	0.85		0.90	
Flt Protected				0.95	0.98	1.00		1.00	1.00		1.00	
Satd. Flow (prot)				1681	1733	2787		3539	1583		4588	
Flt Permitted				0.95	0.98	1.00		1.00	1.00		1.00	
Satd. Flow (perm)				1681	1733	2787		3539	1583		4588	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	72	47	886	0	1365	373	0	321	601
RTOR Reduction (vph)	0	0	0	0	0	36	0	0	161	0	260	0
Lane Group Flow (vph)	0	0	0	38	81	850	0	1365	212	0	662	0
Turn Type				Split	NA	Perm		NA	Perm		NA	
Protected Phases				8	8			2			6	
Permitted Phases						8			2			
Actuated Green, G (s)				35.2	35.2	35.2		55.5	55.5		55.5	
Effective Green, g (s)				35.2	35.2	35.2		56.8	56.8		56.8	
Actuated g/C Ratio				0.35	0.35	0.35		0.57	0.57		0.57	
Clearance Time (s)				4.0	4.0	4.0		5.3	5.3		5.3	
Vehicle Extension (s)				2.0	2.0	2.0		4.0	4.0		4.0	
Lane Grp Cap (vph)				591	610	981		2010	899		2605	
v/s Ratio Prot				0.02	0.05			c0.39			0.14	
v/s Ratio Perm						c0.31			0.13			
v/c Ratio				0.06	0.13	0.87		0.68	0.24		0.25	
Uniform Delay, d1				21.5	22.0	30.2		15.2	10.8		10.9	
Progression Factor				1.00	1.00	1.00		0.53	0.14		1.00	
Incremental Delay, d2				0.0	0.0	7.9		1.7	0.5		0.2	
Delay (s)				21.5	22.1	38.1		9.7	2.0		11.1	
Level of Service				C	C	D		A	A		B	
Approach Delay (s)		0.0			36.2			8.1			11.1	
Approach LOS		A			D			A			B	

Intersection Summary

HCM 2000 Control Delay	16.6	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.75		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	69.9%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 26: Airway Blvd & I-580 EB Ramps/Kitty Hawk Rd

BART to Livermore Extension Project
 2040 Enhanced Bus + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↑	↖	↖	↑	↖	↖	↑↗		↖	↑↗	
Traffic Volume (vph)	642	194	219	27	37	93	32	517	164	75	141	165
Future Volume (vph)	642	194	219	27	37	93	32	517	164	75	141	165
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.4	4.4	4.4	4.5	2.7		4.0	2.7	
Lane Util. Factor	0.97	1.00	1.00	1.00	1.00	1.00	1.00	0.95		1.00	0.95	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.96		1.00	0.92	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	3433	1863	1583	1770	1863	1583	1770	3412		1770	3253	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	3433	1863	1583	1770	1863	1583	1770	3412		1770	3253	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	698	211	238	29	40	101	35	562	178	82	153	179
RTOR Reduction (vph)	0	0	179	0	0	78	0	29	0	0	98	0
Lane Group Flow (vph)	698	211	59	29	40	23	35	711	0	82	234	0
Turn Type	Split	NA	Perm	Split	NA	pm+ov	Prot	NA		Prot	NA	
Protected Phases	7	7		8	8	1	5	2		1	6	
Permitted Phases			7			8						
Actuated Green, G (s)	24.9	24.9	24.9	11.2	11.2	21.2	3.7	37.9		10.0	44.2	
Effective Green, g (s)	24.9	24.9	24.9	10.8	10.8	20.4	3.2	39.2		10.0	45.5	
Actuated g/C Ratio	0.25	0.25	0.25	0.11	0.11	0.20	0.03	0.39		0.10	0.46	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Vehicle Extension (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	3.5		2.0	4.0	
Lane Grp Cap (vph)	854	463	394	191	201	392	56	1337		177	1480	
v/s Ratio Prot	c0.20	0.11		0.02	c0.02	0.01	0.02	c0.21		c0.05	0.07	
v/s Ratio Perm			0.04			0.01						
v/c Ratio	0.82	0.46	0.15	0.15	0.20	0.06	0.62	0.53		0.46	0.16	
Uniform Delay, d1	35.4	31.8	29.3	40.4	40.7	32.1	47.8	23.3		42.5	16.0	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		0.98	0.89	
Incremental Delay, d2	5.8	0.3	0.1	0.1	0.2	0.0	14.6	1.5		0.7	0.2	
Delay (s)	41.2	32.1	29.4	40.6	40.8	32.1	62.4	24.9		42.5	14.5	
Level of Service	D	C	C	D	D	C	E	C		D	B	
Approach Delay (s)		37.1			35.6			26.6			20.0	
Approach LOS		D			D			C			C	

Intersection Summary

HCM 2000 Control Delay	30.9	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.57		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	15.6
Intersection Capacity Utilization	58.7%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 27: Collier Canyon Rd & N Canyons Pkwy/Portola Ave

BART to Livermore Extension Project
 2040 Enhanced Bus + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	267	189	99	151	931	58	81	8	102	57	14	214
Future Volume (vph)	267	189	99	151	931	58	81	8	102	57	14	214
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	2.7	2.7	4.0	2.7	2.7	4.0	3.0		4.0	4.6	4.6
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.86		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	1770	1604		1770	1863	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	1770	1604		1770	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	290	205	108	164	1012	63	88	9	111	62	15	233
RTOR Reduction (vph)	0	0	66	0	0	37	0	91	0	0	0	196
Lane Group Flow (vph)	290	205	42	164	1012	26	88	29	0	62	15	37
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA		Prot	NA	Perm
Protected Phases	1	6		5	2		3	8		7		4
Permitted Phases			6			2						4
Actuated Green, G (s)	11.0	27.9	27.9	12.4	29.3	29.3	5.9	12.8		5.7	12.6	12.6
Effective Green, g (s)	11.0	29.2	29.2	12.4	30.6	30.6	5.9	13.8		5.7	12.0	12.0
Actuated g/C Ratio	0.15	0.39	0.39	0.17	0.41	0.41	0.08	0.18		0.08	0.16	0.16
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	504	1381	617	293	1447	647	139	295		134	298	253
v/s Ratio Prot	0.08	0.06		c0.09	c0.29		c0.05	0.02		0.04	0.01	
v/s Ratio Perm			0.03			0.02						c0.02
v/c Ratio	0.58	0.15	0.07	0.56	0.70	0.04	0.63	0.10		0.46	0.05	0.15
Uniform Delay, d1	29.7	14.8	14.3	28.7	18.3	13.3	33.4	25.3		33.1	26.6	27.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	1.6	0.0	0.0	2.3	1.5	0.0	9.1	0.1		2.5	0.1	0.3
Delay (s)	31.3	14.8	14.3	31.0	19.8	13.3	42.5	25.5		35.6	26.6	27.3
Level of Service	C	B	B	C	B	B	D	C		D	C	C
Approach Delay (s)		22.7			20.9			32.7			28.9	
Approach LOS		C			C			C			C	

Intersection Summary

HCM 2000 Control Delay	23.5	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.57		
Actuated Cycle Length (s)	74.8	Sum of lost time (s)	15.3
Intersection Capacity Utilization	54.5%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
28: Isabel Ave/Campus Hill Dr & Portola Ave

BART to Livermore Extension Project
2040 Enhanced Bus + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↘	↑↑	↗↗	↘↘↘	↑↑		↘↘	↑↑	↗	↘	↑↑	↗
Traffic Volume (vph)	1	198	224	504	629	145	505	295	79	66	199	2
Future Volume (vph)	1	198	224	504	629	145	505	295	79	66	199	2
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	5.8	5.8
Lane Util. Factor	1.00	0.95	0.88	0.94	0.95		0.97	0.95	1.00	1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	0.97		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3539	2787	4990	3440		3433	3539	1583	1770	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	3539	2787	4990	3440		3433	3539	1583	1770	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	1	215	243	548	684	158	549	321	86	72	216	2
RTOR Reduction (vph)	0	0	188	0	14	0	0	0	58	0	0	2
Lane Group Flow (vph)	1	215	55	548	828	0	549	321	28	72	216	0
Turn Type	Prot	NA	Perm	Prot	NA		Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4						2			6
Actuated Green, G (s)	1.5	18.5	18.5	15.2	32.2		21.4	26.8	26.8	7.7	13.5	13.5
Effective Green, g (s)	1.5	19.8	19.8	15.2	33.5		21.4	28.1	28.1	7.7	12.6	12.6
Actuated g/C Ratio	0.02	0.23	0.23	0.18	0.39		0.25	0.32	0.32	0.09	0.15	0.15
Clearance Time (s)	4.0	5.3	5.3	4.0	5.3		4.0	5.3	5.3	4.0	4.9	4.9
Vehicle Extension (s)	2.0	3.0	3.0	2.0	3.0		2.0	3.0	3.0	2.0	3.0	3.0
Lane Grp Cap (vph)	30	807	635	873	1327		846	1145	512	157	513	229
v/s Ratio Prot	0.00	0.06		c0.11	c0.24		c0.16	0.09		0.04	c0.06	
v/s Ratio Perm			0.02						0.02			0.00
v/c Ratio	0.03	0.27	0.09	0.63	0.62		0.65	0.28	0.05	0.46	0.42	0.00
Uniform Delay, d1	41.9	27.5	26.4	33.2	21.6		29.3	21.8	20.2	37.6	33.8	31.7
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.2	0.2	0.1	1.0	0.9		1.3	0.1	0.0	0.8	0.6	0.0
Delay (s)	42.1	27.7	26.4	34.2	22.5		30.6	22.0	20.2	38.3	34.3	31.7
Level of Service	D	C	C	C	C		C	C	C	D	C	C
Approach Delay (s)		27.1			27.1			26.8			35.3	
Approach LOS		C			C			C			D	

Intersection Summary

HCM 2000 Control Delay	27.8	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.62		
Actuated Cycle Length (s)	86.8	Sum of lost time (s)	17.8
Intersection Capacity Utilization	68.8%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 29: Isabel Ave & I-580 WB Ramps

BART to Livermore Extension Project
 2040 Enhanced Bus + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↔↔		↗		↑↑↑	↗		↑↑↑	↗
Traffic Volume (vph)	0	0	0	653	0	449	0	517	0	0	677	453
Future Volume (vph)	0	0	0	653	0	449	0	517	0	0	677	453
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0		4.0		4.8			4.8	4.8
Lane Util. Factor				0.97		1.00		0.91			0.91	1.00
Frt				1.00		0.85		1.00			1.00	0.85
Flt Protected				0.95		1.00		1.00			1.00	1.00
Satd. Flow (prot)				3433		1583		5085			5085	1583
Flt Permitted				0.95		1.00		1.00			1.00	1.00
Satd. Flow (perm)				3433		1583		5085			5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	710	0	488	0	562	0	0	736	492
RTOR Reduction (vph)	0	0	0	0	0	107	0	0	0	0	0	246
Lane Group Flow (vph)	0	0	0	710	0	381	0	562	0	0	736	246
Turn Type				Prot		Prot		NA	Free		NA	Prot
Protected Phases				8		8		2			6	6
Permitted Phases									Free			
Actuated Green, G (s)				16.2		16.2		25.8			25.8	25.8
Effective Green, g (s)				16.2		16.2		25.0			25.0	25.0
Actuated g/C Ratio				0.32		0.32		0.50			0.50	0.50
Clearance Time (s)				4.0		4.0		4.0			4.0	4.0
Vehicle Extension (s)				2.0		2.0		4.0			4.0	4.0
Lane Grp Cap (vph)				1112		512		2542			2542	791
v/s Ratio Prot				0.21		c0.24		0.11			0.14	c0.16
v/s Ratio Perm												
v/c Ratio				0.64		0.74		0.22			0.29	0.31
Uniform Delay, d1				14.4		15.0		7.0			7.3	7.4
Progression Factor				1.00		1.00		0.78			1.00	1.00
Incremental Delay, d2				0.9		5.1		0.2			0.3	1.0
Delay (s)				15.3		20.1		5.6			7.6	8.4
Level of Service				B		C		A			A	A
Approach Delay (s)		0.0			17.3			5.6			7.9	
Approach LOS		A			B			A			A	

Intersection Summary		
HCM 2000 Control Delay	11.2	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.48	B
Actuated Cycle Length (s)	50.0	Sum of lost time (s)
Intersection Capacity Utilization	45.1%	8.8
Analysis Period (min)	15	ICU Level of Service
		A

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
30: Isabel Ave & I-580 EB Ramps

BART to Livermore Extension Project
2040 Enhanced Bus + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗		↖↗					↑↑↑	↖		↑↑↑	↖
Traffic Volume (vph)	237	0	514	0	0	0	0	726	509	0	987	364
Future Volume (vph)	237	0	514	0	0	0	0	726	509	0	987	364
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0					4.0	4.0		4.0	4.0
Lane Util. Factor	0.97		0.88					0.91	1.00		0.91	1.00
Frt	1.00		0.85					1.00	0.85		1.00	0.85
Flt Protected	0.95		1.00					1.00	1.00		1.00	1.00
Satd. Flow (prot)	3433		2787					5085	1583		5085	1583
Flt Permitted	0.95		1.00					1.00	1.00		1.00	1.00
Satd. Flow (perm)	3433		2787					5085	1583		5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	258	0	559	0	0	0	0	789	553	0	1073	396
RTOR Reduction (vph)	0	0	152	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	258	0	407	0	0	0	0	789	553	0	1073	396
Turn Type	Prot		Perm					NA	Free		NA	Free
Protected Phases	4							2			6	
Permitted Phases			4						Free			Free
Actuated Green, G (s)	10.9		10.9					30.1	50.0		30.1	50.0
Effective Green, g (s)	10.9		10.9					31.1	50.0		31.1	50.0
Actuated g/C Ratio	0.22		0.22					0.62	1.00		0.62	1.00
Clearance Time (s)	4.0		4.0					5.0			5.0	
Vehicle Extension (s)	2.0		2.0					4.0			4.0	
Lane Grp Cap (vph)	748		607					3162	1583		3162	1583
v/s Ratio Prot	0.08							0.16			0.21	
v/s Ratio Perm			c0.15						c0.35			0.25
v/c Ratio	0.34		0.67					0.25	0.35		0.34	0.25
Uniform Delay, d1	16.5		17.9					4.2	0.0		4.5	0.0
Progression Factor	1.00		1.00					1.00	1.00		0.53	1.00
Incremental Delay, d2	0.1		2.3					0.2	0.6		0.3	0.4
Delay (s)	16.6		20.2					4.4	0.6		2.7	0.4
Level of Service	B		C					A	A		A	A
Approach Delay (s)		19.1			0.0			2.8			2.1	
Approach LOS		B			A			A			A	

Intersection Summary

HCM 2000 Control Delay	6.2	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.47		
Actuated Cycle Length (s)	50.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	43.7%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
31: Isabel Ave & Airway Blvd

BART to Livermore Extension Project
2040 Enhanced Bus + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↑	↗	↖	↑	↗	↖	↑↑↑	↗	↖↗	↑↑↑	↖
Traffic Volume (vph)	0	74	261	215	301	134	336	1067	24	253	1427	16
Future Volume (vph)	0	74	261	215	301	134	336	1067	24	253	1427	16
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.2	5.6	5.2	5.2	5.6	4.0	4.0	4.0	4.0	4.0	5.0
Lane Util. Factor		1.00	1.00	1.00	1.00	1.00	1.00	0.91	1.00	0.97	0.91	1.00
Frt		1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1863	1583	1770	1863	1583	1770	5085	1583	3433	5085	1583
Flt Permitted		1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)		1863	1583	1770	1863	1583	1770	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	80	284	234	327	146	365	1160	26	275	1551	17
RTOR Reduction (vph)	0	0	109	0	0	79	0	0	15	0	0	11
Lane Group Flow (vph)	0	80	175	234	327	67	365	1160	11	275	1551	6
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4	5	3	8	1	5	2		1	6	
Permitted Phases			4			8			2			6
Actuated Green, G (s)		7.6	23.7	11.9	24.1	34.7	16.1	37.0	37.0	10.6	31.5	31.5
Effective Green, g (s)		7.0	22.5	11.3	23.5	33.5	17.1	38.0	38.0	11.6	32.5	31.5
Actuated g/C Ratio		0.08	0.26	0.13	0.27	0.39	0.20	0.44	0.44	0.13	0.38	0.37
Clearance Time (s)		4.6	5.0	4.6	4.6	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Extension (s)		3.0	3.0	3.0	3.0	3.0	3.0	5.0	5.0	3.0	5.0	5.0
Lane Grp Cap (vph)		151	412	231	507	614	350	2239	697	461	1914	577
v/s Ratio Prot		0.04	0.08	c0.13	c0.18	0.01	c0.21	0.23		0.08	c0.30	
v/s Ratio Perm			0.03			0.03			0.01			0.00
v/c Ratio		0.53	0.43	1.01	0.64	0.11	1.04	0.52	0.02	0.60	0.81	0.01
Uniform Delay, d1		38.1	26.5	37.5	27.7	16.9	34.6	17.5	13.6	35.1	24.1	17.5
Progression Factor		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2		3.3	0.7	62.6	2.8	0.1	59.7	0.4	0.0	2.1	3.1	0.0
Delay (s)		41.4	27.2	100.1	30.5	16.9	94.3	17.9	13.6	37.2	27.2	17.5
Level of Service		D	C	F	C	B	F	B	B	D	C	B
Approach Delay (s)		30.3			50.7			35.8			28.6	
Approach LOS		C			D			D			C	

Intersection Summary

HCM 2000 Control Delay	34.8	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.93		
Actuated Cycle Length (s)	86.3	Sum of lost time (s)	20.0
Intersection Capacity Utilization	75.8%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
32: Isabel Ave & Jack London Blvd

BART to Livermore Extension Project
2040 Enhanced Bus + Garage AM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	24	56	61	319	1050	366	414	870	115	172	1374	308
Future Volume (vph)	24	56	61	319	1050	366	414	870	115	172	1374	308
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.97	0.91	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	3433	5085	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	3433	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	26	61	66	347	1141	398	450	946	125	187	1493	335
RTOR Reduction (vph)	0	0	54	0	0	53	0	0	80	0	0	98
Lane Group Flow (vph)	26	61	12	347	1141	345	450	946	45	187	1493	237
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8	1	5	2		1	NA	6
Permitted Phases			4			8			2			6
Actuated Green, G (s)	3.9	23.7	23.7	27.3	47.1	59.5	18.6	46.9	46.9	12.4	40.7	40.7
Effective Green, g (s)	3.9	23.7	23.7	27.3	47.1	59.5	18.6	46.9	46.9	12.4	40.7	40.7
Actuated g/C Ratio	0.03	0.18	0.18	0.21	0.36	0.45	0.14	0.36	0.36	0.09	0.31	0.31
Clearance Time (s)	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	101	637	285	367	1267	780	485	1813	564	323	1573	489
v/s Ratio Prot	0.01	0.02		c0.20	c0.32	0.04	c0.13	0.19		0.05	c0.29	
v/s Ratio Perm			0.01			0.18			0.03			0.15
v/c Ratio	0.26	0.10	0.04	0.95	0.90	0.44	0.93	0.52	0.08	0.58	0.95	0.48
Uniform Delay, d1	62.4	45.0	44.5	51.4	40.0	24.7	55.8	33.4	28.0	57.0	44.4	36.9
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.4	0.1	0.1	32.9	9.0	0.4	23.9	0.3	0.1	2.5	12.5	0.8
Delay (s)	63.7	45.0	44.6	84.2	49.0	25.1	79.7	33.7	28.1	59.6	56.9	37.6
Level of Service	E	D	D	F	D	C	E	C	C	E	E	D
Approach Delay (s)		48.0			50.4			46.9			53.9	
Approach LOS		D			D			D			D	

Intersection Summary

HCM 2000 Control Delay	50.7	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.95		
Actuated Cycle Length (s)	131.5	Sum of lost time (s)	21.2
Intersection Capacity Utilization	80.6%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 33: Isabel Ave Connector & Stanley Blvd



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑	↑	↔	↑↑	↔	↔
Traffic Volume (vph)	340	140	741	2523	562	635
Future Volume (vph)	340	140	741	2523	562	635
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	2.3	2.3	4.0	2.3	2.5	2.5
Lane Util. Factor	0.95	1.00	0.97	0.95	0.97	0.88
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	3539	1583	3433	3539	3433	2787
Flt Permitted	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (perm)	3539	1583	3433	3539	3433	2787
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	370	152	805	2742	611	690
RTOR Reduction (vph)	0	2	0	0	0	138
Lane Group Flow (vph)	370	150	805	2742	611	552
Turn Type	NA	pm+ov	Prot	NA	Prot	pm+ov
Protected Phases	2	8	1	6	8	1
Permitted Phases		2				8
Actuated Green, G (s)	13.6	33.5	42.5	60.1	19.9	62.4
Effective Green, g (s)	15.3	36.9	42.5	61.8	21.4	65.4
Actuated g/C Ratio	0.17	0.42	0.48	0.70	0.24	0.74
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Grp Cap (vph)	615	705	1657	2485	834	2150
v/s Ratio Prot	0.10	0.05	0.23	c0.77	c0.18	0.13
v/s Ratio Perm		0.04				0.07
v/c Ratio	0.60	0.21	0.49	1.10	0.73	0.26
Uniform Delay, d1	33.5	16.3	15.4	13.1	30.7	3.6
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.1	0.1	0.1	53.3	2.9	0.0
Delay (s)	34.7	16.3	15.5	66.4	33.6	3.6
Level of Service	C	B	B	E	C	A
Approach Delay (s)	29.3			54.8	17.7	
Approach LOS	C			D	B	

Intersection Summary

HCM 2000 Control Delay	43.3	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	1.06		
Actuated Cycle Length (s)	88.0	Sum of lost time (s)	8.8
Intersection Capacity Utilization	92.4%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 34: Murrieta Blvd/Driveway & Portola Ave

BART to Livermore Extension Project
 2040 Enhanced Bus + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗		↖	↗		↖	↗	↗		↗	
Traffic Volume (vph)	0	437	101	268	1259	1	188	6	148	1	3	0
Future Volume (vph)	0	437	101	268	1259	1	188	6	148	1	3	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.8		4.0	5.8		5.2	5.2	5.2		4.0	
Lane Util. Factor		0.95		1.00	0.95		0.95	0.95	1.00		1.00	
Frt		0.97		1.00	1.00		1.00	1.00	0.85		1.00	
Flt Protected		1.00		0.95	1.00		0.95	0.96	1.00		0.99	
Satd. Flow (prot)		3439		1770	3539		1681	1691	1583		1840	
Flt Permitted		1.00		0.95	1.00		0.95	0.96	1.00		0.99	
Satd. Flow (perm)		3439		1770	3539		1681	1691	1583		1840	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	475	110	291	1368	1	204	7	161	1	3	0
RTOR Reduction (vph)	0	25	0	0	0	0	0	0	138	0	0	0
Lane Group Flow (vph)	0	560	0	291	1369	0	106	105	23	0	4	0
Turn Type	Prot	NA		Prot	NA		Split	NA	Perm		Split	NA
Protected Phases	5	2		1	6		8	8			4	4
Permitted Phases									8			
Actuated Green, G (s)		13.5		14.5	32.0		8.2	8.2	8.2		0.6	
Effective Green, g (s)		12.6		14.5	31.1		7.6	7.6	7.6		0.6	
Actuated g/C Ratio		0.23		0.27	0.57		0.14	0.14	0.14		0.01	
Clearance Time (s)		4.9		4.0	4.9		4.6	4.6	4.6		4.0	
Vehicle Extension (s)		2.0		2.0	2.0		2.0	2.0	2.0		2.0	
Lane Grp Cap (vph)		798		472	2026		235	236	221		20	
v/s Ratio Prot		0.16		0.16	c0.39		c0.06	0.06			c0.00	
v/s Ratio Perm									0.01			
v/c Ratio		0.70		0.62	0.68		0.45	0.44	0.10		0.20	
Uniform Delay, d1		19.1		17.5	8.1		21.4	21.4	20.4		26.6	
Progression Factor		1.00		1.00	1.00		1.00	1.00	1.00		1.00	
Incremental Delay, d2		2.3		1.7	0.7		0.5	0.5	0.1		1.8	
Delay (s)		21.4		19.1	8.8		21.9	21.9	20.4		28.4	
Level of Service		C		B	A		C	C	C		C	
Approach Delay (s)		21.4			10.6			21.3			28.4	
Approach LOS		C			B			C			C	

Intersection Summary		
HCM 2000 Control Delay	14.6	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.70	B
Actuated Cycle Length (s)	54.3	Sum of lost time (s)
Intersection Capacity Utilization	62.7%	19.0
Analysis Period (min)	15	ICU Level of Service
		B

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
35: Murrieta Blvd & Jack London Blvd

BART to Livermore Extension Project
2040 Enhanced Bus + Garage AM



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	68	297	902	215	243	176
Future Volume (vph)	68	297	902	215	243	176
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00	1.00	0.95	0.91	
Frt	1.00	0.85	1.00	1.00	0.94	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1770	1583	1770	3539	4765	
Flt Permitted	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	1770	1583	1770	3539	4765	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	74	323	980	234	264	191
RTOR Reduction (vph)	0	285	0	0	155	0
Lane Group Flow (vph)	74	38	980	234	300	0
Turn Type	Prot	Perm	Prot	NA	NA	
Protected Phases	4		5	2	6	
Permitted Phases		4				
Actuated Green, G (s)	9.2	9.2	46.3	60.6	10.3	
Effective Green, g (s)	9.2	9.2	46.3	60.6	10.3	
Actuated g/C Ratio	0.12	0.12	0.60	0.78	0.13	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	209	187	1053	2756	630	
v/s Ratio Prot	c0.04		c0.55	0.07	c0.06	
v/s Ratio Perm		0.02				
v/c Ratio	0.35	0.20	0.93	0.08	0.48	
Uniform Delay, d1	31.6	31.0	14.3	2.0	31.2	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	1.0	0.5	14.1	0.0	0.6	
Delay (s)	32.6	31.5	28.3	2.0	31.8	
Level of Service	C	C	C	A	C	
Approach Delay (s)	31.7			23.3	31.8	
Approach LOS	C			C	C	

Intersection Summary

HCM 2000 Control Delay	26.8	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.78		
Actuated Cycle Length (s)	77.8	Sum of lost time (s)	12.0
Intersection Capacity Utilization	72.4%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 36: Murrieta Blvd & Stanley Blvd

BART to Livermore Extension Project
 2040 Enhanced Bus + Garage AM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	215	777	261	24	1380	136	697	385	17	198	190	464
Future Volume (vph)	215	777	261	24	1380	136	697	385	17	198	190	464
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	5.8	5.8	4.0	5.8	5.8	5.8	5.8		5.8	5.8	4.9
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.97	0.95		1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	3433	3517		1770	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	3433	3517		1770	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	234	845	284	26	1500	148	758	418	18	215	207	504
RTOR Reduction (vph)	0	0	129	0	0	29	0	2	0	0	0	65
Lane Group Flow (vph)	234	845	155	26	1500	119	758	434	0	215	207	439
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Split	NA		Split	NA	Perm
Protected Phases	1	6		5	2	4	3	3		4	4	
Permitted Phases			6			2						4
Actuated Green, G (s)	7.0	56.2	56.2	3.6	52.8	84.9	31.0	31.0		32.1	32.1	32.1
Effective Green, g (s)	7.0	55.3	55.3	3.6	51.9	83.1	30.1	30.1		31.2	31.2	32.1
Actuated g/C Ratio	0.05	0.39	0.39	0.03	0.37	0.59	0.21	0.21		0.22	0.22	0.23
Clearance Time (s)	4.0	4.9	4.9	4.0	4.9	4.9	4.9	4.9		4.9	4.9	4.9
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	169	1382	618	45	1297	929	729	747		390	779	358
v/s Ratio Prot	c0.07	c0.24		0.01	c0.42	0.03	c0.22	0.12		0.12	0.06	
v/s Ratio Perm			0.10			0.05						c0.28
v/c Ratio	1.38	0.61	0.25	0.58	1.16	0.13	1.04	0.58		0.55	0.27	1.23
Uniform Delay, d1	67.3	34.5	29.1	68.2	44.8	13.1	55.8	50.1		49.0	45.7	54.7
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	205.4	0.8	0.2	16.7	79.5	0.1	44.1	1.2		1.7	0.2	124.2
Delay (s)	272.7	35.4	29.4	85.0	124.4	13.1	99.8	51.2		50.7	45.9	179.0
Level of Service	F	D	C	F	F	B	F	D		D	D	F
Approach Delay (s)		74.9			113.9			82.1			119.4	
Approach LOS		E			F			F			F	

Intersection Summary

HCM 2000 Control Delay	97.2	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.15		
Actuated Cycle Length (s)	141.6	Sum of lost time (s)	21.4
Intersection Capacity Utilization	100.5%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
37: Livermore Ave & I-580 WB Ramps

BART to Livermore Extension Project
2040 Enhanced Bus + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↖	↔		↗	↑			↕	
Traffic Volume (vph)	0	0	0	344	93	30	456	84	0	0	151	0
Future Volume (vph)	0	0	0	344	93	30	456	84	0	0	151	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)					4.0		4.0	4.0			4.0	
Lane Util. Factor					0.95		0.97	1.00			0.95	
Frt					0.99		1.00	1.00			1.00	
Flt Protected					0.96		0.95	1.00			1.00	
Satd. Flow (prot)					1690		3433	1863			3539	
Flt Permitted					0.96		0.95	1.00			1.00	
Satd. Flow (perm)					1690		3433	1863			3539	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	374	101	33	496	91	0	0	164	0
RTOR Reduction (vph)	0	0	0	0	3	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	0	505	0	496	91	0	0	164	0
Turn Type				Split	NA		Prot	NA			NA	
Protected Phases				8	8		5	2			6	
Permitted Phases												
Actuated Green, G (s)					36.1		18.8	54.2			31.9	
Effective Green, g (s)					36.1		18.3	55.9			33.6	
Actuated g/C Ratio					0.36		0.18	0.56			0.34	
Clearance Time (s)					4.0		3.5	5.7			5.7	
Vehicle Extension (s)					2.0		2.0	2.5			2.5	
Lane Grp Cap (vph)					610		628	1041			1189	
v/s Ratio Prot					c0.30		c0.14	0.05			c0.05	
v/s Ratio Perm												
v/c Ratio					0.83		0.79	0.09			0.14	
Uniform Delay, d1					29.1		39.0	10.2			23.1	
Progression Factor					1.00		0.86	0.75			1.00	
Incremental Delay, d2					8.6		5.2	0.1			0.2	
Delay (s)					37.7		38.6	7.8			23.4	
Level of Service					D		D	A			C	
Approach Delay (s)		0.0			37.7			33.9			23.4	
Approach LOS		A			D			C			C	

Intersection Summary

HCM 2000 Control Delay	34.1	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.56		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	56.0%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 38: Livermore Ave & I-580 EB Ramps

BART to Livermore Extension Project
 2040 Enhanced Bus + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔	↗					↕		↘	↕	
Traffic Volume (vph)	13	2	703	0	0	0	0	521	379	23	477	0
Future Volume (vph)	13	2	703	0	0	0	0	521	379	23	477	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0					3.0		5.0	3.0	
Lane Util. Factor		0.95	0.95					0.95		1.00	0.95	
Frt		0.86	0.85					0.94		1.00	1.00	
Flt Protected		1.00	1.00					1.00		0.95	1.00	
Satd. Flow (prot)		1512	1504					3316		1770	3539	
Flt Permitted		1.00	1.00					1.00		0.95	1.00	
Satd. Flow (perm)		1512	1504					3316		1770	3539	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	14	2	764	0	0	0	0	566	412	25	518	0
RTOR Reduction (vph)	0	200	200	0	0	0	0	233	0	0	0	0
Lane Group Flow (vph)	0	190	190	0	0	0	0	745	0	25	518	0
Turn Type	Prot	NA	Perm					NA		Prot	NA	
Protected Phases	7	4						2		1	6	
Permitted Phases			4									
Actuated Green, G (s)		16.6	16.6					20.6		0.8	25.4	
Effective Green, g (s)		16.6	16.6					21.6		0.0	26.4	
Actuated g/C Ratio		0.33	0.33					0.43		0.00	0.53	
Clearance Time (s)		4.0	4.0					4.0		4.0	4.0	
Vehicle Extension (s)		2.0	2.0					2.5		2.0	2.5	
Lane Grp Cap (vph)		501	499					1432		0	1868	
v/s Ratio Prot								c0.22			c0.15	
v/s Ratio Perm		0.13	c0.13									
v/c Ratio		0.38	0.38					0.52		no cap	0.28	
Uniform Delay, d1		12.8	12.8					10.4		Error	6.5	
Progression Factor		1.00	1.00					1.00			0.78	
Incremental Delay, d2		0.2	0.2					1.4		Error	0.3	
Delay (s)		12.9	13.0					11.8		Error	5.4	
Level of Service		B	B					B		F	A	
Approach Delay (s)		12.9			0.0			11.8			Error	
Approach LOS		B			A			B			F	

Intersection Summary

HCM 2000 Control Delay	Error	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	0.48		
Actuated Cycle Length (s)	50.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	56.0%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	283	246	89	31	746	96	250	493	69	139	743	452
Future Volume (vph)	283	246	89	31	746	96	250	493	69	139	743	452
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	2.7	4.0	4.0	2.7	4.0	4.0	4.9		4.0	4.9	4.9
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	1.00	0.95		1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.98		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	1770	3474		1770	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	1770	3474		1770	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	308	267	97	34	811	104	272	536	75	151	808	491
RTOR Reduction (vph)	0	0	74	0	0	75	0	9	0	0	0	50
Lane Group Flow (vph)	308	267	23	34	811	29	272	602	0	151	808	441
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA		Prot	NA	pm+ov
Protected Phases	3	8		7	4		1	6		5	2	3
Permitted Phases			8			4						2
Actuated Green, G (s)	14.9	28.8	28.8	20.0	33.9	33.9	21.0	40.4		14.8	34.2	49.1
Effective Green, g (s)	14.9	30.1	28.8	20.0	35.2	33.9	21.0	39.5		14.8	33.3	47.3
Actuated g/C Ratio	0.12	0.25	0.24	0.17	0.29	0.28	0.18	0.33		0.12	0.28	0.39
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	426	887	379	295	1038	447	309	1143		218	982	623
v/s Ratio Prot	c0.09	0.08		0.02	c0.23		c0.15	0.17		0.09	c0.23	0.08
v/s Ratio Perm			0.01			0.02						0.20
v/c Ratio	0.72	0.30	0.06	0.12	0.78	0.07	0.88	0.53		0.69	0.82	0.71
Uniform Delay, d1	50.6	36.4	35.2	42.5	38.9	31.5	48.3	32.7		50.4	40.6	30.6
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	6.0	0.2	0.1	0.2	3.9	0.1	24.0	1.7		9.1	7.8	3.7
Delay (s)	56.5	36.6	35.2	42.7	42.8	31.5	72.2	34.4		59.6	48.3	34.2
Level of Service	E	D	D	D	D	C	E	C		E	D	C
Approach Delay (s)		45.6			41.5			46.1			44.7	
Approach LOS		D			D			D			D	

Intersection Summary

HCM 2000 Control Delay	44.4	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.81		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	16.5
Intersection Capacity Utilization	77.2%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
40: First St/Springtown Blvd & I-580 WB Ramps

BART to Livermore Extension Project
2040 Enhanced Bus + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations			↗↘			↗	↗↘	↑			↗↘	↗
Traffic Volume (vph)	0	0	443	0	0	0	341	375	0	0	875	525
Future Volume (vph)	0	0	443	0	0	0	341	375	0	0	875	525
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)			4.5				4.5	4.0			4.5	4.5
Lane Util. Factor			0.88				0.97	1.00			0.95	1.00
Frt			0.85				1.00	1.00			1.00	0.85
Flt Protected			1.00				0.95	1.00			1.00	1.00
Satd. Flow (prot)			2787				3433	1863			3539	1583
Flt Permitted			1.00				0.95	1.00			1.00	1.00
Satd. Flow (perm)			2787				3433	1863			3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	482	0	0	0	371	408	0	0	951	571
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	71
Lane Group Flow (vph)	0	0	482	0	0	0	371	408	0	0	951	500
Turn Type			Over			Free	Prot	NA			NA	Perm
Protected Phases			5				5	2			6	
Permitted Phases						Free						6
Actuated Green, G (s)			21.8				21.8	100.0			70.2	70.2
Effective Green, g (s)			21.3				21.3	100.0			69.7	69.7
Actuated g/C Ratio			0.21				0.21	1.00			0.70	0.70
Clearance Time (s)			4.0				4.0	4.0			4.0	4.0
Vehicle Extension (s)			2.0				2.0	0.2			4.0	4.0
Lane Grp Cap (vph)			593				731	1863			2466	1103
v/s Ratio Prot			c0.17				0.11	0.22			0.27	
v/s Ratio Perm												c0.32
v/c Ratio			0.81				0.51	0.22			0.39	0.45
Uniform Delay, d1			37.5				34.7	0.0			6.3	6.7
Progression Factor			1.00				1.04	1.00			1.00	1.00
Incremental Delay, d2			7.9				0.2	0.3			0.5	1.3
Delay (s)			45.4				36.2	0.3			6.7	8.1
Level of Service			D				D	A			A	A
Approach Delay (s)		45.4			0.0			17.4			7.2	
Approach LOS		D			A			B			A	






















Intersection Summary

HCM 2000 Control Delay	16.7	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.54		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	49.7%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
41: First St & I-580 EB Ramps

BART to Livermore Extension Project
2040 Enhanced Bus + Garage AM

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations			 					 			 		
Traffic Volume (vph)	73	2	382	0	0	0	0	878	873	91	1200	0	
Future Volume (vph)	73	2	382	0	0	0	0	878	873	91	1200	0	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)		4.0	4.0					5.0	5.0	5.0	5.0		
Lane Util. Factor		1.00	0.88					0.95	1.00	1.00	0.95		
Frt		1.00	0.85					1.00	0.85	1.00	1.00		
Flt Protected		0.95	1.00					1.00	1.00	0.95	1.00		
Satd. Flow (prot)		1776	2787					3539	1583	1770	3539		
Flt Permitted		0.95	1.00					1.00	1.00	0.95	1.00		
Satd. Flow (perm)		1776	2787					3539	1583	1770	3539		
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	
Adj. Flow (vph)	79	2	415	0	0	0	0	954	949	99	1304	0	
RTOR Reduction (vph)	0	0	174	0	0	0	0	0	251	0	0	0	
Lane Group Flow (vph)	0	81	241	0	0	0	0	954	698	99	1304	0	
Turn Type	Perm	NA	Perm					NA	Perm	Prot	NA		
Protected Phases		4						2		1	6		
Permitted Phases	4		4						2				
Actuated Green, G (s)		12.4	12.4					67.5	67.5	8.1	79.6		
Effective Green, g (s)		11.9	11.9					67.0	67.0	7.1	79.1		
Actuated g/C Ratio		0.12	0.12					0.67	0.67	0.07	0.79		
Clearance Time (s)		3.5	3.5					4.5	4.5	4.0	4.5		
Vehicle Extension (s)		2.5	2.5					4.0	4.0	2.0	4.0		
Lane Grp Cap (vph)		211	331					2371	1060	125	2799		
v/s Ratio Prot								0.27		c0.06	0.37		
v/s Ratio Perm		0.05	c0.09						c0.44				
v/c Ratio		0.38	0.73					0.40	0.66	0.79	0.47		
Uniform Delay, d1		40.7	42.5					7.5	9.7	45.7	3.5		
Progression Factor		1.00	1.00					1.00	1.00	0.84	0.93		
Incremental Delay, d2		0.8	7.3					0.5	3.2	24.6	0.5		
Delay (s)		41.5	49.7					8.0	12.9	63.0	3.7		
Level of Service		D	D					A	B	E	A		
Approach Delay (s)		48.4			0.0			10.4			7.9		
Approach LOS		D			A			B			A		
Intersection Summary													
HCM 2000 Control Delay			14.5									HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio			0.68										
Actuated Cycle Length (s)			100.0									Sum of lost time (s)	14.0
Intersection Capacity Utilization			74.9%									ICU Level of Service	D
Analysis Period (min)			15										

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
42: 1st St & Mines Rd

BART to Livermore Extension Project
2040 Enhanced Bus + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗		↖↗	↑	↖	↖	↑↑↑		↖↗	↑↑↑	
Traffic Volume (vph)	41	59	47	534	102	364	26	1395	342	169	1322	21
Future Volume (vph)	41	59	47	534	102	364	26	1395	342	169	1322	21
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		0.97	1.00	1.00	1.00	0.91		0.97	0.91	
Frt	1.00	0.93		1.00	1.00	0.85	1.00	0.97		1.00	1.00	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1739		3433	1863	1583	1770	4935		3433	5073	
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	1739		3433	1863	1583	1770	4935		3433	5073	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	45	64	51	580	111	396	28	1516	372	184	1437	23
RTOR Reduction (vph)	0	35	0	0	0	48	0	43	0	0	1	0
Lane Group Flow (vph)	45	80	0	580	111	348	28	1845	0	184	1459	0
Turn Type	Prot	NA		Prot	NA	pm+ov	Prot	NA		Prot	NA	
Protected Phases	7	4		3	8	1	5	2		1	6	
Permitted Phases						8						
Actuated Green, G (s)	3.4	8.6		15.9	21.1	27.1	1.9	38.8		6.0	42.9	
Effective Green, g (s)	3.4	8.6		15.9	21.1	27.1	1.9	38.8		6.0	42.9	
Actuated g/C Ratio	0.04	0.10		0.19	0.25	0.32	0.02	0.45		0.07	0.50	
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	70	175		639	460	577	39	2244		241	2551	
v/s Ratio Prot	0.03	0.05		c0.17	0.06	c0.04	0.02	c0.37		c0.05	0.29	
v/s Ratio Perm						0.18						
v/c Ratio	0.64	0.46		0.91	0.24	0.60	0.72	0.82		0.76	0.57	
Uniform Delay, d1	40.4	36.1		34.0	25.7	24.6	41.4	20.2		39.0	14.8	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	18.4	1.9		16.6	0.3	1.8	47.4	2.6		13.4	0.3	
Delay (s)	58.8	38.0		50.6	26.0	26.4	88.8	22.8		52.3	15.1	
Level of Service	E	D		D	C	C	F	C		D	B	
Approach Delay (s)		43.9			39.2			23.8			19.3	
Approach LOS		D			D			C			B	























Intersection Summary

HCM 2000 Control Delay	26.4	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.86		
Actuated Cycle Length (s)	85.3	Sum of lost time (s)	16.0
Intersection Capacity Utilization	71.3%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group























HCM Unsignalized Intersection Capacity Analysis
 43: Vasco Rd & I-580 WB Ramps

BART to Livermore Extension Project
 2040 Enhanced Bus + Garage AM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations								  			  	
Traffic Volume (veh/h)	0	0	0	0	0	163	0	1043	0	0	1942	0
Future Volume (Veh/h)	0	0	0	0	0	163	0	1043	0	0	1942	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	0	0	0	177	0	1134	0	0	2111	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage (veh)												
Upstream signal (ft)											524	
pX, platoon unblocked												
vC, conflicting volume	2666	3245	704	1838	3245	378	2111			1134		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	2666	3245	704	1838	3245	378	2111			1134		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	100	100	71	100			100		
cM capacity (veh/h)	8	9	380	47	9	620	256			612		
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	NB 4	SB 1	SB 2	SB 3	SB 4		
Volume Total	0	177	378	378	378	0	704	704	704	0		
Volume Left	0	0	0	0	0	0	0	0	0	0		
Volume Right	0	177	0	0	0	0	0	0	0	0		
cSH	1700	620	1700	1700	1700	1700	1700	1700	1700	1700		
Volume to Capacity	0.00	0.29	0.22	0.22	0.22	0.00	0.41	0.41	0.41	0.00		
Queue Length 95th (ft)	0	29	0	0	0	0	0	0	0	0		
Control Delay (s)	0.0	13.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
Lane LOS	A	B										
Approach Delay (s)	0.0	13.1	0.0				0.0					
Approach LOS	A	B										
Intersection Summary												
Average Delay			0.7									
Intersection Capacity Utilization			40.9%		ICU Level of Service					A		
Analysis Period (min)			15									

HCM Unsignalized Intersection Capacity Analysis
 44: Vasco Rd & I-580 EB Ramps

BART to Livermore Extension Project
 2040 Enhanced Bus + Garage AM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations								  			  	
Traffic Volume (veh/h)	0	0	0	0	0	0	0	1081	0	73	2071	0
Future Volume (Veh/h)	0	0	0	0	0	0	0	1081	0	73	2071	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	0	0	0	0	0	1175	0	79	2251	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	2801	3584	750	2083	3584	392	2251			1175		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	2801	3584	750	2083	3584	392	2251			1175		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	100	100	100	100			87		
cM capacity (veh/h)	8	5	354	27	5	607	225			590		
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	NB 4	SB 1	SB 2	SB 3	SB 4		
Volume Total	0	0	392	392	392	0	79	750	750	750		
Volume Left	0	0	0	0	0	0	79	0	0	0		
Volume Right	0	0	0	0	0	0	0	0	0	0		
cSH	1700	1700	1700	1700	1700	1700	590	1700	1700	1700		
Volume to Capacity	0.00	0.00	0.23	0.23	0.23	0.00	0.13	0.44	0.44	0.44		
Queue Length 95th (ft)	0	0	0	0	0	0	12	0	0	0		
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	12.0	0.0	0.0	0.0		
Lane LOS	A	A					B					
Approach Delay (s)	0.0	0.0	0.0				0.4					
Approach LOS	A	A										
Intersection Summary												
Average Delay			0.3									
Intersection Capacity Utilization			43.3%		ICU Level of Service					A		
Analysis Period (min)			15									

HCM Signalized Intersection Capacity Analysis
45: Vasco Rd & East Ave

BART to Livermore Extension Project
2040 Enhanced Bus + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	297	368	53	10	25	19	65	256	198	259	293	295
Future Volume (vph)	297	368	53	10	25	19	65	256	198	259	293	295
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	0.95		0.97	1.00	1.00
Frt	1.00	0.98		1.00	0.93		1.00	0.93		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	3472		1770	3307		1770	3308		3433	1863	1583
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1770	3472		1770	3307		1770	3308		3433	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	323	400	58	11	27	21	71	278	215	282	318	321
RTOR Reduction (vph)	0	20	0	0	20	0	0	158	0	0	0	216
Lane Group Flow (vph)	323	438	0	11	28	0	71	335	0	282	318	105
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												6
Actuated Green, G (s)	12.5	15.1		0.6	3.2		2.1	13.3		5.2	16.4	16.4
Effective Green, g (s)	12.5	15.1		0.6	3.2		2.1	13.3		5.2	16.4	16.4
Actuated g/C Ratio	0.25	0.30		0.01	0.06		0.04	0.26		0.10	0.33	0.33
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	440	1044		21	210		74	876		355	608	517
v/s Ratio Prot	c0.18	c0.13		0.01	0.01		0.04	0.10		c0.08	c0.17	
v/s Ratio Perm												0.07
v/c Ratio	0.73	0.42		0.52	0.13		0.96	0.38		0.79	0.52	0.20
Uniform Delay, d1	17.3	14.0		24.7	22.2		24.0	15.1		22.0	13.7	12.2
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	6.2	0.3		21.6	0.3		89.6	0.3		11.6	0.8	0.2
Delay (s)	23.6	14.3		46.2	22.5		113.6	15.4		33.6	14.5	12.4
Level of Service	C	B		D	C		F	B		C	B	B
Approach Delay (s)		18.1			26.9			27.7			19.6	
Approach LOS		B			C			C			B	

Intersection Summary

HCM 2000 Control Delay	21.3	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.67		
Actuated Cycle Length (s)	50.2	Sum of lost time (s)	16.0
Intersection Capacity Utilization	53.9%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
46: Greenville Rd & I-580 WB Ramps

BART to Livermore Extension Project
2040 Enhanced Bus + Garage AM
























Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↖↗		↖		↕↕	↖		↕↔	
Traffic Volume (vph)	0	0	0	233	0	39	0	122	303	0	942	522
Future Volume (vph)	0	0	0	233	0	39	0	122	303	0	942	522
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0		4.0		4.0	4.0		4.0	
Lane Util. Factor				0.97		1.00		0.95	1.00		0.95	
Frt				1.00		0.85		1.00	0.85		0.95	
Flt Protected				0.95		1.00		1.00	1.00		1.00	
Satd. Flow (prot)				3433		1583		3539	1583		3350	
Flt Permitted				0.95		1.00		1.00	1.00		1.00	
Satd. Flow (perm)				3433		1583		3539	1583		3350	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	253	0	42	0	133	329	0	1024	567
RTOR Reduction (vph)	0	0	0	0	0	35	0	0	105	0	150	0
Lane Group Flow (vph)	0	0	0	253	0	7	0	133	224	0	1441	0
Turn Type				Prot		Prot		NA	Perm		NA	
Protected Phases				3		3		2			6	
Permitted Phases									2			
Actuated Green, G (s)				7.9		7.9		34.1	34.1		34.1	
Effective Green, g (s)				7.9		7.9		34.1	34.1		34.1	
Actuated g/C Ratio				0.16		0.16		0.68	0.68		0.68	
Clearance Time (s)				4.0		4.0		4.0	4.0		4.0	
Vehicle Extension (s)				3.0		3.0		3.0	3.0		3.0	
Lane Grp Cap (vph)				542		250		2413	1079		2284	
v/s Ratio Prot				c0.07		0.00		0.04			c0.43	
v/s Ratio Perm									0.14			
v/c Ratio				0.47		0.03		0.06	0.21		0.63	
Uniform Delay, d1				19.1		17.8		2.6	2.9		4.4	
Progression Factor				1.00		1.00		1.19	6.03		1.00	
Incremental Delay, d2				0.6		0.0		0.0	0.4		1.3	
Delay (s)				19.8		17.8		3.2	18.2		5.8	
Level of Service				B		B		A	B		A	
Approach Delay (s)		0.0			19.5			13.9			5.8	
Approach LOS		A			B			B			A	

Intersection Summary			
HCM 2000 Control Delay	9.1	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.60		
Actuated Cycle Length (s)	50.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	56.1%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
47: Greenville Rd & I-580 EB Ramps

BART to Livermore Extension Project
2040 Enhanced Bus + Garage AM

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations	 							 			 		
Traffic Volume (vph)	34	0	140	0	0	0	0	400	73	0	891	30	
Future Volume (vph)	34	0	140	0	0	0	0	400	73	0	891	30	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)	4.0		4.0					4.0	4.0		4.0	4.0	
Lane Util. Factor	0.97		1.00					0.95	1.00		0.95	1.00	
Frt	1.00		0.85					1.00	0.85		1.00	0.85	
Flt Protected	0.95		1.00					1.00	1.00		1.00	1.00	
Satd. Flow (prot)	3433		1583					3539	1583		3539	1583	
Flt Permitted	0.95		1.00					1.00	1.00		1.00	1.00	
Satd. Flow (perm)	3433		1583					3539	1583		3539	1583	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	
Adj. Flow (vph)	37	0	152	0	0	0	0	435	79	0	968	33	
RTOR Reduction (vph)	0	0	105	0	0	0	0	0	22	0	0	9	
Lane Group Flow (vph)	37	0	47	0	0	0	0	435	57	0	968	24	
Turn Type	Prot		Prot					NA	Perm		NA	Perm	
Protected Phases	7		7					2			6		
Permitted Phases									2			6	
Actuated Green, G (s)	6.2		6.2					35.8	35.8		35.8	35.8	
Effective Green, g (s)	6.2		6.2					35.8	35.8		35.8	35.8	
Actuated g/C Ratio	0.12		0.12					0.72	0.72		0.72	0.72	
Clearance Time (s)	4.0		4.0					4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0		3.0					3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	425		196					2533	1133		2533	1133	
v/s Ratio Prot	0.01		c0.03					0.12			c0.27		
v/s Ratio Perm									0.04			0.01	
v/c Ratio	0.09		0.24					0.17	0.05		0.38	0.02	
Uniform Delay, d1	19.4		19.8					2.3	2.1		2.8	2.0	
Progression Factor	1.00		1.00					0.74	0.40		0.85	0.72	
Incremental Delay, d2	0.1		0.6					0.1	0.1		0.3	0.0	
Delay (s)	19.5		20.4					1.8	0.9		2.7	1.5	
Level of Service	B		C					A	A		A	A	
Approach Delay (s)		20.2			0.0			1.7			2.7		
Approach LOS		C			A			A			A		
Intersection Summary													
HCM 2000 Control Delay			4.3									HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio			0.36										
Actuated Cycle Length (s)			50.0									Sum of lost time (s)	8.0
Intersection Capacity Utilization			40.0%									ICU Level of Service	A
Analysis Period (min)			15										

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 48: Greenville Rd & Northfront Road/Altamont Pass Road

BART to Livermore Extension Project
 2040 Enhanced Bus + Garage AM



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↑	↑	↑	↑	↑
Traffic Volume (vph)	6	651	647	507	91	61
Future Volume (vph)	6	651	647	507	91	61
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	1863	1583	1770	1863	1770	1583
Flt Permitted	1.00	1.00	0.75	1.00	0.95	1.00
Satd. Flow (perm)	1863	1583	1403	1863	1770	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	7	708	703	551	99	66
RTOR Reduction (vph)	0	251	0	0	0	54
Lane Group Flow (vph)	7	457	703	551	99	12
Turn Type	NA	Perm	Perm	NA	Prot	Perm
Protected Phases	4			8	2	
Permitted Phases		4	8			2
Actuated Green, G (s)	29.5	29.5	29.5	29.5	8.2	8.2
Effective Green, g (s)	29.5	29.5	29.5	29.5	8.2	8.2
Actuated g/C Ratio	0.65	0.65	0.65	0.65	0.18	0.18
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	1202	1021	905	1202	317	284
v/s Ratio Prot	0.00			0.30	c0.06	
v/s Ratio Perm		0.29	c0.50			0.01
v/c Ratio	0.01	0.45	0.78	0.46	0.31	0.04
Uniform Delay, d1	2.9	4.0	5.8	4.1	16.3	15.5
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.0	0.3	4.2	0.3	0.6	0.1
Delay (s)	2.9	4.4	10.0	4.4	16.9	15.6
Level of Service	A	A	A	A	B	B
Approach Delay (s)	4.3			7.5	16.3	
Approach LOS	A			A	B	

Intersection Summary

HCM 2000 Control Delay	7.1	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.68		
Actuated Cycle Length (s)	45.7	Sum of lost time (s)	8.0
Intersection Capacity Utilization	82.8%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
49: Greenville Rd & Southfront Rd

BART to Livermore Extension Project
2040 Enhanced Bus + Garage AM



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	118	172	124	380	749	223
Future Volume (vph)	118	172	124	380	749	223
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.2	5.2	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.88	0.97	0.95	0.95	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	3433	2787	3433	3539	3539	1583
Flt Permitted	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (perm)	3433	2787	3433	3539	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	128	187	135	413	814	242
RTOR Reduction (vph)	0	167	0	0	0	87
Lane Group Flow (vph)	128	20	135	413	814	155
Turn Type	Prot	Perm	Prot	NA	NA	Perm
Protected Phases	8		1	6	2	
Permitted Phases		8				2
Actuated Green, G (s)	11.2	11.2	12.1	78.5	62.4	62.4
Effective Green, g (s)	10.6	10.6	12.1	80.2	64.1	64.1
Actuated g/C Ratio	0.11	0.11	0.12	0.80	0.64	0.64
Clearance Time (s)	4.6	4.6	4.0	5.7	5.7	5.7
Vehicle Extension (s)	5.0	5.0	6.0	2.5	2.5	2.5
Lane Grp Cap (vph)	363	295	415	2838	2268	1014
v/s Ratio Prot	c0.04		c0.04	0.12	c0.23	
v/s Ratio Perm		0.01				0.10
v/c Ratio	0.35	0.07	0.33	0.15	0.36	0.15
Uniform Delay, d1	41.5	40.2	40.2	2.2	8.4	7.1
Progression Factor	1.00	1.00	1.00	1.00	0.79	0.58
Incremental Delay, d2	1.2	0.2	1.3	0.1	0.4	0.3
Delay (s)	42.8	40.5	41.5	2.3	7.0	4.5
Level of Service	D	D	D	A	A	A
Approach Delay (s)	41.4			12.0	6.4	
Approach LOS	D			B	A	

Intersection Summary

HCM 2000 Control Delay	13.8	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.35		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	13.2
Intersection Capacity Utilization	38.6%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
50: Greenville Rd & Patterson Pass Rd

BART to Livermore Extension Project
2040 Enhanced Bus + Garage AM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	37	6	74	253	439	289	21	143	1	6	336	51
Future Volume (vph)	37	6	74	253	439	289	21	143	1	6	336	51
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.86		1.00	0.94		1.00	1.00		1.00	0.98	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1606		1770	1752		1770	1861		1770	1826	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	1606		1770	1752		1770	1861		1770	1826	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	40	7	80	275	477	314	23	155	1	7	365	55
RTOR Reduction (vph)	0	62	0	0	27	0	0	0	0	0	6	0
Lane Group Flow (vph)	40	25	0	275	764	0	23	156	0	7	414	0
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												
Actuated Green, G (s)	2.1	18.6		21.5	38.0		1.4	26.0		0.7	25.3	
Effective Green, g (s)	2.1	18.6		21.5	38.0		1.4	26.0		0.7	25.3	
Actuated g/C Ratio	0.03	0.22		0.26	0.46		0.02	0.31		0.01	0.31	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	44	360		459	804		29	584		14	557	
v/s Ratio Prot	0.02	0.02		c0.16	c0.44		c0.01	0.08		0.00	c0.23	
v/s Ratio Perm												
v/c Ratio	0.91	0.07		0.60	0.95		0.79	0.27		0.50	0.74	
Uniform Delay, d1	40.3	25.3		26.9	21.5		40.6	21.3		40.9	25.8	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	99.9	0.1		2.1	20.6		83.5	1.1		25.4	8.7	
Delay (s)	140.1	25.4		29.0	42.1		124.1	22.4		66.3	34.6	
Level of Service	F	C		C	D		F	C		E	C	
Approach Delay (s)		61.5			38.7			35.5			35.1	
Approach LOS		E			D			D			D	

Intersection Summary

HCM 2000 Control Delay	39.2	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.87		
Actuated Cycle Length (s)	82.8	Sum of lost time (s)	16.0
Intersection Capacity Utilization	68.2%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
1: Dougherty Rd & Amador Valley Rd

BART to Livermore Extension Project
2040 Enhanced Bus + Garage PM



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	395	470	832	2122	1133	317
Future Volume (vph)	395	470	832	2122	1133	317
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00	0.97	0.91	0.91	
Frt	1.00	0.85	1.00	1.00	0.97	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1770	1583	3433	5085	4918	
Flt Permitted	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	1770	1583	3433	5085	4918	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	429	511	904	2307	1232	345
RTOR Reduction (vph)	0	375	0	0	41	0
Lane Group Flow (vph)	429	136	904	2307	1536	0
Turn Type	Perm	Perm	Prot	NA	NA	
Protected Phases			5	2	6	
Permitted Phases	4	4				
Actuated Green, G (s)	31.0	31.0	33.3	77.3	40.0	
Effective Green, g (s)	31.0	31.0	33.3	77.3	40.0	
Actuated g/C Ratio	0.27	0.27	0.29	0.66	0.34	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	471	421	982	3379	1691	
v/s Ratio Prot			c0.26	0.45	c0.31	
v/s Ratio Perm	c0.24	0.09				
v/c Ratio	0.91	0.32	0.92	0.68	0.91	
Uniform Delay, d1	41.3	34.2	40.2	12.0	36.4	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	21.7	0.4	13.5	0.6	7.5	
Delay (s)	63.0	34.7	53.7	12.6	43.9	
Level of Service	E	C	D	B	D	
Approach Delay (s)	47.6			24.1	43.9	
Approach LOS	D			C	D	

Intersection Summary

HCM 2000 Control Delay	33.4	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.91		
Actuated Cycle Length (s)	116.3	Sum of lost time (s)	12.0
Intersection Capacity Utilization	84.6%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

2: Hopyard Road/Dougherty Rd & Dublin Blvd

BART to Livermore Extension Project
2040 Enhanced Bus + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔↔	↑↑↑	↔↔	↔↔↔	↑↑↑	↔	↔↔↔	↑↑↑	↔↔	↔↔	↑↑↑	↔
Traffic Volume (vph)	97	1160	898	628	1062	941	845	2012	318	707	1221	39
Future Volume (vph)	97	1160	898	628	1062	941	845	2012	318	707	1221	39
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	6.0	5.0	5.0	5.5	5.0	5.0	5.5	5.0	5.0	5.5	
Lane Util. Factor	0.97	0.91	0.88	0.94	0.91	1.00	0.94	0.91	0.88	0.97	0.86	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	3433	5085	2787	4990	5085	1583	4990	5085	2787	3433	6378	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	3433	5085	2787	4990	5085	1583	4990	5085	2787	3433	6378	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	105	1261	976	683	1154	1023	918	2187	346	768	1327	42
RTOR Reduction (vph)	0	0	60	0	0	70	0	0	57	0	4	0
Lane Group Flow (vph)	105	1261	916	683	1154	953	918	2187	289	768	1365	0
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	
Protected Phases	5	2	3	1	6	7	3	8	1	7	4	
Permitted Phases			2			6			8			
Actuated Green, G (s)	17.1	35.5	55.3	19.0	37.9	51.9	19.8	45.0	64.0	14.0	39.2	
Effective Green, g (s)	17.1	35.5	55.3	19.0	37.9	51.9	19.8	45.0	64.0	14.0	39.2	
Actuated g/C Ratio	0.13	0.26	0.41	0.14	0.28	0.38	0.15	0.33	0.47	0.10	0.29	
Clearance Time (s)	5.0	6.0	5.0	5.0	5.5	5.0	5.0	5.5	5.0	5.0	5.5	
Vehicle Extension (s)	2.0	4.5	2.0	2.0	4.5	2.0	2.0	4.5	2.0	2.0	4.5	
Lane Grp Cap (vph)	434	1337	1141	702	1427	608	731	1695	1321	356	1851	
v/s Ratio Prot	0.03	c0.25	0.12	0.14	0.23	c0.16	0.18	c0.43	0.03	c0.22	0.21	
v/s Ratio Perm			0.21			0.44			0.07			
v/c Ratio	0.24	0.94	0.80	0.97	0.81	1.57	1.26	1.29	0.22	2.16	0.74	
Uniform Delay, d1	53.1	48.8	35.1	57.7	45.2	41.5	57.6	45.0	20.8	60.5	43.3	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.1	13.6	3.9	27.1	3.9	263.6	126.1	135.2	0.0	530.0	1.8	
Delay (s)	53.2	62.3	39.0	84.8	49.1	305.1	183.7	180.2	20.9	590.5	45.0	
Level of Service	D	E	D	F	D	F	F	F	C	F	D	
Approach Delay (s)		52.2			149.2			165.2			241.1	
Approach LOS		D			F			F			F	

Intersection Summary

HCM 2000 Control Delay	151.4	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.46		
Actuated Cycle Length (s)	135.0	Sum of lost time (s)	21.5
Intersection Capacity Utilization	122.6%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 3: Dougherty Rd/Hopyard Road & I-580 WB Ramps

BART to Livermore Extension Project
 2040 Enhanced Bus + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↔		↔		↑↑↑			↑↑↑	↔
Traffic Volume (vph)	0	0	0	325	0	674	0	2527	0	0	1656	0
Future Volume (vph)	0	0	0	325	0	674	0	2527	0	0	1656	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0		4.0		4.0			4.0	
Lane Util. Factor				0.97		0.88		0.91			0.86	
Frt				1.00		0.85		1.00			1.00	
Flt Protected				0.95		1.00		1.00			1.00	
Satd. Flow (prot)				3433		2787		5085			4806	
Flt Permitted				0.95		1.00		1.00			1.00	
Satd. Flow (perm)				3433		2787		5085			4806	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	353	0	733	0	2747	0	0	1800	0
RTOR Reduction (vph)	0	0	0	0	0	17	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	353	0	716	0	2747	0	0	1800	0
Turn Type				Prot		Prot		NA			NA	Perm
Protected Phases				4		4		2			6	
Permitted Phases												6
Actuated Green, G (s)				31.2		31.2		68.0			68.0	
Effective Green, g (s)				32.6		32.6		69.4			69.4	
Actuated g/C Ratio				0.30		0.30		0.63			0.63	
Clearance Time (s)				5.4		5.4		5.4			5.4	
Vehicle Extension (s)				3.0		3.0		3.0			3.0	
Lane Grp Cap (vph)				1017		825		3208			3032	
v/s Ratio Prot				0.10		c0.26		c0.54			0.37	
v/s Ratio Perm												
v/c Ratio				0.35		0.87		0.86			0.59	
Uniform Delay, d1				30.4		36.7		16.3			12.0	
Progression Factor				1.00		1.00		0.88			1.00	
Incremental Delay, d2				0.2		9.6		0.3			0.9	
Delay (s)				30.6		46.2		14.7			12.8	
Level of Service				C		D		B			B	
Approach Delay (s)		0.0			41.1			14.7			12.8	
Approach LOS		A			D			B			B	

Intersection Summary			
HCM 2000 Control Delay	19.2	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.86		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	79.1%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 4: Hopyard Rd/Dougherty Rd & I-580 EB Ramps

BART to Livermore Extension Project
 2040 Enhanced Bus + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↗↘		↗↘					↑↑↑	↗		↑↑↑	↗
Traffic Volume (vph)	1151	0	982	0	0	0	0	2647	0	0	1313	0
Future Volume (vph)	1151	0	982	0	0	0	0	2647	0	0	1313	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0					4.0			4.0	
Lane Util. Factor	0.97		0.88					0.91			0.86	
Frt	1.00		0.85					1.00			1.00	
Flt Protected	0.95		1.00					1.00			1.00	
Satd. Flow (prot)	3433		2787					5085			4806	
Flt Permitted	0.95		1.00					1.00			1.00	
Satd. Flow (perm)	3433		2787					5085			4806	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	1251	0	1067	0	0	0	0	2877	0	0	1427	0
RTOR Reduction (vph)	0	0	40	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	1251	0	1027	0	0	0	0	2877	0	0	1427	0
Turn Type	Prot		Prot					NA	Free		NA	Perm
Protected Phases	4		4					2			6	
Permitted Phases									Free			6
Actuated Green, G (s)	38.6		38.6					60.6			60.6	
Effective Green, g (s)	40.0		40.0					62.0			62.0	
Actuated g/C Ratio	0.36		0.36					0.56			0.56	
Clearance Time (s)	5.4		5.4					5.4			5.4	
Vehicle Extension (s)	3.0		3.0					3.0			3.0	
Lane Grp Cap (vph)	1248		1013					2866			2708	
v/s Ratio Prot	0.36		c0.37					c0.57			0.30	
v/s Ratio Perm												
v/c Ratio	1.00		1.01					1.00			0.53	
Uniform Delay, d1	35.0		35.0					24.0			14.9	
Progression Factor	1.00		1.00					1.00			1.77	
Incremental Delay, d2	26.1		31.7					17.7			0.6	
Delay (s)	61.1		66.7					41.7			27.0	
Level of Service	E		E					D			C	
Approach Delay (s)		63.7			0.0			41.7			27.0	
Approach LOS		E			A			D			C	
























Intersection Summary

HCM 2000 Control Delay	46.2	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	1.01		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	90.6%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group





































HCM Signalized Intersection Capacity Analysis
5: Hopyard Rd & Owens Rd

BART to Livermore Extension Project
2040 Enhanced Bus + Garage PM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	388	277	251	538	298	372	240	977	301	488	1588	265
Future Volume (vph)	388	277	251	538	298	372	240	977	301	488	1588	265
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	2.7	2.7		2.7	2.7	2.7	4.0	2.3	2.3	4.0	2.3	
Lane Util. Factor	0.91	0.91		1.00	0.95	0.95	1.00	0.91	1.00	0.97	0.91	
Frt	1.00	0.95		1.00	0.96	0.85	1.00	1.00	0.85	1.00	0.98	
Flt Protected	0.95	0.99		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1610	3169		1770	1696	1504	1770	5085	1583	3433	4976	
Flt Permitted	0.95	0.99		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1610	3169		1770	1696	1504	1770	5085	1583	3433	4976	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	422	301	273	585	324	404	261	1062	327	530	1726	288
RTOR Reduction (vph)	0	55	0	0	11	24	0	0	231	0	19	0
Lane Group Flow (vph)	232	709	0	585	438	255	261	1062	96	530	1995	0
Turn Type	Split	NA		Split	NA	pm+ov	Prot	NA	Perm	Prot	NA	
Protected Phases	8	8		4	4	1	5	2		1	6	
Permitted Phases						4			2			
Actuated Green, G (s)	18.0	18.0		29.0	29.0	52.3	14.0	33.7	33.7	23.3	43.0	
Effective Green, g (s)	19.3	19.3		30.3	30.3	54.9	14.0	35.4	35.4	23.3	44.7	
Actuated g/C Ratio	0.16	0.16		0.25	0.25	0.46	0.12	0.29	0.29	0.19	0.37	
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	258	509		446	428	721	206	1500	466	666	1853	
v/s Ratio Prot	0.14	c0.22		c0.33	0.26	0.07	c0.15	0.21		0.15	c0.40	
v/s Ratio Perm						0.10			0.06			
v/c Ratio	0.90	1.39		1.31	1.02	0.35	1.27	0.71	0.21	0.80	1.08	
Uniform Delay, d1	49.4	50.4		44.9	44.9	21.1	53.0	37.7	31.8	46.1	37.6	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	30.6	188.2		155.6	49.4	0.3	152.8	2.8	1.0	6.5	44.9	
Delay (s)	80.0	238.6		200.4	94.3	21.4	205.8	40.5	32.8	52.6	82.5	
Level of Service	F	F		F	F	C	F	D	C	D	F	
Approach Delay (s)		201.7			126.1			65.1			76.3	
Approach LOS		F			F			E			E	
Intersection Summary												
HCM 2000 Control Delay			102.7			HCM 2000 Level of Service			F			
HCM 2000 Volume to Capacity ratio			1.22									
Actuated Cycle Length (s)			120.0			Sum of lost time (s)			11.7			
Intersection Capacity Utilization			111.0%			ICU Level of Service			H			
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis
6: Hopyard Rd & Stoneridge Dr

BART to Livermore Extension Project
2040 Enhanced Bus + Garage PM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 	  		 	  		  	 		 	  	
Traffic Volume (vph)	269	1175	687	120	1367	196	622	865	91	271	921	208
Future Volume (vph)	269	1175	687	120	1367	196	622	865	91	271	921	208
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.91	1.00	0.97	0.91	1.00	0.94	0.95	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5085	1583	3433	5085	1583	4990	3539	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5085	1583	3433	5085	1583	4990	3539	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	292	1277	747	130	1486	213	676	940	99	295	1001	226
RTOR Reduction (vph)	0	0	186	0	0	151	0	0	71	0	0	121
Lane Group Flow (vph)	292	1277	561	130	1486	62	676	940	28	295	1001	105
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8			2			6
Actuated Green, G (s)	4.0	18.6	18.6	3.2	17.8	17.8	7.0	17.0	17.0	6.0	16.0	16.0
Effective Green, g (s)	4.0	18.6	18.6	3.2	17.8	17.8	7.0	17.0	17.0	6.0	16.0	16.0
Actuated g/C Ratio	0.07	0.31	0.31	0.05	0.29	0.29	0.12	0.28	0.28	0.10	0.26	0.26
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	225	1555	484	180	1488	463	574	989	442	338	1338	416
v/s Ratio Prot	c0.09	0.25		0.04	0.29		c0.14	c0.27		0.09	0.20	
v/s Ratio Perm			c0.35			0.04			0.02			0.07
v/c Ratio	1.30	0.82	1.16	0.72	1.00	0.13	1.18	0.95	0.06	0.87	0.75	0.25
Uniform Delay, d1	28.4	19.6	21.1	28.4	21.5	15.8	26.9	21.5	16.1	27.0	20.6	17.7
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	162.7	3.6	92.5	13.3	22.8	0.1	97.1	17.8	0.1	21.1	2.3	0.3
Delay (s)	191.1	23.2	113.6	41.7	44.3	16.0	124.0	39.3	16.1	48.2	22.9	18.0
Level of Service	F	C	F	D	D	B	F	D	B	D	C	B
Approach Delay (s)		73.5			40.8			71.4			27.1	
Approach LOS		E			D			E			C	

Intersection Summary			
HCM 2000 Control Delay	55.3	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.14		
Actuated Cycle Length (s)	60.8	Sum of lost time (s)	16.0
Intersection Capacity Utilization	79.1%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

7: Hopyard Rd & Las Positas Blvd

BART to Livermore Extension Project

2040 Enhanced Bus + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↕	↖	↖↗	↕	↖	↖↗	↕↕	↖	↖↗	↕↕	↖
Traffic Volume (vph)	102	260	487	610	422	51	380	1007	268	72	1525	73
Future Volume (vph)	102	260	487	610	422	51	380	1007	268	72	1525	73
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.95	1.00	0.97	0.95	1.00	0.97	0.91	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	3433	3539	1583	3433	5085	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	3433	3539	1583	3433	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	111	283	529	663	459	55	413	1095	291	78	1658	79
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	51
Lane Group Flow (vph)	111	283	529	663	459	55	413	1095	291	78	1658	28
Turn Type	Prot	NA	Free	Prot	NA	Free	Prot	NA	Free	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			Free			Free			Free			6
Actuated Green, G (s)	4.8	13.0	87.9	17.0	25.2	87.9	11.0	37.9	87.9	4.0	30.9	30.9
Effective Green, g (s)	4.8	13.0	87.9	17.0	25.2	87.9	11.0	37.9	87.9	4.0	30.9	30.9
Actuated g/C Ratio	0.05	0.15	1.00	0.19	0.29	1.00	0.13	0.43	1.00	0.05	0.35	0.35
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	187	523	1583	663	1014	1583	429	2192	1583	156	1787	556
v/s Ratio Prot	0.03	c0.08		c0.19	0.13		c0.12	0.22		0.02	c0.33	
v/s Ratio Perm			0.33			0.03			0.18			0.02
v/c Ratio	0.59	0.54	0.33	1.00	0.45	0.03	0.96	0.50	0.18	0.50	0.93	0.05
Uniform Delay, d1	40.6	34.7	0.0	35.5	25.7	0.0	38.2	18.1	0.0	41.0	27.4	18.8
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	5.0	1.1	0.6	35.0	0.3	0.0	33.7	0.2	0.3	2.5	8.9	0.0
Delay (s)	45.6	35.8	0.6	70.4	26.0	0.0	71.9	18.3	0.3	43.5	36.3	18.8
Level of Service	D	D	A	E	C	A	E	B	A	D	D	B
Approach Delay (s)		16.8			49.8			27.7			35.8	
Approach LOS		B			D			C			D	

Intersection Summary

HCM 2000 Control Delay	33.1	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.88		
Actuated Cycle Length (s)	87.9	Sum of lost time (s)	16.0
Intersection Capacity Utilization	78.2%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

8: Willow Rd & Owens Rd

BART to Livermore Extension Project

2040 Enhanced Bus + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	89	827	191	124	691	82	185	79	0	194	67	123
Future Volume (vph)	89	827	191	124	691	82	185	79	0	194	67	123
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	5.3	4.0		5.3	4.0	4.0
Lane Util. Factor	0.97	0.91		0.97	0.91	1.00	1.00	0.95		1.00	1.00	1.00
Frt	1.00	0.97		1.00	1.00	0.85	1.00	1.00		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	4942		3433	5085	1583	1770	3539		1770	1863	1583
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.71	1.00		0.70	1.00	1.00
Satd. Flow (perm)	3433	4942		3433	5085	1583	1322	3539		1301	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	97	899	208	135	751	89	201	86	0	211	73	134
RTOR Reduction (vph)	0	25	0	0	0	41	0	0	0	0	0	103
Lane Group Flow (vph)	97	1082	0	135	751	48	201	86	0	211	73	31
Turn Type	Prot	NA		Prot	NA	Perm	Perm	NA	Perm	Perm	NA	Perm
Protected Phases	1	6		5	2			4				8
Permitted Phases						2	4		4	8		8
Actuated Green, G (s)	13.4	60.7		10.4	57.7	57.7	23.9	23.9		23.9	23.9	23.9
Effective Green, g (s)	13.4	62.4		10.4	59.4	59.4	23.9	25.2		23.9	25.2	25.2
Actuated g/C Ratio	0.12	0.57		0.09	0.54	0.54	0.22	0.23		0.22	0.23	0.23
Clearance Time (s)	4.0	5.7		4.0	5.7	5.7	5.3	5.3		5.3	5.3	5.3
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	418	2803		324	2745	854	287	810		282	426	362
v/s Ratio Prot	c0.03	c0.22		c0.04	0.15			0.02			0.04	
v/s Ratio Perm						0.03	0.15			c0.16		0.02
v/c Ratio	0.23	0.39		0.42	0.27	0.06	0.70	0.11		0.75	0.17	0.08
Uniform Delay, d1	43.7	13.2		46.9	13.7	12.0	39.7	33.5		40.2	34.0	33.3
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	0.3	0.4		0.9	0.2	0.1	7.5	0.1		10.4	0.2	0.1
Delay (s)	43.9	13.6		47.8	13.9	12.1	47.2	33.6		50.6	34.2	33.4
Level of Service	D	B		D	B	B	D	C		D	C	C
Approach Delay (s)		16.0			18.4			43.1			42.2	
Approach LOS		B			B			D			D	

Intersection Summary

HCM 2000 Control Delay	23.3	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.47		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	51.2%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
9: Hacienda Dr & Dublin Blvd

BART to Livermore Extension Project
2040 Enhanced Bus + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	53	1167	172	238	605	28	378	651	563	40	694	218
Future Volume (vph)	53	1167	172	238	605	28	378	651	563	40	694	218
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	6.0	5.0	4.5	6.0		5.0	6.0	6.0	4.5	5.5	5.5
Lane Util. Factor	0.97	0.91	0.88	0.97	0.91		0.94	0.95	0.88	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5085	2787	3433	5052		4990	3539	2787	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5085	2787	3433	5052		4990	3539	2787	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	58	1268	187	259	658	30	411	708	612	43	754	237
RTOR Reduction (vph)	0	0	60	0	4	0	0	0	194	0	0	162
Lane Group Flow (vph)	58	1268	127	259	684	0	411	708	418	43	754	75
Turn Type	Prot	NA	pm+ov	Prot	NA		Prot	NA	Perm	Prot	NA	Perm
Protected Phases	5	2	3	1	6		3	8		7	NA	4
Permitted Phases			2						8			4
Actuated Green, G (s)	4.2	36.4	48.7	9.9	42.1		12.3	34.9	34.9	2.2	24.8	24.8
Effective Green, g (s)	4.2	36.4	48.7	9.9	42.1		12.3	34.9	34.9	2.2	24.8	24.8
Actuated g/C Ratio	0.04	0.35	0.47	0.09	0.40		0.12	0.33	0.33	0.02	0.24	0.24
Clearance Time (s)	4.5	6.0	5.0	4.5	6.0		5.0	6.0	6.0	4.5	5.5	5.5
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	138	1772	1433	325	2037		587	1183	931	72	1207	376
v/s Ratio Prot	0.02	c0.25	0.01	c0.08	0.14		c0.08	0.20		0.01	c0.15	
v/s Ratio Perm			0.04						0.15			0.05
v/c Ratio	0.42	0.72	0.09	0.80	0.34		0.70	0.60	0.45	0.60	0.62	0.20
Uniform Delay, d1	48.9	29.5	15.5	46.3	21.5		44.3	28.9	27.2	50.7	35.6	31.9
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	2.1	1.4	0.0	12.7	0.1		3.8	0.8	0.3	12.6	1.0	0.3
Delay (s)	51.0	30.9	15.5	59.0	21.6		48.0	29.7	27.6	63.3	36.6	32.1
Level of Service	D	C	B	E	C		D	C	C	E	D	C
Approach Delay (s)		29.8			31.8			33.3			36.7	
Approach LOS		C			C			C			D	

Intersection Summary

HCM 2000 Control Delay	32.7	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.70		
Actuated Cycle Length (s)	104.4	Sum of lost time (s)	21.0
Intersection Capacity Utilization	68.2%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 10: Hacienda Dr & Martinelli Blvd/Hacienda Crossings

BART to Livermore Extension Project
 2040 Enhanced Bus + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗	↖↗	↖↗	↗		↖↗	↑↑↑	↖	↖↗	↑↑↑	↖↗
Traffic Volume (vph)	32	55	512	286	40	22	552	1570	467	55	1016	88
Future Volume (vph)	32	55	512	286	40	22	552	1570	467	55	1016	88
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	2.0	2.0	4.5	2.0		3.0	2.0	2.0	4.5	2.5	
Lane Util. Factor	1.00	0.91	0.91	0.97	1.00		0.94	0.91	1.00	0.97	0.86	
Frt	1.00	0.93	0.85	1.00	0.95		1.00	1.00	0.85	1.00	0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1770	1572	2882	3433	1763		4990	5085	1583	3433	6331	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1770	1572	2882	3433	1763		4990	5085	1583	3433	6331	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	35	60	557	311	43	24	600	1707	508	60	1104	96
RTOR Reduction (vph)	0	39	263	0	17	0	0	0	166	0	10	0
Lane Group Flow (vph)	35	77	238	311	50	0	600	1707	342	60	1190	0
Turn Type	Prot	NA	Perm	Prot	NA		Prot	NA	pm+ov	Prot	NA	
Protected Phases	5	2		1	6		3	8	1	7	4	
Permitted Phases			2						8			
Actuated Green, G (s)	3.6	17.7	17.7	13.8	27.9		13.5	56.3	70.1	6.2	49.0	
Effective Green, g (s)	3.1	19.7	19.7	13.3	29.9		14.5	58.3	74.1	5.7	50.5	
Actuated g/C Ratio	0.03	0.18	0.18	0.12	0.27		0.13	0.53	0.67	0.05	0.46	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	4.0	4.0	2.0	4.0		3.0	4.0	2.0	3.0	4.0	
Lane Grp Cap (vph)	49	281	516	415	479		657	2695	1095	177	2906	
v/s Ratio Prot	0.02	0.05		c0.09	0.03		c0.12	c0.34	0.04	0.02	c0.19	
v/s Ratio Perm			c0.08						0.17			
v/c Ratio	0.71	0.28	0.46	0.75	0.10		0.91	0.63	0.31	0.34	0.41	
Uniform Delay, d1	53.0	39.0	40.4	46.7	30.0		47.1	18.3	7.4	50.3	19.8	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.02	1.05	1.84	1.00	1.00	
Incremental Delay, d2	39.0	0.7	0.9	6.4	0.1		12.1	0.7	0.0	1.1	0.4	
Delay (s)	92.0	39.7	41.3	53.1	30.1		60.3	19.9	13.7	51.5	20.2	
Level of Service	F	D	D	D	C		E	B	B	D	C	
Approach Delay (s)		43.7			49.0			27.4			21.7	
Approach LOS		D			D			C			C	

Intersection Summary		
HCM 2000 Control Delay	29.7	HCM 2000 Level of Service C
HCM 2000 Volume to Capacity ratio	0.63	
Actuated Cycle Length (s)	110.0	Sum of lost time (s) 13.0
Intersection Capacity Utilization	67.7%	ICU Level of Service C
Analysis Period (min)	15	

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 11: Hacienda Dr & I-580 WB Ramps

BART to Livermore Extension Project
 2040 Enhanced Bus + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↔↔		↔↔		↑↑↑			↑↑↑	↔
Traffic Volume (vph)	0	0	0	420	0	550	0	1781	810	0	967	802
Future Volume (vph)	0	0	0	420	0	550	0	1781	810	0	967	802
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				2.6		2.6		2.1			2.1	2.1
Lane Util. Factor				0.97		0.88		0.91			0.86	0.86
Frt				1.00		0.85		0.95			0.96	0.85
Flt Protected				0.95		1.00		1.00			1.00	1.00
Satd. Flow (prot)				3433		2787		4847			4595	1362
Flt Permitted				0.95		1.00		1.00			1.00	1.00
Satd. Flow (perm)				3433		2787		4847			4595	1362
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	457	0	598	0	1936	880	0	1051	872
RTOR Reduction (vph)	0	0	0	0	0	25	0	147	0	0	134	150
Lane Group Flow (vph)	0	0	0	457	0	573	0	2669	0	0	1353	286
Turn Type				Prot		Prot		NA			NA	Perm
Protected Phases				4		4		2			6	
Permitted Phases												6
Actuated Green, G (s)				12.8		12.8		34.2			34.2	34.2
Effective Green, g (s)				14.2		14.2		36.1			36.1	36.1
Actuated g/C Ratio				0.26		0.26		0.66			0.66	0.66
Clearance Time (s)				4.0		4.0		4.0			4.0	4.0
Vehicle Extension (s)				3.0		3.0		3.0			3.0	3.0
Lane Grp Cap (vph)				886		719		3181			3015	893
v/s Ratio Prot				0.13		c0.21		c0.55			0.29	
v/s Ratio Perm												0.21
v/c Ratio				0.52		0.80		0.84			0.45	0.32
Uniform Delay, d1				17.5		19.1		7.2			4.6	4.1
Progression Factor				1.00		1.00		0.84			0.64	1.32
Incremental Delay, d2				0.5		6.1		1.7			0.4	0.9
Delay (s)				18.0		25.2		7.8			3.4	6.3
Level of Service				B		C		A			A	A
Approach Delay (s)		0.0			22.1			7.8			4.0	
Approach LOS		A			C			A			A	

Intersection Summary			
HCM 2000 Control Delay	9.2	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.82		
Actuated Cycle Length (s)	55.0	Sum of lost time (s)	4.7
Intersection Capacity Utilization	78.4%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 12: Hacienda Dr & I-580 EB Ramps

BART to Livermore Extension Project
 2040 Enhanced Bus + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔↔		↔↔					↑↑↑	↔		↑↑↑	
Traffic Volume (vph)	904	0	470	0	0	0	0	1843	582	0	963	313
Future Volume (vph)	904	0	470	0	0	0	0	1843	582	0	963	313
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0					4.0	4.0		4.0	
Lane Util. Factor	0.97		0.88					0.86	0.86		0.91	
Frt	1.00		0.85					0.99	0.85		0.96	
Flt Protected	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (prot)	3433		2787					4742	1362		4898	
Flt Permitted	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (perm)	3433		2787					4742	1362		4898	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	983	0	511	0	0	0	0	2003	633	0	1047	340
RTOR Reduction (vph)	0	0	103	0	0	0	0	9	181	0	50	0
Lane Group Flow (vph)	983	0	408	0	0	0	0	2190	256	0	1337	0
Turn Type	Prot		Prot					NA	Perm		NA	
Protected Phases	4		4					2			6	
Permitted Phases									2			
Actuated Green, G (s)	36.1		36.1					62.6	62.6		62.6	
Effective Green, g (s)	37.5		37.5					64.5	64.5		64.5	
Actuated g/C Ratio	0.34		0.34					0.59	0.59		0.59	
Clearance Time (s)	5.4		5.4					5.9	5.9		5.9	
Vehicle Extension (s)	2.0		2.0					2.0	2.0		2.0	
Lane Grp Cap (vph)	1170		950					2780	798		2872	
v/s Ratio Prot	c0.29		0.15					c0.46			0.27	
v/s Ratio Perm									0.19			
v/c Ratio	0.84		0.43					0.79	0.32		0.47	
Uniform Delay, d1	33.5		28.0					17.5	11.6		12.9	
Progression Factor	1.00		1.00					1.00	1.00		0.69	
Incremental Delay, d2	5.4		0.1					2.3	1.1		0.5	
Delay (s)	38.8		28.1					19.8	12.7		9.4	
Level of Service	D		C					B	B		A	
Approach Delay (s)		35.2			0.0			18.6			9.4	
Approach LOS		D			A			B			A	





































Intersection Summary

HCM 2000 Control Delay	20.8	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.81		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	72.4%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
13: Hacienda Dr & Owens Rd

BART to Livermore Extension Project
2040 Enhanced Bus + Garage PM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 	  		 	  		 	  		 	  	
Traffic Volume (vph)	685	1007	56	147	372	875	28	733	279	626	511	281
Future Volume (vph)	685	1007	56	147	372	875	28	733	279	626	511	281
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	2.3	4.0	4.0	2.3	4.0	4.0	2.7	4.0	4.0	2.7
Lane Util. Factor	0.97	0.91	1.00	0.97	0.91	1.00	0.97	0.91	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5085	1583	3433	5085	1583	3433	5085	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5085	1583	3433	5085	1583	3433	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	745	1095	61	160	404	951	30	797	303	680	555	305
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	745	1095	61	160	404	951	30	797	303	680	555	305
Turn Type	Prot	NA	Free	Prot	NA	Free	Prot	NA	Free	Prot	NA	Free
Protected Phases	1	6		5	2		7	4		3	8	
Permitted Phases			Free			Free			Free			Free
Actuated Green, G (s)	33.3	38.6	115.0	9.4	14.7	115.0	2.4	24.0	115.0	24.0	45.6	115.0
Effective Green, g (s)	33.3	40.3	115.0	9.4	16.4	115.0	2.4	25.3	115.0	24.0	46.9	115.0
Actuated g/C Ratio	0.29	0.35	1.00	0.08	0.14	1.00	0.02	0.22	1.00	0.21	0.41	1.00
Clearance Time (s)	4.0	5.7		4.0	5.7		4.0	5.3		4.0	5.3	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	994	1781	1583	280	725	1583	71	1118	1583	716	2073	1583
v/s Ratio Prot	c0.22	0.22		0.05	0.08		0.01	c0.16		c0.20	0.11	
v/s Ratio Perm			0.04			c0.60			0.19			0.19
v/c Ratio	0.75	0.61	0.04	0.57	0.56	0.60	0.42	0.71	0.19	0.95	0.27	0.19
Uniform Delay, d1	37.1	30.9	0.0	50.9	45.9	0.0	55.6	41.5	0.0	44.9	22.6	0.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	3.1	0.6	0.0	2.8	0.9	1.7	4.0	3.9	0.3	21.8	0.3	0.3
Delay (s)	40.2	31.6	0.0	53.7	46.9	1.7	59.6	45.4	0.3	66.7	23.0	0.3
Level of Service	D	C	A	D	D	A	E	D	A	E	C	A
Approach Delay (s)		33.9			19.2			33.7			37.8	
Approach LOS		C			B			C			D	

Intersection Summary

HCM 2000 Control Delay	31.2	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.80		
Actuated Cycle Length (s)	115.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	72.1%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
14: Tassajara Rd & Dublin Blvd

BART to Livermore Extension Project
2040 Enhanced Bus + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	284	1168	469	286	367	25	393	919	666	43	799	151
Future Volume (vph)	284	1168	469	286	367	25	393	919	666	43	799	151
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	6.0	6.0	5.0	6.0		5.0	6.0	6.0	5.0	5.7	5.7
Lane Util. Factor	0.97	0.86	0.88	0.94	0.91		0.94	0.86	1.00	0.97	0.86	0.88
Frt	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	6408	2787	4990	5037		4990	6408	1583	3433	6408	2787
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	6408	2787	4990	5037		4990	6408	1583	3433	6408	2787
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	309	1270	510	311	399	27	427	999	724	47	868	164
RTOR Reduction (vph)	0	0	279	0	5	0	0	0	225	0	0	130
Lane Group Flow (vph)	309	1270	231	311	421	0	427	999	499	47	868	34
Turn Type	Prot	NA	Perm	Prot	NA		Prot	NA	Perm	Prot	NA	Perm
Protected Phases	5	2		1	6		3	8		7		4
Permitted Phases			2						8			4
Actuated Green, G (s)	16.4	42.6	42.6	16.4	42.6		31.7	49.0	49.0	11.3	28.9	28.9
Effective Green, g (s)	16.4	42.6	42.6	16.4	42.6		31.7	49.0	49.0	11.3	28.9	28.9
Actuated g/C Ratio	0.12	0.30	0.30	0.12	0.30		0.22	0.35	0.35	0.08	0.20	0.20
Clearance Time (s)	5.0	6.0	6.0	5.0	6.0		5.0	6.0	6.0	5.0	5.7	5.7
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	398	1931	840	579	1518		1119	2222	548	274	1310	570
v/s Ratio Prot	c0.09	c0.20		0.06	0.08		c0.09	0.16		0.01	0.14	
v/s Ratio Perm			0.08						c0.31			0.01
v/c Ratio	0.78	0.66	0.28	0.54	0.28		0.38	0.45	0.91	0.17	0.66	0.06
Uniform Delay, d1	60.7	43.0	37.6	58.9	37.6		46.5	35.7	44.0	60.6	51.7	45.3
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	9.2	0.8	0.2	1.0	0.1		0.2	0.1	19.0	0.3	1.3	0.0
Delay (s)	69.8	43.8	37.8	59.8	37.7		46.7	35.9	63.0	60.9	53.0	45.3
Level of Service	E	D	D	E	D		D	D	E	E	D	D
Approach Delay (s)		46.2			47.1			47.2			52.2	
Approach LOS		D			D			D			D	

Intersection Summary

HCM 2000 Control Delay	47.7	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.76		
Actuated Cycle Length (s)	141.3	Sum of lost time (s)	22.0
Intersection Capacity Utilization	84.8%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 15: Tassajara Rd & I-580 WB Ramps

BART to Livermore Extension Project
 2040 Enhanced Bus + Garage PM






























Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↔↔		↔↔		↑↑	↔		↑↑↑	↔
Traffic Volume (vph)	0	0	0	574	0	227	0	1669	724	0	1314	641
Future Volume (vph)	0	0	0	574	0	227	0	1669	724	0	1314	641
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0		4.0		4.0	4.0		4.0	4.0
Lane Util. Factor				0.97		0.88		0.95	1.00		0.86	0.86
Frt				1.00		0.85		1.00	0.85		0.98	0.85
Flt Protected				0.95		1.00		1.00	1.00		1.00	1.00
Satd. Flow (prot)				3433		2787		3539	1583		4711	1362
Flt Permitted				0.95		1.00		1.00	1.00		1.00	1.00
Satd. Flow (perm)				3433		2787		3539	1583		4711	1362
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	624	0	247	0	1814	787	0	1428	697
RTOR Reduction (vph)	0	0	0	0	0	17	0	0	321	0	31	196
Lane Group Flow (vph)	0	0	0	624	0	230	0	1814	466	0	1613	285
Turn Type				Perm		Perm		NA	Perm		NA	Perm
Protected Phases								2			6	
Permitted Phases				8		8			2			6
Actuated Green, G (s)				14.4		14.4		32.6	32.6		32.6	32.6
Effective Green, g (s)				14.4		14.4		32.6	32.6		32.6	32.6
Actuated g/C Ratio				0.26		0.26		0.59	0.59		0.59	0.59
Clearance Time (s)				4.0		4.0		4.0	4.0		4.0	4.0
Vehicle Extension (s)				3.0		3.0		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)				898		729		2097	938		2792	807
v/s Ratio Prot								c0.51			0.34	
v/s Ratio Perm				c0.18		0.08			0.29			0.21
v/c Ratio				0.69		0.32		0.87	0.50		0.58	0.35
Uniform Delay, d1				18.3		16.3		9.4	6.5		6.9	5.8
Progression Factor				1.00		1.00		1.00	1.00		1.00	1.00
Incremental Delay, d2				2.4		0.3		5.1	1.9		0.9	1.2
Delay (s)				20.7		16.6		14.4	8.4		7.8	7.0
Level of Service				C		B		B	A		A	A
Approach Delay (s)		0.0			19.5			12.6			7.6	
Approach LOS		A			B			B			A	

Intersection Summary			
HCM 2000 Control Delay	11.8	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.81		
Actuated Cycle Length (s)	55.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	69.2%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group
























HCM Signalized Intersection Capacity Analysis
 16: Santa Rita Rd & I-580 EB Ramps/Pimilco Dr

BART to Livermore Extension Project
 2040 Enhanced Bus + Garage PM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 			 		 		  			 	
Traffic Volume (vph)	437	82	256	140	0	318	0	1591	194	315	1132	0
Future Volume (vph)	437	82	256	140	0	318	0	1591	194	315	1132	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0		4.0		4.0		4.0	4.0	
Lane Util. Factor	0.97	1.00	1.00	0.97		0.88		0.86		1.00	0.95	
Frt	1.00	1.00	0.85	1.00		0.85		0.98		1.00	1.00	
Flt Protected	0.95	1.00	1.00	0.95		1.00		1.00		0.95	1.00	
Satd. Flow (prot)	3433	1863	1583	3433		2787		6303		1770	3539	
Flt Permitted	0.95	1.00	1.00	0.95		1.00		1.00		0.95	1.00	
Satd. Flow (perm)	3433	1863	1583	3433		2787		6303		1770	3539	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	475	89	278	152	0	346	0	1729	211	342	1230	0
RTOR Reduction (vph)	0	0	73	0	0	35	0	19	0	0	0	0
Lane Group Flow (vph)	475	89	205	152	0	311	0	1921	0	342	1230	0
Turn Type	Perm	NA	Perm	Prot		pm+ov		NA		Prot	NA	Perm
Protected Phases		4		3		1		2		1	6	
Permitted Phases	4		4			3						6
Actuated Green, G (s)	19.9	19.9	19.9	7.6		32.3		41.8		24.7	70.5	
Effective Green, g (s)	19.9	19.9	19.9	7.6		32.3		41.8		24.7	70.5	
Actuated g/C Ratio	0.18	0.18	0.18	0.07		0.29		0.38		0.22	0.64	
Clearance Time (s)	4.0	4.0	4.0	4.0		4.0		4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0		3.0		3.0		3.0	3.0	
Lane Grp Cap (vph)	621	337	286	237		818		2395		397	2268	
v/s Ratio Prot		0.05		c0.04		0.09		c0.30		c0.19	0.35	
v/s Ratio Perm	c0.14		0.13			0.03						
v/c Ratio	0.76	0.26	0.72	0.64		0.38		0.80		0.86	0.54	
Uniform Delay, d1	42.8	38.8	42.4	49.9		30.9		30.4		41.0	10.9	
Progression Factor	1.00	1.00	1.00	1.00		1.00		1.00		1.00	1.00	
Incremental Delay, d2	5.6	0.4	8.3	5.8		0.3		3.0		17.2	0.9	
Delay (s)	48.4	39.2	50.7	55.7		31.2		33.4		58.2	11.8	
Level of Service	D	D	D	E		C		C		E	B	
Approach Delay (s)		48.2			38.7			33.4			21.9	
Approach LOS		D			D			C			C	
Intersection Summary												
HCM 2000 Control Delay			32.8									C
HCM 2000 Volume to Capacity ratio			0.80									
Actuated Cycle Length (s)			110.0							16.0		
Intersection Capacity Utilization			66.2%									C
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis
 17: Santa Rita Rd & Valley Ave

BART to Livermore Extension Project
 2040 Enhanced Bus + Garage PM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	360	719	118	136	369	803	141	630	160	1438	1073	267
Future Volume (vph)	360	719	118	136	369	803	141	630	160	1438	1073	267
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.97	0.95		0.97	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.97		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	3433	3432		3433	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	3433	3432		3433	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	391	782	128	148	401	873	153	685	174	1563	1166	290
RTOR Reduction (vph)	0	0	95	0	0	0	0	18	0	0	0	126
Lane Group Flow (vph)	391	782	33	148	401	873	153	841	0	1563	1166	164
Turn Type	Prot	NA	Perm	Prot	NA	Free	Prot	NA		Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1		6
Permitted Phases			4			Free						6
Actuated Green, G (s)	14.0	23.0	23.0	8.0	17.0	120.0	9.4	28.0		45.0	63.6	63.6
Effective Green, g (s)	14.0	23.0	23.0	8.0	17.0	120.0	9.4	28.0		45.0	63.6	63.6
Actuated g/C Ratio	0.12	0.19	0.19	0.07	0.14	1.00	0.08	0.23		0.38	0.53	0.53
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	400	678	303	118	501	1583	268	800		1287	1875	838
v/s Ratio Prot	c0.11	c0.22		c0.08	0.11		0.04	c0.24		c0.46	0.33	
v/s Ratio Perm			0.02			0.55						0.10
v/c Ratio	0.98	1.15	0.11	1.25	0.80	0.55	0.57	1.05		1.21	0.62	0.20
Uniform Delay, d1	52.8	48.5	40.0	56.0	49.9	0.0	53.4	46.0		37.5	19.8	14.8
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	38.6	85.2	0.2	166.2	8.9	1.4	2.9	46.0		103.9	0.6	0.1
Delay (s)	91.5	133.7	40.2	222.2	58.8	1.4	56.3	92.0		141.4	20.4	14.9
Level of Service	F	F	D	F	E	A	E	F		F	C	B
Approach Delay (s)		111.8			40.6			86.6			82.5	
Approach LOS		F			D			F			F	
Intersection Summary												
HCM 2000 Control Delay			79.9			HCM 2000 Level of Service				E		
HCM 2000 Volume to Capacity ratio			1.16									
Actuated Cycle Length (s)			120.0			Sum of lost time (s)			16.0			
Intersection Capacity Utilization			104.3%			ICU Level of Service				G		
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis
18: Bernal Ave/Valley Ave & Stanley Blvd

BART to Livermore Extension Project
2040 Enhanced Bus + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	230	839	59	92	235	351	95	366	301	823	551	132
Future Volume (vph)	230	839	59	92	235	351	95	366	301	823	551	132
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.95	1.00	0.97	0.91	0.91	1.00	0.95	1.00	0.97	0.95	0.95
Frt	1.00	1.00	0.85	1.00	0.94	0.85	1.00	1.00	0.85	1.00	0.97	0.97
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	3433	3178	1441	1770	3539	1583	3433	3437	3437
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	3433	3178	1441	1770	3539	1583	3433	3437	3437
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	250	912	64	100	255	382	103	398	327	895	599	143
RTOR Reduction (vph)	0	0	39	0	127	53	0	0	169	0	22	0
Lane Group Flow (vph)	250	912	25	100	311	146	103	398	158	895	720	0
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	NA
Protected Phases	7	4	5	3	8	1	5	2		1	6	
Permitted Phases			4			8			2			
Actuated Green, G (s)	10.3	25.6	33.3	3.0	18.3	43.7	7.7	15.4	15.4	25.4	33.1	
Effective Green, g (s)	10.3	25.6	33.3	3.0	18.3	43.7	7.7	15.4	15.4	25.4	33.1	
Actuated g/C Ratio	0.12	0.30	0.39	0.04	0.21	0.51	0.09	0.18	0.18	0.30	0.39	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	414	1060	691	120	681	804	159	638	285	1021	1332	
v/s Ratio Prot	c0.07	c0.26	0.00	0.03	0.10	0.05	0.06	0.11		c0.26	c0.21	
v/s Ratio Perm			0.01			0.05			0.10			
v/c Ratio	0.60	0.86	0.04	0.83	0.46	0.18	0.65	0.62	0.55	0.88	0.54	
Uniform Delay, d1	35.6	28.2	16.1	41.0	29.2	11.2	37.5	32.3	31.9	28.5	20.3	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	2.5	7.3	0.0	36.7	0.5	0.1	8.8	1.9	2.3	8.6	0.5	
Delay (s)	38.1	35.5	16.1	77.6	29.7	11.3	46.3	34.2	34.2	37.1	20.7	
Level of Service	D	D	B	E	C	B	D	C	C	D	C	
Approach Delay (s)		35.0			31.2			35.7			29.7	
Approach LOS		D			C			D			C	










































Intersection Summary

HCM 2000 Control Delay	32.5	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.82		
Actuated Cycle Length (s)	85.4	Sum of lost time (s)	16.0
Intersection Capacity Utilization	75.3%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
19: Fallon Rd & Dublin Blvd/Croak Rd

BART to Livermore Extension Project
2040 Enhanced Bus + Garage PM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 	  	 	  	  		  	  	 	  	  	
Traffic Volume (vph)	224	990	441	81	29	93	245	802	339	189	644	29
Future Volume (vph)	224	990	441	81	29	93	245	802	339	189	644	29
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.91	0.88	0.94	0.91	1.00	0.94	0.91	0.88	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5085	2787	4990	5085	1583	4990	5085	2787	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5085	2787	4990	5085	1583	4990	5085	2787	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	243	1076	479	88	32	101	266	872	368	205	700	32
RTOR Reduction (vph)	0	0	67	0	0	89	0	0	165	0	0	22
Lane Group Flow (vph)	243	1076	412	88	32	12	266	872	203	205	700	10
Turn Type	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4	5	3	8		5	2		1	6	
Permitted Phases			4			8			2			6
Actuated Green, G (s)	20.4	26.8	36.6	3.2	9.6	9.6	9.8	27.6	27.6	6.4	24.2	24.2
Effective Green, g (s)	20.4	26.8	36.6	3.2	9.6	9.6	9.8	27.6	27.6	6.4	24.2	24.2
Actuated g/C Ratio	0.25	0.34	0.46	0.04	0.12	0.12	0.12	0.35	0.35	0.08	0.30	0.30
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	875	1703	1414	199	610	189	611	1754	961	274	1538	478
v/s Ratio Prot	0.07	c0.21	0.04	c0.02	0.01		0.05	c0.17		c0.06	0.14	
v/s Ratio Perm			0.11			0.01			0.07			0.01
v/c Ratio	0.28	0.63	0.29	0.44	0.05	0.06	0.44	0.50	0.21	0.75	0.46	0.02
Uniform Delay, d1	23.9	22.4	13.6	37.5	31.2	31.2	32.5	20.7	18.5	36.0	22.6	19.6
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.12	0.92	0.97	1.00	1.00	1.00
Incremental Delay, d2	0.2	0.8	0.1	1.6	0.0	0.1	0.5	0.9	0.5	10.6	1.0	0.1
Delay (s)	24.1	23.2	13.7	39.1	31.2	31.4	37.0	20.0	18.4	46.6	23.5	19.7
Level of Service	C	C	B	D	C	C	D	B	B	D	C	B
Approach Delay (s)		20.8			34.4			22.6			28.5	
Approach LOS		C			C			C			C	
Intersection Summary												
HCM 2000 Control Delay			23.7				HCM 2000 Level of Service			C		
HCM 2000 Volume to Capacity ratio			0.58									
Actuated Cycle Length (s)			80.0				Sum of lost time (s)		16.0			
Intersection Capacity Utilization			54.0%				ICU Level of Service		A			
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis
20: El Charro Rd/Fallon Rd & I-580 WB Ramps

BART to Livermore Extension Project
2040 Enhanced Bus + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↙	↘	↗		↑↑↑	↗		↑↑↑	↗
Traffic Volume (vph)	0	0	0	592	0	546	0	927	245	0	853	404
Future Volume (vph)	0	0	0	592	0	546	0	927	245	0	853	404
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0	4.0	4.0		4.0	4.0		4.0	4.0
Lane Util. Factor				0.95	0.95	0.88		0.91	1.00		0.91	1.00
Frt				1.00	1.00	0.85		1.00	0.85		1.00	0.85
Flt Protected				0.95	0.95	1.00		1.00	1.00		1.00	1.00
Satd. Flow (prot)				1681	1681	2787		5085	1583		5085	1583
Flt Permitted				0.95	0.95	1.00		1.00	1.00		1.00	1.00
Satd. Flow (perm)				1681	1681	2787		5085	1583		5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	643	0	593	0	1008	266	0	927	439
RTOR Reduction (vph)	0	0	0	0	0	33	0	0	143	0	0	236
Lane Group Flow (vph)	0	0	0	328	315	560	0	1008	123	0	927	203
Turn Type				Perm	NA	Perm		NA	Perm		NA	Perm
Protected Phases					8			2			6	
Permitted Phases				8		8			2			6
Actuated Green, G (s)				14.0	14.0	14.0		18.5	18.5		18.5	18.5
Effective Green, g (s)				13.5	13.5	13.5		18.5	18.5		18.5	18.5
Actuated g/C Ratio				0.34	0.34	0.34		0.46	0.46		0.46	0.46
Clearance Time (s)				3.5	3.5	3.5		4.0	4.0		4.0	4.0
Vehicle Extension (s)				2.0	2.0	2.0		2.0	2.0		2.0	2.0
Lane Grp Cap (vph)				567	567	940		2351	732		2351	732
v/s Ratio Prot								c0.20			0.18	
v/s Ratio Perm				0.20	0.19	c0.20			0.08			0.13
v/c Ratio				0.58	0.56	0.60		0.43	0.17		0.39	0.28
Uniform Delay, d1				10.9	10.8	11.0		7.2	6.3		7.1	6.6
Progression Factor				1.00	1.00	1.00		1.00	1.00		1.07	3.56
Incremental Delay, d2				0.9	0.7	0.7		0.6	0.5		0.5	0.9
Delay (s)				11.8	11.5	11.7		7.8	6.8		8.0	24.5
Level of Service				B	B	B		A	A		A	C
Approach Delay (s)		0.0			11.7			7.6			13.3	
Approach LOS		A			B			A			B	

Intersection Summary

HCM 2000 Control Delay	10.9	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.50		
Actuated Cycle Length (s)	40.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	48.1%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 21: El Charro Rd & I-580 EB Ramps

BART to Livermore Extension Project
 2040 Enhanced Bus + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗		↖↗					↕↔	↖		↕↔	↖
Traffic Volume (vph)	334	0	456	0	0	0	0	1545	281	0	1514	0
Future Volume (vph)	334	0	456	0	0	0	0	1545	281	0	1514	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0					4.0	4.0		4.0	
Lane Util. Factor	0.97		0.88					0.91	0.91		0.91	
Frt	1.00		0.85					1.00	0.85		1.00	
Flt Protected	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (prot)	3433		2787					3379	1441		3390	
Flt Permitted	0.95		1.00					1.00	1.00		1.00	
Satd. Flow (perm)	3433		2787					3379	1441		3390	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	363	0	496	0	0	0	0	1679	305	0	1646	0
RTOR Reduction (vph)	0	0	46	0	0	0	0	2	94	0	0	0
Lane Group Flow (vph)	363	0	450	0	0	0	0	1714	174	0	1646	0
Turn Type	Prot		Perm					NA	Perm		NA	Perm
Protected Phases	4							2			6	
Permitted Phases			4						2			6
Actuated Green, G (s)	11.3		11.3					35.7	35.7		35.7	
Effective Green, g (s)	11.3		11.3					35.7	35.7		35.7	
Actuated g/C Ratio	0.21		0.21					0.65	0.65		0.65	
Clearance Time (s)	4.0		4.0					4.0	4.0		4.0	
Vehicle Extension (s)	2.0		2.0					3.0	3.0		3.0	
Lane Grp Cap (vph)	705		572					2193	935		2200	
v/s Ratio Prot	0.11							c0.51			0.49	
v/s Ratio Perm			c0.16						0.12			
v/c Ratio	0.51		0.79					0.78	0.19		0.75	
Uniform Delay, d1	19.4		20.7					6.9	3.9		6.6	
Progression Factor	1.00		1.00					1.00	1.00		1.00	
Incremental Delay, d2	0.3		6.5					2.9	0.4		2.4	
Delay (s)	19.7		27.2					9.7	4.3		9.0	
Level of Service	B		C					A	A		A	
Approach Delay (s)		24.0			0.0			9.0			9.0	
Approach LOS		C			A			A			A	

Intersection Summary

HCM 2000 Control Delay	11.9	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.78		
Actuated Cycle Length (s)	55.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	64.5%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 22: El Charro Rd & Stoneridge Dr/Jack London Blvd

BART to Livermore Extension Project
 2040 Enhanced Bus + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔↔↔	↑↑	↗	↖	↑↑	↗↗	↖	↑↑		↖↖↖	↑	↗↗
Traffic Volume (vph)	184	598	57	96	323	652	17	469	56	776	397	70
Future Volume (vph)	184	598	57	96	323	652	17	469	56	776	397	70
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	0.94	0.95	1.00	1.00	0.95	0.88	1.00	0.95		0.94	1.00	0.88
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.98		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	4491	3185	1425	1593	3185	2508	1593	3134		4491	1676	2508
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	4491	3185	1425	1593	3185	2508	1593	3134		4491	1676	2508
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	200	650	62	104	351	709	18	510	61	843	432	76
RTOR Reduction (vph)	0	0	47	0	0	74	0	13	0	0	0	41
Lane Group Flow (vph)	200	650	15	104	351	635	18	558	0	843	432	35
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Prot	NA		Prot	NA	Perm
Protected Phases	7	4		3	8	1	5	2		1	6	
Permitted Phases			4			8						6
Actuated Green, G (s)	6.0	16.7	16.7	4.6	15.3	33.6	0.8	15.7		18.3	33.2	33.2
Effective Green, g (s)	6.0	16.7	16.7	4.6	15.3	33.6	0.8	15.7		18.3	33.2	33.2
Actuated g/C Ratio	0.08	0.23	0.23	0.06	0.21	0.47	0.01	0.22		0.26	0.47	0.47
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	377	745	333	102	683	1181	17	690		1152	780	1167
v/s Ratio Prot	0.04	c0.20		c0.07	0.11	0.14	0.01	c0.18		c0.19	0.26	
v/s Ratio Perm			0.01			0.12						0.01
v/c Ratio	0.53	0.87	0.04	1.02	0.51	0.54	1.06	0.81		0.73	0.55	0.03
Uniform Delay, d1	31.3	26.3	21.1	33.4	24.7	13.3	35.2	26.4		24.3	13.7	10.3
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	1.4	11.0	0.1	94.5	0.7	0.5	238.2	6.9		2.4	0.9	0.0
Delay (s)	32.7	37.3	21.2	127.9	25.4	13.8	273.5	33.3		26.7	14.6	10.3
Level of Service	C	D	C	F	C	B	F	C		C	B	B
Approach Delay (s)		35.2			27.5			40.6			21.9	
Approach LOS		D			C			D			C	

Intersection Summary

HCM 2000 Control Delay	29.3	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.82		
Actuated Cycle Length (s)	71.3	Sum of lost time (s)	16.0
Intersection Capacity Utilization	70.4%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 23: Stanley Blvd & El Charro Rd

BART to Livermore Extension Project
 2040 Enhanced Bus + Garage PM



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	↖	↑↑	↑↑↑	↗	↖↗	↖↗
Traffic Volume (vph)	418	2685	780	13	185	372
Future Volume (vph)	418	2685	780	13	185	372
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95	0.91	1.00	0.97	0.88
Frt	1.00	1.00	1.00	0.85	1.00	0.85
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1770	3539	5085	1583	3433	2787
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1770	3539	5085	1583	3433	2787
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	454	2918	848	14	201	404
RTOR Reduction (vph)	0	0	0	7	0	362
Lane Group Flow (vph)	454	2918	848	7	201	42
Turn Type	Prot	NA	NA	Perm	Prot	Perm
Protected Phases	7	4	8		6	
Permitted Phases				8		6
Actuated Green, G (s)	34.7	96.0	57.3	57.3	12.2	12.2
Effective Green, g (s)	34.7	96.0	57.3	57.3	12.2	12.2
Actuated g/C Ratio	0.30	0.83	0.49	0.49	0.10	0.10
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	528	2923	2507	780	360	292
v/s Ratio Prot	0.26	c0.82	0.17		c0.06	
v/s Ratio Perm				0.00		0.02
v/c Ratio	0.86	1.00	0.34	0.01	0.56	0.15
Uniform Delay, d1	38.5	10.0	17.9	15.0	49.4	47.3
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	13.2	16.1	0.1	0.0	1.9	0.2
Delay (s)	51.6	26.1	18.0	15.0	51.3	47.5
Level of Service	D	C	B	B	D	D
Approach Delay (s)		29.6	17.9		48.8	
Approach LOS		C	B		D	

Intersection Summary

HCM 2000 Control Delay	29.9	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.98		
Actuated Cycle Length (s)	116.2	Sum of lost time (s)	12.0
Intersection Capacity Utilization	86.2%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
24: Airway Blvd/Driveway & N Canyons Pkwy

BART to Livermore Extension Project
2040 Enhanced Bus + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑	↑	↑↑	↑	↑		↑	↑↑		↑	
Traffic Volume (vph)	0	885	571	967	82	0	52	0	749	0	0	0
Future Volume (vph)	0	885	571	967	82	0	52	0	749	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		2.0	2.0	2.0	2.0			4.2	2.0			
Lane Util. Factor		0.95	1.00	0.97	1.00			1.00	0.88			
Frt		1.00	0.85	1.00	1.00			1.00	0.85			
Flt Protected		1.00	1.00	0.95	1.00			0.95	1.00			
Satd. Flow (prot)		3539	1583	3433	1863			1770	2787			
Flt Permitted		1.00	1.00	0.95	1.00			0.95	1.00			
Satd. Flow (perm)		3539	1583	3433	1863			1770	2787			
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	962	621	1051	89	0	57	0	814	0	0	0
RTOR Reduction (vph)	0	0	246	0	0	0	0	0	481	0	0	0
Lane Group Flow (vph)	0	962	375	1051	89	0	0	57	333	0	0	0
Turn Type		NA	Perm	Prot	NA	Perm	Split	NA	pm+ov			
Protected Phases		2		1	6		8	8	1	4	4	
Permitted Phases			2			6			8			
Actuated Green, G (s)		62.9	62.9	34.0	100.9			11.1	45.1			
Effective Green, g (s)		64.9	64.9	36.0	102.9			10.9	49.1			
Actuated g/C Ratio		0.54	0.54	0.30	0.86			0.09	0.41			
Clearance Time (s)		4.0	4.0	4.0	4.0			4.0	4.0			
Vehicle Extension (s)		3.0	3.0	3.0	3.0			3.0	3.0			
Lane Grp Cap (vph)		1914	856	1029	1597			160	1186			
v/s Ratio Prot		c0.27		c0.31	0.05			0.03	c0.08			
v/s Ratio Perm			0.24						0.04			
v/c Ratio		0.50	0.44	1.02	0.06			0.36	0.28			
Uniform Delay, d1		17.4	16.6	42.0	1.3			51.3	23.7			
Progression Factor		1.00	1.00	1.00	1.00			1.00	1.00			
Incremental Delay, d2		0.9	1.6	33.6	0.1			1.4	0.1			
Delay (s)		18.3	18.2	75.6	1.3			52.6	23.8			
Level of Service		B	B	E	A			D	C			
Approach Delay (s)		18.3			69.8			25.7			0.0	
Approach LOS		B			E			C			A	

Intersection Summary

HCM 2000 Control Delay	36.4	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.68		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	12.2
Intersection Capacity Utilization	69.6%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 25: Airway Blvd & I-580 WB Ramps

BART to Livermore Extension Project
 2040 Enhanced Bus + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↙	↖	↗		↑↑	↗		↑↑↑	
Traffic Volume (vph)	0	0	0	131	35	180	0	689	390	0	922	716
Future Volume (vph)	0	0	0	131	35	180	0	689	390	0	922	716
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0	4.0	4.0		4.0	4.0		4.0	
Lane Util. Factor				0.95	0.95	0.88		0.95	1.00		0.91	
Frt				1.00	1.00	0.85		1.00	0.85		0.93	
Flt Protected				0.95	0.97	1.00		1.00	1.00		1.00	
Satd. Flow (prot)				1681	1715	2787		3539	1583		4752	
Flt Permitted				0.95	0.97	1.00		1.00	1.00		1.00	
Satd. Flow (perm)				1681	1715	2787		3539	1583		4752	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	142	38	196	0	749	424	0	1002	778
RTOR Reduction (vph)	0	0	0	0	0	167	0	0	112	0	168	0
Lane Group Flow (vph)	0	0	0	75	105	29	0	749	312	0	1612	0
Turn Type				Split	NA	Perm		NA	Perm		NA	
Protected Phases				8	8			2			6	
Permitted Phases						8			2			
Actuated Green, G (s)				10.5	10.5	10.5		50.2	50.2		50.2	
Effective Green, g (s)				10.5	10.5	10.5		51.5	51.5		51.5	
Actuated g/C Ratio				0.15	0.15	0.15		0.74	0.74		0.74	
Clearance Time (s)				4.0	4.0	4.0		5.3	5.3		5.3	
Vehicle Extension (s)				2.0	2.0	2.0		4.0	4.0		4.0	
Lane Grp Cap (vph)				252	257	418		2603	1164		3496	
v/s Ratio Prot				0.04	c0.06			0.21			c0.34	
v/s Ratio Perm						0.01			0.20			
v/c Ratio				0.30	0.41	0.07		0.29	0.27		0.46	
Uniform Delay, d1				26.5	26.9	25.6		3.1	3.0		3.7	
Progression Factor				1.00	1.00	1.00		0.36	0.31		1.00	
Incremental Delay, d2				0.2	0.4	0.0		0.2	0.5		0.4	
Delay (s)				26.7	27.3	25.6		1.3	1.4		4.1	
Level of Service				C	C	C		A	A		A	
Approach Delay (s)		0.0			26.3			1.4			4.1	
Approach LOS		A			C			A			A	

Intersection Summary		
HCM 2000 Control Delay	5.7	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.45	A
Actuated Cycle Length (s)	70.0	Sum of lost time (s)
Intersection Capacity Utilization	48.9%	8.0
Analysis Period (min)	15	ICU Level of Service
		A

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 26: Airway Blvd & I-580 EB Ramps/Kitty Hawk Rd

BART to Livermore Extension Project
 2040 Enhanced Bus + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↑	↖	↖	↑	↖	↖	↕↗		↖	↕↗	
Traffic Volume (vph)	567	186	350	64	97	121	56	463	159	122	384	490
Future Volume (vph)	567	186	350	64	97	121	56	463	159	122	384	490
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.4	4.4	4.4	4.5	2.7		4.0	2.7	
Lane Util. Factor	0.97	1.00	1.00	1.00	1.00	1.00	1.00	0.95		1.00	0.95	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.96		1.00	0.92	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	3433	1863	1583	1770	1863	1583	1770	3403		1770	3241	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	3433	1863	1583	1770	1863	1583	1770	3403		1770	3241	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	616	202	380	70	105	132	61	503	173	133	417	533
RTOR Reduction (vph)	0	0	295	0	0	94	0	21	0	0	143	0
Lane Group Flow (vph)	616	202	86	70	105	38	61	655	0	133	807	0
Turn Type	Split	NA	Perm	Split	NA	pm+ov	Prot	NA		Prot	NA	
Protected Phases	7	7		8	8	1	5	2		1	6	
Permitted Phases			7			8						
Actuated Green, G (s)	31.5	31.5	31.5	14.7	14.7	29.6	10.8	62.9		14.9	67.0	
Effective Green, g (s)	31.5	31.5	31.5	14.3	14.3	28.8	10.3	64.2		14.9	68.3	
Actuated g/C Ratio	0.22	0.22	0.22	0.10	0.10	0.21	0.07	0.46		0.11	0.49	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Vehicle Extension (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	3.5		2.0	4.0	
Lane Grp Cap (vph)	772	419	356	180	190	375	130	1560		188	1581	
v/s Ratio Prot	c0.18	0.11		0.04	c0.06	0.01	0.03	c0.19		c0.08	c0.25	
v/s Ratio Perm			0.05			0.01						
v/c Ratio	0.80	0.48	0.24	0.39	0.55	0.10	0.47	0.42		0.71	0.51	
Uniform Delay, d1	51.2	47.2	44.4	58.8	59.8	45.1	62.2	25.4		60.4	24.4	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		0.99	0.92	
Incremental Delay, d2	5.4	0.3	0.1	0.5	2.0	0.0	1.0	0.8		8.6	1.1	
Delay (s)	56.6	47.5	44.6	59.3	61.8	45.2	63.2	26.3		68.3	23.5	
Level of Service	E	D	D	E	E	D	E	C		E	C	
Approach Delay (s)		51.3			54.1			29.3			29.0	
Approach LOS		D			D			C			C	

Intersection Summary

HCM 2000 Control Delay	39.4	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.61		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	15.6
Intersection Capacity Utilization	71.6%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 27: Collier Canyon Rd & N Canyons Pkwy/Portola Ave

BART to Livermore Extension Project
 2040 Enhanced Bus + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↖↖	↖↗	↖↗	↖↖	↖↗	↖↗	↖↗		↖↗	↖↖	↖↗
Traffic Volume (vph)	435	869	198	38	206	12	58	5	191	132	14	189
Future Volume (vph)	435	869	198	38	206	12	58	5	191	132	14	189
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	2.7	2.7	4.0	2.7	2.7	4.0	3.0		4.0	4.6	4.6
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.85		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	1770	1590		1770	1863	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	1770	1590		1770	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	473	945	215	41	224	13	63	5	208	143	15	205
RTOR Reduction (vph)	0	0	123	0	0	9	0	153	0	0	0	152
Lane Group Flow (vph)	473	945	92	41	224	4	63	60	0	143	15	53
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA		Prot	NA	Perm
Protected Phases	1	6		5	2		3	8		7		4
Permitted Phases			6			2						4
Actuated Green, G (s)	14.5	30.4	30.4	3.2	19.1	19.1	4.7	14.5		9.8	19.6	19.6
Effective Green, g (s)	14.5	31.7	31.7	3.2	20.4	20.4	4.7	15.5		9.8	19.0	19.0
Actuated g/C Ratio	0.20	0.43	0.43	0.04	0.28	0.28	0.06	0.21		0.13	0.26	0.26
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	673	1518	679	76	976	436	112	333		234	478	406
v/s Ratio Prot	c0.14	c0.27		0.02	0.06		0.04	c0.04		c0.08	0.01	
v/s Ratio Perm			0.06			0.00						0.03
v/c Ratio	0.70	0.62	0.14	0.54	0.23	0.01	0.56	0.18		0.61	0.03	0.13
Uniform Delay, d1	27.7	16.4	12.8	34.6	20.7	19.4	33.6	24.0		30.3	20.6	21.1
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	3.3	0.8	0.1	7.2	0.1	0.0	6.3	0.3		4.7	0.0	0.1
Delay (s)	31.0	17.2	12.9	41.8	20.8	19.4	39.9	24.2		34.9	20.6	21.2
Level of Service	C	B	B	D	C	B	D	C		C	C	C
Approach Delay (s)		20.7			23.8			27.8			26.6	
Approach LOS		C			C			C			C	
























Intersection Summary

HCM 2000 Control Delay	22.6	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.57		
Actuated Cycle Length (s)	73.9	Sum of lost time (s)	15.3
Intersection Capacity Utilization	60.1%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 28: Isabel Ave/Campus Hill Dr & Portola Ave

BART to Livermore Extension Project
 2040 Enhanced Bus + Garage PM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	3	724	473	394	138	124	174	397	169	130	226	1
Future Volume (vph)	3	724	473	394	138	124	174	397	169	130	226	1
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	5.8	5.8
Lane Util. Factor	1.00	0.95	0.88	0.94	0.95		0.97	0.95	1.00	1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	0.93		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3539	2787	4990	3288		3433	3539	1583	1770	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	3539	2787	4990	3288		3433	3539	1583	1770	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	3	787	514	428	150	135	189	432	184	141	246	1
RTOR Reduction (vph)	0	0	322	0	73	0	0	0	146	0	0	1
Lane Group Flow (vph)	3	787	192	428	212	0	189	432	38	141	246	0
Turn Type	Prot	NA	Perm	Prot	NA		Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4						2			6
Actuated Green, G (s)	1.5	31.4	31.4	9.2	39.1		9.2	17.0	17.0	11.4	19.6	19.6
Effective Green, g (s)	1.5	32.7	32.7	9.2	40.4		9.2	18.3	18.3	11.4	18.7	18.7
Actuated g/C Ratio	0.02	0.37	0.37	0.11	0.46		0.11	0.21	0.21	0.13	0.21	0.21
Clearance Time (s)	4.0	5.3	5.3	4.0	5.3		4.0	5.3	5.3	4.0	4.9	4.9
Vehicle Extension (s)	2.0	3.0	3.0	2.0	3.0		2.0	3.0	3.0	2.0	3.0	3.0
Lane Grp Cap (vph)	30	1321	1040	524	1516		360	739	330	230	755	337
v/s Ratio Prot	0.00	c0.22		c0.09	0.06		0.06	c0.12		c0.08	0.07	
v/s Ratio Perm			0.07						0.02			0.00
v/c Ratio	0.10	0.60	0.18	0.82	0.14		0.53	0.58	0.12	0.61	0.33	0.00
Uniform Delay, d1	42.4	22.1	18.5	38.4	13.6		37.1	31.2	28.1	36.0	29.1	27.1
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.5	0.7	0.1	9.1	0.0		0.6	1.2	0.2	3.4	0.3	0.0
Delay (s)	42.9	22.9	18.6	47.5	13.6		37.8	32.4	28.3	39.4	29.4	27.1
Level of Service	D	C	B	D	B		D	C	C	D	C	C
Approach Delay (s)		21.2			33.9			32.7			33.0	
Approach LOS		C			C			C			C	

Intersection Summary		
HCM 2000 Control Delay	28.3	HCM 2000 Level of Service C
HCM 2000 Volume to Capacity ratio	0.63	
Actuated Cycle Length (s)	87.6	Sum of lost time (s) 17.8
Intersection Capacity Utilization	59.8%	ICU Level of Service B
Analysis Period (min)	15	

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
29: Isabel Ave & I-580 WB Ramps

BART to Livermore Extension Project
2040 Enhanced Bus + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↖↗		↖		↑↑↑	↖		↑↑↑	↖
Traffic Volume (vph)	0	0	0	681	0	439	0	440	0	0	680	513
Future Volume (vph)	0	0	0	681	0	439	0	440	0	0	680	513
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0		4.0		4.8			4.8	4.8
Lane Util. Factor				0.97		1.00		0.91			0.91	1.00
Frt				1.00		0.85		1.00			1.00	0.85
Flt Protected				0.95		1.00		1.00			1.00	1.00
Satd. Flow (prot)				3433		1583		5085			5085	1583
Flt Permitted				0.95		1.00		1.00			1.00	1.00
Satd. Flow (perm)				3433		1583		5085			5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	740	0	477	0	478	0	0	739	558
RTOR Reduction (vph)	0	0	0	0	0	211	0	0	0	0	0	229
Lane Group Flow (vph)	0	0	0	740	0	266	0	478	0	0	739	329
Turn Type				Prot		Prot		NA	Free		NA	Prot
Protected Phases				8		8		2			6	6
Permitted Phases									Free			
Actuated Green, G (s)				19.9		19.9		42.1			42.1	42.1
Effective Green, g (s)				19.9		19.9		41.3			41.3	41.3
Actuated g/C Ratio				0.28		0.28		0.59			0.59	0.59
Clearance Time (s)				4.0		4.0		4.0			4.0	4.0
Vehicle Extension (s)				2.0		2.0		4.0			4.0	4.0
Lane Grp Cap (vph)				975		450		3000			3000	933
v/s Ratio Prot				c0.22		0.17		0.09			0.15	c0.21
v/s Ratio Perm												
v/c Ratio				0.76		0.59		0.16			0.25	0.35
Uniform Delay, d1				22.9		21.5		6.5			6.9	7.4
Progression Factor				1.00		1.00		0.78			1.00	1.00
Incremental Delay, d2				3.1		1.4		0.1			0.2	1.0
Delay (s)				25.9		22.9		5.2			7.1	8.5
Level of Service				C		C		A			A	A
Approach Delay (s)		0.0			24.7			5.2			7.7	
Approach LOS		A			C			A			A	

Intersection Summary

HCM 2000 Control Delay	14.2	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.48		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	8.8
Intersection Capacity Utilization	43.0%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 30: Isabel Ave & I-580 EB Ramps

BART to Livermore Extension Project
 2040 Enhanced Bus + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗		↖↗					↑↑↑	↖		↑↑↑	↖
Traffic Volume (vph)	192	0	390	0	0	0	0	707	701	0	907	666
Future Volume (vph)	192	0	390	0	0	0	0	707	701	0	907	666
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0					4.0	4.0		4.0	4.0
Lane Util. Factor	0.97		0.88					0.91	1.00		0.91	1.00
Frt	1.00		0.85					1.00	0.85		1.00	0.85
Flt Protected	0.95		1.00					1.00	1.00		1.00	1.00
Satd. Flow (prot)	3433		2787					5085	1583		5085	1583
Flt Permitted	0.95		1.00					1.00	1.00		1.00	1.00
Satd. Flow (perm)	3433		2787					5085	1583		5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	209	0	424	0	0	0	0	768	762	0	986	724
RTOR Reduction (vph)	0	0	166	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	209	0	258	0	0	0	0	768	762	0	986	724
Turn Type	Prot		Perm					NA	Free		NA	Free
Protected Phases	4							2			6	
Permitted Phases			4						Free			Free
Actuated Green, G (s)	10.7		10.7					50.3	70.0		50.3	70.0
Effective Green, g (s)	10.7		10.7					51.3	70.0		51.3	70.0
Actuated g/C Ratio	0.15		0.15					0.73	1.00		0.73	1.00
Clearance Time (s)	4.0		4.0					5.0			5.0	
Vehicle Extension (s)	2.0		2.0					4.0			4.0	
Lane Grp Cap (vph)	524		426					3726	1583		3726	1583
v/s Ratio Prot	0.06							0.15			0.19	
v/s Ratio Perm			0.09						c0.48			0.46
v/c Ratio	0.40		0.61					0.21	0.48		0.26	0.46
Uniform Delay, d1	26.7		27.7					2.9	0.0		3.1	0.0
Progression Factor	1.00		1.00					1.00	1.00		0.67	1.00
Incremental Delay, d2	0.2		1.7					0.1	1.1		0.2	0.9
Delay (s)	26.9		29.4					3.1	1.1		2.2	0.9
Level of Service	C		C					A	A		A	A
Approach Delay (s)		28.6			0.0			2.1			1.7	
Approach LOS		C			A			A			A	

Intersection Summary		
HCM 2000 Control Delay	6.2	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.54	A
Actuated Cycle Length (s)	70.0	Sum of lost time (s)
Intersection Capacity Utilization	37.8%	8.0
Analysis Period (min)	15	ICU Level of Service
		A

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 31: Isabel Ave & Airway Blvd

BART to Livermore Extension Project
 2040 Enhanced Bus + Garage PM




































Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↑	↗	↖	↑	↗	↖	↑↑↑	↗	↖↗	↑↑↑	↗
Traffic Volume (vph)	0	172	361	144	145	58	428	1219	71	384	1283	10
Future Volume (vph)	0	172	361	144	145	58	428	1219	71	384	1283	10
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.2	5.6	5.2	5.2	5.6	4.0	4.0	4.0	4.0	4.0	5.0
Lane Util. Factor		1.00	1.00	1.00	1.00	1.00	1.00	0.91	1.00	0.97	0.91	1.00
Frt		1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1863	1583	1770	1863	1583	1770	5085	1583	3433	5085	1583
Flt Permitted		1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)		1863	1583	1770	1863	1583	1770	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	187	392	157	158	63	465	1325	77	417	1395	11
RTOR Reduction (vph)	0	0	66	0	0	36	0	0	46	0	0	8
Lane Group Flow (vph)	0	187	326	157	158	27	465	1325	31	417	1395	3
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4	5	3	8	1	5	2		1	NA	6
Permitted Phases			4			8			2			6
Actuated Green, G (s)		14.5	35.6	8.4	27.5	41.5	21.1	36.5	36.5	14.0	29.4	29.4
Effective Green, g (s)		13.9	34.4	7.8	26.9	40.3	22.1	37.5	37.5	15.0	30.4	29.4
Actuated g/C Ratio		0.15	0.37	0.08	0.29	0.44	0.24	0.40	0.40	0.16	0.33	0.32
Clearance Time (s)		4.6	5.0	4.6	4.6	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Extension (s)		3.0	3.0	3.0	3.0	3.0	3.0	5.0	5.0	3.0	5.0	5.0
Lane Grp Cap (vph)		279	588	149	541	688	422	2059	641	556	1669	502
v/s Ratio Prot		c0.10	0.12	c0.09	0.08	0.01	c0.26	0.26		0.12	c0.27	
v/s Ratio Perm			0.08			0.01			0.02			0.00
v/c Ratio		0.67	0.55	1.05	0.29	0.04	1.10	0.64	0.05	0.75	0.84	0.01
Uniform Delay, d1		37.2	23.0	42.4	25.5	15.0	35.2	22.2	16.7	37.0	28.8	21.6
Progression Factor		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2		6.2	1.1	88.7	0.3	0.0	74.3	1.0	0.1	5.6	4.2	0.0
Delay (s)		43.4	24.2	131.1	25.8	15.1	109.6	23.1	16.8	42.7	33.0	21.6
Level of Service		D	C	F	C	B	F	C	B	D	C	C
Approach Delay (s)		30.4			67.7			44.4			35.2	
Approach LOS		C			E			D			D	

Intersection Summary		
HCM 2000 Control Delay	40.9	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.93	D
Actuated Cycle Length (s)	92.6	Sum of lost time (s)
Intersection Capacity Utilization	80.9%	20.0
Analysis Period (min)	15	ICU Level of Service
		D

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
32: Isabel Ave & Jack London Blvd

BART to Livermore Extension Project
2040 Enhanced Bus + Garage PM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 	 			 		 	  		 	  	
Traffic Volume (vph)	113	899	325	284	180	292	146	1431	636	480	1269	55
Future Volume (vph)	113	899	325	284	180	292	146	1431	636	480	1269	55
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.97	0.91	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	3433	5085	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	3433	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	123	977	353	309	196	317	159	1555	691	522	1379	60
RTOR Reduction (vph)	0	0	147	0	0	30	0	0	205	0	0	39
Lane Group Flow (vph)	123	977	206	309	196	287	159	1555	486	522	1379	21
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8	1	5	2		1	NA	6
Permitted Phases			4			8			2			6
Actuated Green, G (s)	9.2	35.8	35.8	23.0	49.6	69.8	10.7	39.8	39.8	20.2	49.3	49.3
Effective Green, g (s)	9.2	35.8	35.8	23.0	49.6	69.8	10.7	39.8	39.8	20.2	49.3	49.3
Actuated g/C Ratio	0.07	0.26	0.26	0.16	0.35	0.50	0.08	0.28	0.28	0.14	0.35	0.35
Clearance Time (s)	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	225	904	404	290	1253	849	262	1445	450	495	1790	557
v/s Ratio Prot	0.04	c0.28		c0.17	0.06	0.05	0.05	0.31		c0.15	0.27	
v/s Ratio Perm			0.13			0.13			c0.31			0.01
v/c Ratio	0.55	1.08	0.51	1.07	0.16	0.34	0.61	1.08	1.08	1.05	0.77	0.04
Uniform Delay, d1	63.4	52.1	44.6	58.5	30.9	21.2	62.6	50.1	50.1	59.9	40.3	29.8
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	2.7	54.2	1.0	71.3	0.1	0.2	3.9	47.1	65.3	55.6	2.1	0.0
Delay (s)	66.1	106.3	45.6	129.8	31.0	21.4	66.6	97.2	115.4	115.5	42.4	29.8
Level of Service	E	F	D	F	C	C	E	F	F	F	D	C
Approach Delay (s)		88.1			64.4			100.4			61.5	
Approach LOS		F			E			F			E	
Intersection Summary												
HCM 2000 Control Delay			81.8									F
HCM 2000 Volume to Capacity ratio			1.07									
Actuated Cycle Length (s)			140.0									21.2
Intersection Capacity Utilization			99.6%									F
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis
 33: Isabel Ave Connector & Stanley Blvd



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑	↑	↑↓	↑↑	↑↓	↑↓
Traffic Volume (vph)	2171	776	818	569	142	902
Future Volume (vph)	2171	776	818	569	142	902
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	2.3	2.3	4.0	2.3	2.5	2.5
Lane Util. Factor	0.95	1.00	0.97	0.95	0.97	0.88
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	3539	1583	3433	3539	3433	2787
Flt Permitted	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (perm)	3539	1583	3433	3539	3433	2787
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	2360	843	889	618	154	980
RTOR Reduction (vph)	0	0	0	0	0	1
Lane Group Flow (vph)	2360	843	889	618	154	979
Turn Type	NA	pm+ov	Prot	NA	Prot	pm+ov
Protected Phases	2	8	1	6	8	1
Permitted Phases		2				8
Actuated Green, G (s)	58.0	67.8	20.0	82.0	9.8	29.8
Effective Green, g (s)	59.7	71.2	20.0	83.7	11.3	32.8
Actuated g/C Ratio	0.60	0.71	0.20	0.84	0.11	0.33
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Grp Cap (vph)	2117	1165	687	2968	388	985
v/s Ratio Prot	c0.67	0.08	c0.26	0.17	0.04	c0.21
v/s Ratio Perm		0.45				0.14
v/c Ratio	1.11	0.72	1.29	0.21	0.40	0.99
Uniform Delay, d1	20.0	8.5	39.9	1.6	41.1	33.4
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	58.9	1.9	143.0	0.0	0.2	26.9
Delay (s)	78.9	10.4	182.9	1.6	41.3	60.3
Level of Service	E	B	F	A	D	E
Approach Delay (s)	60.9			108.5	57.7	
Approach LOS	E			F	E	

Intersection Summary

HCM 2000 Control Delay	72.6	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.14		
Actuated Cycle Length (s)	99.8	Sum of lost time (s)	8.8
Intersection Capacity Utilization	100.0%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
34: Murrieta Blvd/Driveway & Portola Ave

BART to Livermore Extension Project
2040 Enhanced Bus + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗		↖	↗		↖	↗	↗		↗	
Traffic Volume (vph)	0	1170	177	256	654	1	186	5	415	4	7	0
Future Volume (vph)	0	1170	177	256	654	1	186	5	415	4	7	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.8		4.0	5.8		5.2	5.2	5.2		4.0	
Lane Util. Factor		0.95		1.00	0.95		0.95	0.95	1.00		1.00	
Frt		0.98		1.00	1.00		1.00	1.00	0.85		1.00	
Flt Protected		1.00		0.95	1.00		0.95	0.95	1.00		0.98	
Satd. Flow (prot)		3470		1770	3538		1681	1689	1583		1832	
Flt Permitted		1.00		0.95	1.00		0.95	0.95	1.00		0.98	
Satd. Flow (perm)		3470		1770	3538		1681	1689	1583		1832	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	1272	192	278	711	1	202	5	451	4	8	0
RTOR Reduction (vph)	0	10	0	0	0	0	0	0	249	0	0	0
Lane Group Flow (vph)	0	1454	0	278	712	0	105	102	202	0	12	0
Turn Type	Prot	NA		Prot	NA		Split	NA	Perm		Split	NA
Protected Phases	5	2		1	6		8	8			4	4
Permitted Phases									8			
Actuated Green, G (s)		46.7		17.2	67.9		15.8	15.8	15.8		0.7	
Effective Green, g (s)		45.8		17.2	67.0		15.2	15.2	15.2		0.7	
Actuated g/C Ratio		0.47		0.18	0.68		0.16	0.16	0.16		0.01	
Clearance Time (s)		4.9		4.0	4.9		4.6	4.6	4.6		4.0	
Vehicle Extension (s)		2.0		2.0	2.0		2.0	2.0	2.0		2.0	
Lane Grp Cap (vph)		1623		310	2421		260	262	245		13	
v/s Ratio Prot		c0.42		c0.16	0.20		0.06	0.06			c0.01	
v/s Ratio Perm									c0.13			
v/c Ratio		0.90		0.90	0.29		0.40	0.39	0.82		0.92	
Uniform Delay, d1		23.9		39.5	6.1		37.3	37.2	40.1		48.6	
Progression Factor		1.00		1.00	1.00		1.00	1.00	1.00		1.00	
Incremental Delay, d2		6.7		26.0	0.0		0.4	0.3	18.8		205.3	
Delay (s)		30.6		65.4	6.1		37.6	37.5	58.8		253.8	
Level of Service		C		E	A		D	D	E		F	
Approach Delay (s)		30.6			22.8			52.1			253.8	
Approach LOS		C			C			D			F	

Intersection Summary

HCM 2000 Control Delay	33.5	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.88		
Actuated Cycle Length (s)	97.9	Sum of lost time (s)	19.0
Intersection Capacity Utilization	79.5%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
35: Murrieta Blvd & Jack London Blvd

BART to Livermore Extension Project
2040 Enhanced Bus + Garage PM



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	356	1154	496	284	386	158
Future Volume (vph)	356	1154	496	284	386	158
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00	1.00	0.95	0.91	
Frt	1.00	0.85	1.00	1.00	0.96	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1770	1583	1770	3539	4864	
Flt Permitted	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	1770	1583	1770	3539	4864	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	387	1254	539	309	420	172
RTOR Reduction (vph)	0	384	0	0	62	0
Lane Group Flow (vph)	387	870	539	309	530	0
Turn Type	Prot	Perm	Prot	NA	NA	
Protected Phases	4		5	2	6	
Permitted Phases		4				
Actuated Green, G (s)	57.0	57.0	34.0	54.4	16.4	
Effective Green, g (s)	57.0	57.0	34.0	54.4	16.4	
Actuated g/C Ratio	0.48	0.48	0.28	0.46	0.14	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	844	755	504	1612	668	
v/s Ratio Prot	0.22		c0.30	0.09	c0.11	
v/s Ratio Perm		c0.55				
v/c Ratio	0.46	1.15	1.07	0.19	0.79	
Uniform Delay, d1	20.9	31.2	42.7	19.4	49.9	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.4	83.6	59.9	0.1	6.4	
Delay (s)	21.3	114.8	102.6	19.4	56.3	
Level of Service	C	F	F	B	E	
Approach Delay (s)	92.7			72.3	56.3	
Approach LOS	F			E	E	

Intersection Summary

HCM 2000 Control Delay	80.1	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.07		
Actuated Cycle Length (s)	119.4	Sum of lost time (s)	12.0
Intersection Capacity Utilization	89.1%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 36: Murrieta Blvd & Stanley Blvd

BART to Livermore Extension Project
 2040 Enhanced Bus + Garage PM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	320	1498	838	82	1050	215	295	339	19	235	375	205
Future Volume (vph)	320	1498	838	82	1050	215	295	339	19	235	375	205
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	5.8	5.8	4.0	5.8	4.9	4.9	5.8		4.9	5.8	4.9
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.97	0.95		1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	3433	3511		1770	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	3433	3511		1770	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	348	1628	911	89	1141	234	321	368	21	255	408	223
RTOR Reduction (vph)	0	0	206	0	0	55	0	4	0	0	0	119
Lane Group Flow (vph)	348	1628	705	89	1141	179	321	385	0	255	408	104
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Prot	NA		Prot	NA	Perm
Protected Phases	1	6		5	2	3	7	4		3	8	
Permitted Phases			6			2						8
Actuated Green, G (s)	12.0	53.3	53.3	4.0	45.3	60.3	13.6	17.9		15.0	19.3	19.3
Effective Green, g (s)	12.0	52.4	52.4	4.0	44.4	58.5	12.7	17.0		14.1	18.4	19.3
Actuated g/C Ratio	0.11	0.49	0.49	0.04	0.41	0.54	0.12	0.16		0.13	0.17	0.18
Clearance Time (s)	4.0	4.9	4.9	4.0	4.9	4.0	4.0	4.9		4.0	4.9	4.9
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	381	1717	768	65	1454	857	403	552		231	602	282
v/s Ratio Prot	c0.10	c0.46		c0.05	0.32	0.03	0.09	0.11		c0.14	c0.12	
v/s Ratio Perm			0.45			0.09						0.07
v/c Ratio	0.91	0.95	0.92	1.37	0.78	0.21	0.80	0.70		1.10	0.68	0.37
Uniform Delay, d1	47.5	26.5	25.8	52.0	27.6	12.8	46.4	43.1		47.0	42.0	39.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	25.7	11.6	15.8	237.9	2.9	0.1	10.5	3.8		89.8	3.0	0.8
Delay (s)	73.2	38.1	41.6	289.9	30.5	12.9	56.8	46.9		136.8	45.0	39.8
Level of Service	E	D	D	F	C	B	E	D		F	D	D
Approach Delay (s)		43.4			43.5			51.4			70.1	
Approach LOS		D			D			D			E	

Intersection Summary		
HCM 2000 Control Delay	48.4	HCM 2000 Level of Service D
HCM 2000 Volume to Capacity ratio	0.96	
Actuated Cycle Length (s)	108.0	Sum of lost time (s) 20.5
Intersection Capacity Utilization	86.0%	ICU Level of Service E
Analysis Period (min)	15	

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
37: Livermore Ave & I-580 WB Ramps

BART to Livermore Extension Project
2040 Enhanced Bus + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↶	↷		↶	↷			↶	↷
Traffic Volume (vph)	0	0	0	723	23	32	580	451	0	0	111	0
Future Volume (vph)	0	0	0	723	23	32	580	451	0	0	111	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)					4.0		4.0	4.0			4.0	
Lane Util. Factor					0.95		0.97	1.00			0.95	
Frt					0.99		1.00	1.00			1.00	
Flt Protected					0.96		0.95	1.00			1.00	
Satd. Flow (prot)					1681		3433	1863			3539	
Flt Permitted					0.96		0.95	1.00			1.00	
Satd. Flow (perm)					1681		3433	1863			3539	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	786	25	35	630	490	0	0	121	0
RTOR Reduction (vph)	0	0	0	0	2	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	0	844	0	630	490	0	0	121	0
Turn Type				Split	NA		Prot	NA			NA	
Protected Phases				8	8		5	2			6	
Permitted Phases												
Actuated Green, G (s)					47.6		18.9	32.7			10.3	
Effective Green, g (s)					47.6		18.4	34.4			12.0	
Actuated g/C Ratio					0.53		0.20	0.38			0.13	
Clearance Time (s)					4.0		3.5	5.7			5.7	
Vehicle Extension (s)					2.0		2.0	2.5			2.5	
Lane Grp Cap (vph)					889		701	712			471	
v/s Ratio Prot					c0.50		c0.18	c0.26			0.03	
v/s Ratio Perm												
v/c Ratio					0.95		0.90	0.69			0.26	
Uniform Delay, d1					20.1		34.9	23.3			35.0	
Progression Factor					1.00		1.00	1.00			1.00	
Incremental Delay, d2					18.7		14.0	5.4			1.3	
Delay (s)					38.7		48.9	28.7			36.3	
Level of Service					D		D	C			D	
Approach Delay (s)		0.0			38.7			40.0			36.3	
Approach LOS		A			D			D			D	

Intersection Summary

HCM 2000 Control Delay	39.3	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.91		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	110.5%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 38: Livermore Ave & I-580 EB Ramps

BART to Livermore Extension Project
 2040 Enhanced Bus + Garage PM































Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔	↗					↕		↘	↕	
Traffic Volume (vph)	236	10	1339	0	0	0	0	812	209	113	719	0
Future Volume (vph)	236	10	1339	0	0	0	0	812	209	113	719	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0					3.0		5.0	3.0	
Lane Util. Factor		0.95	0.95					0.95		1.00	0.95	
Frt		0.89	0.85					0.97		1.00	1.00	
Flt Protected		0.99	1.00					1.00		0.95	1.00	
Satd. Flow (prot)		1556	1504					3431		1770	3539	
Flt Permitted		0.99	1.00					1.00		0.95	1.00	
Satd. Flow (perm)		1556	1504					3431		1770	3539	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	257	11	1455	0	0	0	0	883	227	123	782	0
RTOR Reduction (vph)	0	62	62	0	0	0	0	16	0	0	0	0
Lane Group Flow (vph)	0	919	680	0	0	0	0	1094	0	123	782	0
Turn Type	Prot	NA	Perm					NA		Prot	NA	
Protected Phases	7	4						2		1	6	
Permitted Phases			4									
Actuated Green, G (s)		68.8	68.8					47.5		11.7	63.2	
Effective Green, g (s)		68.8	68.8					48.5		10.7	64.2	
Actuated g/C Ratio		0.49	0.49					0.35		0.08	0.46	
Clearance Time (s)		4.0	4.0					4.0		4.0	4.0	
Vehicle Extension (s)		2.0	2.0					2.5		2.0	2.5	
Lane Grp Cap (vph)		764	739					1188		135	1622	
v/s Ratio Prot								c0.32		c0.07	0.22	
v/s Ratio Perm		0.59	0.45									
v/c Ratio		1.20	0.92					0.92		0.91	0.48	
Uniform Delay, d1		35.6	33.0					43.9		64.2	26.3	
Progression Factor		1.00	1.00					1.00		1.00	1.00	
Incremental Delay, d2		103.6	16.5					12.9		50.6	1.0	
Delay (s)		139.2	49.5					56.8		114.8	27.4	
Level of Service		F	D					E		F	C	
Approach Delay (s)		100.6			0.0			56.8			39.2	
Approach LOS		F			A			E			D	

Intersection Summary		
HCM 2000 Control Delay	72.7	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	1.07	E
Actuated Cycle Length (s)	140.0	Sum of lost time (s)
Intersection Capacity Utilization	110.5%	12.0
Analysis Period (min)	15	ICU Level of Service
		H

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
39: Livermore Ave & Portola Ave

BART to Livermore Extension Project
2040 Enhanced Bus + Garage PM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 	 			 			 			 	
Traffic Volume (vph)	740	675	188	19	327	70	202	665	98	251	1027	466
Future Volume (vph)	740	675	188	19	327	70	202	665	98	251	1027	466
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	2.7	4.0	4.0	2.7	4.0	4.0	4.9		4.0	4.9	4.9
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	1.00	0.95		1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.98		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	1770	3471		1770	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	1770	3471		1770	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	804	734	204	21	355	76	220	723	107	273	1116	507
RTOR Reduction (vph)	0	0	128	0	0	65	0	8	0	0	0	59
Lane Group Flow (vph)	804	734	76	21	355	11	220	822	0	273	1116	448
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA		Prot	NA	pm+ov
Protected Phases	3	8		7	4		1	6		5	2	3
Permitted Phases			8			4						2
Actuated Green, G (s)	33.4	46.8	46.8	4.6	18.0	18.0	16.0	37.0		22.0	43.0	76.4
Effective Green, g (s)	33.4	48.1	46.8	4.6	19.3	18.0	16.0	36.1		22.0	42.1	74.6
Actuated g/C Ratio	0.26	0.38	0.37	0.04	0.15	0.14	0.13	0.29		0.17	0.33	0.59
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	907	1346	586	64	540	225	224	991		308	1178	934
v/s Ratio Prot	c0.23	0.21		0.01	c0.10		c0.12	0.24		c0.15	c0.32	0.12
v/s Ratio Perm			0.05			0.01						0.16
v/c Ratio	0.89	0.55	0.13	0.33	0.66	0.05	0.98	0.83		0.89	0.95	0.48
Uniform Delay, d1	44.7	30.6	26.3	59.4	50.4	46.8	55.1	42.3		51.0	41.1	14.8
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	10.4	0.5	0.1	3.0	2.9	0.1	54.8	5.9		24.8	15.2	0.4
Delay (s)	55.1	31.1	26.4	62.4	53.3	46.9	109.8	48.1		75.8	56.2	15.2
Level of Service	E	C	C	E	D	D	F	D		E	E	B
Approach Delay (s)		41.6			52.7			61.0			48.1	
Approach LOS		D			D			E			D	
Intersection Summary												
HCM 2000 Control Delay			48.9			HCM 2000 Level of Service			D			
HCM 2000 Volume to Capacity ratio			0.90									
Actuated Cycle Length (s)			126.4			Sum of lost time (s)			16.5			
Intersection Capacity Utilization			83.8%			ICU Level of Service			E			
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis
40: First St/Springtown Blvd & I-580 WB Ramps

BART to Livermore Extension Project
2040 Enhanced Bus + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations			↗↘			↗	↗↘	↑			↗↘	↗
Traffic Volume (vph)	0	0	262	0	0	0	385	1439	0	0	421	181
Future Volume (vph)	0	0	262	0	0	0	385	1439	0	0	421	181
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)			4.5				4.5	4.0			4.5	4.5
Lane Util. Factor			0.88				0.97	1.00			0.95	1.00
Frt			0.85				1.00	1.00			1.00	0.85
Flt Protected			1.00				0.95	1.00			1.00	1.00
Satd. Flow (prot)			2787				3433	1863			3539	1583
Flt Permitted			1.00				0.95	1.00			1.00	1.00
Satd. Flow (perm)			2787				3433	1863			3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	285	0	0	0	418	1564	0	0	458	197
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	9
Lane Group Flow (vph)	0	0	285	0	0	0	418	1564	0	0	458	188
Turn Type			Over			Free	Prot	NA			NA	Perm
Protected Phases			5				5	2			6	
Permitted Phases						Free						6
Actuated Green, G (s)			21.0				21.0	140.0			111.0	111.0
Effective Green, g (s)			20.5				20.5	140.0			110.5	110.5
Actuated g/C Ratio			0.15				0.15	1.00			0.79	0.79
Clearance Time (s)			4.0				4.0	4.0			4.0	4.0
Vehicle Extension (s)			2.0				2.0	0.2			4.0	4.0
Lane Grp Cap (vph)			408				502	1863			2793	1249
v/s Ratio Prot			0.10				0.12	c0.84			0.13	
v/s Ratio Perm												0.12
v/c Ratio			0.70				0.83	0.84			0.16	0.15
Uniform Delay, d1			56.8				58.1	0.0			3.6	3.5
Progression Factor			1.00				0.83	1.00			1.00	1.00
Incremental Delay, d2			4.2				1.1	0.5			0.1	0.3
Delay (s)			61.0				49.3	0.5			3.7	3.8
Level of Service			E				D	A			A	A
Approach Delay (s)		61.0			0.0			10.7			3.7	
Approach LOS		E			A			B			A	

Intersection Summary



















HCM 2000 Control Delay	14.1	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.90		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	79.1%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

41: First St & I-580 EB Ramps

BART to Livermore Extension Project
2040 Enhanced Bus + Garage PM

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations													
Traffic Volume (vph)	536	3	696	0	0	0	0	1700	446	97	1207	0	
Future Volume (vph)	536	3	696	0	0	0	0	1700	446	97	1207	0	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)		4.0	4.0					5.0	5.0	5.0	5.0		
Lane Util. Factor		1.00	0.88					0.95	1.00	1.00	0.95		
Frt		1.00	0.85					1.00	0.85	1.00	1.00		
Flt Protected		0.95	1.00					1.00	1.00	0.95	1.00		
Satd. Flow (prot)		1774	2787					3539	1583	1770	3539		
Flt Permitted		0.95	1.00					1.00	1.00	0.95	1.00		
Satd. Flow (perm)		1774	2787					3539	1583	1770	3539		
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	
Adj. Flow (vph)	583	3	757	0	0	0	0	1848	485	105	1312	0	
RTOR Reduction (vph)	0	0	75	0	0	0	0	0	141	0	0	0	
Lane Group Flow (vph)	0	586	682	0	0	0	0	1848	344	105	1312	0	
Turn Type	Perm	NA	Perm					NA	Perm	Prot	NA		
Protected Phases		4						2		1	6		
Permitted Phases	4		4						2				
Actuated Green, G (s)		45.5	45.5					73.5	73.5	9.0	86.5		
Effective Green, g (s)		45.0	45.0					73.0	73.0	8.0	86.0		
Actuated g/C Ratio		0.32	0.32					0.52	0.52	0.06	0.61		
Clearance Time (s)		3.5	3.5					4.5	4.5	4.0	4.5		
Vehicle Extension (s)		2.5	2.5					4.0	4.0	2.0	4.0		
Lane Grp Cap (vph)		570	895					1845	825	101	2173		
v/s Ratio Prot								c0.52		c0.06	0.37		
v/s Ratio Perm		0.33	0.24						0.22				
v/c Ratio		1.03	0.76					1.00	0.42	1.04	0.60		
Uniform Delay, d1		47.5	42.7					33.5	20.5	66.0	16.6		
Progression Factor		1.00	1.00					1.00	1.00	0.93	0.95		
Incremental Delay, d2		45.1	3.7					21.3	1.5	100.3	1.2		
Delay (s)		92.6	46.4					54.8	22.0	161.7	17.0		
Level of Service		F	D					D	C	F	B		
Approach Delay (s)		66.5			0.0			48.0			27.7		
Approach LOS		E			A			D			C		
Intersection Summary													
HCM 2000 Control Delay			47.3		HCM 2000 Level of Service						D		
HCM 2000 Volume to Capacity ratio			1.01										
Actuated Cycle Length (s)			140.0		Sum of lost time (s)						14.0		
Intersection Capacity Utilization			93.9%		ICU Level of Service						F		
Analysis Period (min)			15										
c Critical Lane Group													

HCM Signalized Intersection Capacity Analysis
42: 1st St & Mines Rd

BART to Livermore Extension Project
2040 Enhanced Bus + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	73	258	84	442	243	299	84	1554	946	376	1192	54
Future Volume (vph)	73	258	84	442	243	299	84	1554	946	376	1192	54
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	0.97	1.00	1.00	1.00	0.91	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	1863	1583	3433	1863	1583	1770	5085	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	1863	1583	3433	1863	1583	1770	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	79	280	91	480	264	325	91	1689	1028	409	1296	59
RTOR Reduction (vph)	0	0	77	0	0	33	0	0	163	0	0	29
Lane Group Flow (vph)	79	280	14	480	264	292	91	1689	865	409	1296	30
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8	1	5	2		1	6	
Permitted Phases			4			8			2			6
Actuated Green, G (s)	5.6	16.8	16.8	14.0	25.2	37.2	8.8	52.8	52.8	12.0	56.0	56.0
Effective Green, g (s)	5.6	16.8	16.8	14.0	25.2	37.2	8.8	52.8	52.8	12.0	56.0	56.0
Actuated g/C Ratio	0.05	0.15	0.15	0.13	0.23	0.33	0.08	0.47	0.47	0.11	0.50	0.50
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	88	280	238	430	420	584	139	2405	748	369	2551	794
v/s Ratio Prot	0.04	c0.15		c0.14	0.14	0.05	0.05	0.33		c0.12	c0.25	
v/s Ratio Perm			0.01			0.13			c0.55			0.02
v/c Ratio	0.90	1.00	0.06	1.12	0.63	0.50	0.65	0.70	1.16	1.11	0.51	0.04
Uniform Delay, d1	52.7	47.4	40.6	48.8	39.0	29.8	49.9	23.2	29.4	49.8	18.6	14.1
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	62.7	53.8	0.1	79.0	2.9	0.7	10.6	0.9	85.2	79.4	0.2	0.0
Delay (s)	115.4	101.2	40.7	127.8	41.9	30.4	60.5	24.1	114.6	129.2	18.7	14.1
Level of Service	F	F	D	F	D	C	E	C	F	F	B	B
Approach Delay (s)		91.4			77.0			58.4			44.2	
Approach LOS		F			E			E			D	























Intersection Summary

HCM 2000 Control Delay	60.0	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.10		
Actuated Cycle Length (s)	111.6	Sum of lost time (s)	16.0
Intersection Capacity Utilization	92.9%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group























HCM Unsignalized Intersection Capacity Analysis
 43: Vasco Rd & I-580 WB Ramps

BART to Livermore Extension Project
 2040 Enhanced Bus + Garage PM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations								  			  	
Traffic Volume (veh/h)	0	0	0	0	0	158	0	2455	0	0	595	0
Future Volume (Veh/h)	0	0	0	0	0	158	0	2455	0	0	595	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	0	0	0	172	0	2668	0	0	647	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage (veh)												
Upstream signal (ft)											524	
pX, platoon unblocked												
vC, conflicting volume	1708	3315	216	2884	3315	889	647			2668		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1708	3315	216	2884	3315	889	647			2668		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	100	100	40	100			100		
cM capacity (veh/h)	23	8	789	7	8	286	934			154		
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	NB 4	SB 1	SB 2	SB 3	SB 4		
Volume Total	0	172	889	889	889	0	216	216	216	0		
Volume Left	0	0	0	0	0	0	0	0	0	0		
Volume Right	0	172	0	0	0	0	0	0	0	0		
cSH	1700	286	1700	1700	1700	1700	1700	1700	1700	1700		
Volume to Capacity	0.00	0.60	0.52	0.52	0.52	0.00	0.13	0.13	0.13	0.00		
Queue Length 95th (ft)	0	90	0	0	0	0	0	0	0	0		
Control Delay (s)	0.0	34.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
Lane LOS	A	D										
Approach Delay (s)	0.0	34.9	0.0				0.0					
Approach LOS	A	D										
Intersection Summary												
Average Delay			1.7									
Intersection Capacity Utilization			63.9%		ICU Level of Service					B		
Analysis Period (min)			15									






















HCM Unsignalized Intersection Capacity Analysis
44: Vasco Rd & I-580 EB Ramps

BART to Livermore Extension Project
2040 Enhanced Bus + Garage PM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations								  			  	
Traffic Volume (veh/h)	0	0	0	0	0	0	0	2864	0	64	735	0
Future Volume (Veh/h)	0	0	0	0	0	0	0	2864	0	64	735	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	0	0	0	0	0	3113	0	70	799	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1977	4052	266	3519	4052	1038	799			3113		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1977	4052	266	3519	4052	1038	799			3113		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	100	100	100	100			31		
cM capacity (veh/h)	16	1	732	1	1	228	819			102		
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	NB 4	SB 1	SB 2	SB 3	SB 4		
Volume Total	0	0	1038	1038	1038	0	70	266	266	266		
Volume Left	0	0	0	0	0	0	70	0	0	0		
Volume Right	0	0	0	0	0	0	0	0	0	0		
cSH	1700	1700	1700	1700	1700	1700	102	1700	1700	1700		
Volume to Capacity	0.00	0.00	0.61	0.61	0.61	0.00	0.69	0.16	0.16	0.16		
Queue Length 95th (ft)	0	0	0	0	0	0	88	0	0	0		
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	96.3	0.0	0.0	0.0		
Lane LOS	A	A					F					
Approach Delay (s)	0.0	0.0	0.0				7.8					
Approach LOS	A	A										
Intersection Summary												
Average Delay			1.7									
Intersection Capacity Utilization			58.7%		ICU Level of Service					B		
Analysis Period (min)			15									

HCM Signalized Intersection Capacity Analysis
45: Vasco Rd & East Ave

BART to Livermore Extension Project
2040 Enhanced Bus + Garage PM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	750	40	121	134	403	280	107	380	12	16	383	469
Future Volume (vph)	750	40	121	134	403	280	107	380	12	16	383	469
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	0.95		0.97	1.00	1.00
Frt	1.00	0.89		1.00	0.94		1.00	1.00		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	3139		1770	3322		1770	3523		3433	1863	1583
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1770	3139		1770	3322		1770	3523		3433	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	815	43	132	146	438	304	116	413	13	17	416	510
RTOR Reduction (vph)	0	73	0	0	115	0	0	2	0	0	0	395
Lane Group Flow (vph)	815	102	0	146	627	0	116	424	0	17	416	115
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												6
Actuated Green, G (s)	46.0	50.5		13.5	18.0		7.0	30.8		1.6	25.4	25.4
Effective Green, g (s)	46.0	50.5		13.5	18.0		7.0	30.8		1.6	25.4	25.4
Actuated g/C Ratio	0.41	0.45		0.12	0.16		0.06	0.27		0.01	0.23	0.23
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	724	1410		212	531		110	965		48	420	357
v/s Ratio Prot	c0.46	0.03		0.08	c0.19		c0.07	0.12		0.00	c0.22	
v/s Ratio Perm												0.07
v/c Ratio	1.13	0.07		0.69	1.18		1.05	0.44		0.35	0.99	0.32
Uniform Delay, d1	33.2	17.6		47.4	47.2		52.7	33.7		54.9	43.4	36.3
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	73.7	0.0		9.0	99.4		101.2	0.3		4.5	41.3	0.5
Delay (s)	106.9	17.6		56.4	146.6		153.9	34.0		59.3	84.6	36.8
Level of Service	F	B		E	F		F	C		E	F	D
Approach Delay (s)		91.1			131.8			59.7			58.3	
Approach LOS		F			F			E			E	
Intersection Summary												
HCM 2000 Control Delay			87.6									F
HCM 2000 Volume to Capacity ratio			1.09									
Actuated Cycle Length (s)			112.4								16.0	
Intersection Capacity Utilization			101.1%									G
ICU Level of Service												
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

46: Greenville Rd & I-580 WB Ramps

BART to Livermore Extension Project
2040 Enhanced Bus + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↔		↔		↕	↔		↕	↔
Traffic Volume (vph)	0	0	0	105	0	32	0	1315	583	0	164	25
Future Volume (vph)	0	0	0	105	0	32	0	1315	583	0	164	25
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0		4.0		4.0	4.0		4.0	
Lane Util. Factor				0.97		1.00		0.95	1.00		0.95	
Frt				1.00		0.85		1.00	0.85		0.98	
Flt Protected				0.95		1.00		1.00	1.00		1.00	
Satd. Flow (prot)				3433		1583		3539	1583		3469	
Flt Permitted				0.95		1.00		1.00	1.00		1.00	
Satd. Flow (perm)				3433		1583		3539	1583		3469	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	114	0	35	0	1429	634	0	178	27
RTOR Reduction (vph)	0	0	0	0	0	33	0	0	82	0	3	0
Lane Group Flow (vph)	0	0	0	114	0	3	0	1429	552	0	202	0
Turn Type				Prot		Prot		NA	Perm		NA	
Protected Phases				3		3		2			6	
Permitted Phases									2			
Actuated Green, G (s)				10.0		10.0		122.0	122.0		122.0	
Effective Green, g (s)				10.0		10.0		122.0	122.0		122.0	
Actuated g/C Ratio				0.07		0.07		0.87	0.87		0.87	
Clearance Time (s)				4.0		4.0		4.0	4.0		4.0	
Vehicle Extension (s)				3.0		3.0		3.0	3.0		3.0	
Lane Grp Cap (vph)				245		113		3083	1379		3022	
v/s Ratio Prot				c0.03		0.00		c0.40			0.06	
v/s Ratio Perm									0.35			
v/c Ratio				0.47		0.02		0.46	0.40		0.07	
Uniform Delay, d1				62.4		60.5		1.9	1.8		1.2	
Progression Factor				1.00		1.00		0.67	0.46		1.00	
Incremental Delay, d2				1.4		0.1		0.5	0.8		0.0	
Delay (s)				63.8		60.5		1.8	1.6		1.3	
Level of Service				E		E		A	A		A	
Approach Delay (s)		0.0			63.1			1.7			1.3	
Approach LOS		A			E			A			A	






















Intersection Summary

HCM 2000 Control Delay	5.5	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.46		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	46.4%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
47: Greenville Rd & I-580 EB Ramps

BART to Livermore Extension Project
2040 Enhanced Bus + Garage PM

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations	 							 			 		
Traffic Volume (vph)	153	0	101	0	0	0	0	1374	398	0	202	63	
Future Volume (vph)	153	0	101	0	0	0	0	1374	398	0	202	63	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)	4.0		4.0					4.0	4.0		4.0	4.0	
Lane Util. Factor	0.97		1.00					0.95	1.00		0.95	1.00	
Frt	1.00		0.85					1.00	0.85		1.00	0.85	
Flt Protected	0.95		1.00					1.00	1.00		1.00	1.00	
Satd. Flow (prot)	3433		1583					3539	1583		3539	1583	
Flt Permitted	0.95		1.00					1.00	1.00		1.00	1.00	
Satd. Flow (perm)	3433		1583					3539	1583		3539	1583	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	
Adj. Flow (vph)	166	0	110	0	0	0	0	1493	433	0	220	68	
RTOR Reduction (vph)	0	0	100	0	0	0	0	0	62	0	0	10	
Lane Group Flow (vph)	166	0	10	0	0	0	0	1493	371	0	220	58	
Turn Type	Prot		Prot					NA	Perm		NA	Perm	
Protected Phases	7		7					2			6		
Permitted Phases									2			6	
Actuated Green, G (s)	12.1		12.1					119.9	119.9		119.9	119.9	
Effective Green, g (s)	12.1		12.1					119.9	119.9		119.9	119.9	
Actuated g/C Ratio	0.09		0.09					0.86	0.86		0.86	0.86	
Clearance Time (s)	4.0		4.0					4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0		3.0					3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	296		136					3030	1355		3030	1355	
v/s Ratio Prot	c0.05		0.01					c0.42			0.06		
v/s Ratio Perm									0.23			0.04	
v/c Ratio	0.56		0.07					0.49	0.27		0.07	0.04	
Uniform Delay, d1	61.4		58.8					2.5	1.9		1.5	1.5	
Progression Factor	1.00		1.00					0.77	0.58		0.60	0.10	
Incremental Delay, d2	2.4		0.2					0.5	0.4		0.0	0.1	
Delay (s)	63.8		59.0					2.4	1.5		1.0	0.2	
Level of Service	E		E					A	A		A	A	
Approach Delay (s)		61.9			0.0			2.2			0.8		
Approach LOS		E			A			A			A		
Intersection Summary													
HCM 2000 Control Delay			8.7									HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio			0.50										
Actuated Cycle Length (s)			140.0									Sum of lost time (s)	8.0
Intersection Capacity Utilization			49.0%									ICU Level of Service	A
Analysis Period (min)			15										
c Critical Lane Group													

HCM Signalized Intersection Capacity Analysis
 48: Greenville Rd & Northfront Road/Altamont Pass Road

BART to Livermore Extension Project
 2040 Enhanced Bus + Garage PM



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↑	↑	↑	↑	↑
Traffic Volume (vph)	555	178	2	73	267	1160
Future Volume (vph)	555	178	2	73	267	1160
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	1863	1583	1770	1863	1770	1583
Flt Permitted	1.00	1.00	0.11	1.00	0.95	1.00
Satd. Flow (perm)	1863	1583	213	1863	1770	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	603	193	2	79	290	1261
RTOR Reduction (vph)	0	86	0	0	0	25
Lane Group Flow (vph)	603	107	2	79	290	1236
Turn Type	NA	Perm	Perm	NA	Prot	Perm
Protected Phases	4			8	2	
Permitted Phases		4	8			2
Actuated Green, G (s)	35.0	35.0	35.0	35.0	77.0	77.0
Effective Green, g (s)	35.0	35.0	35.0	35.0	77.0	77.0
Actuated g/C Ratio	0.29	0.29	0.29	0.29	0.64	0.64
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	543	461	62	543	1135	1015
v/s Ratio Prot	c0.32			0.04	0.16	
v/s Ratio Perm		0.07	0.01			c0.78
v/c Ratio	1.11	0.23	0.03	0.15	0.26	1.22
Uniform Delay, d1	42.5	32.3	30.4	31.4	9.2	21.5
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	72.6	0.3	0.2	0.1	0.1	107.2
Delay (s)	115.1	32.5	30.6	31.6	9.3	128.7
Level of Service	F	C	C	C	A	F
Approach Delay (s)	95.0			31.5	106.4	
Approach LOS	F			C	F	

Intersection Summary

HCM 2000 Control Delay	100.2	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.18		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	107.7%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 49: Greenville Rd & Southfront Rd



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	404	109	230	1275	159	143
Future Volume (vph)	404	109	230	1275	159	143
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.2	5.2	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.88	0.97	0.95	0.95	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	3433	2787	3433	3539	3539	1583
Flt Permitted	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (perm)	3433	2787	3433	3539	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	439	118	250	1386	173	155
RTOR Reduction (vph)	0	93	0	0	0	84
Lane Group Flow (vph)	439	25	250	1386	173	71
Turn Type	Prot	Perm	Prot	NA	NA	Perm
Protected Phases	8		1	6	2	
Permitted Phases		8				2
Actuated Green, G (s)	15.2	15.2	10.3	44.5	30.2	30.2
Effective Green, g (s)	14.6	14.6	10.3	46.2	31.9	31.9
Actuated g/C Ratio	0.21	0.21	0.15	0.66	0.46	0.46
Clearance Time (s)	4.6	4.6	4.0	5.7	5.7	5.7
Vehicle Extension (s)	5.0	5.0	6.0	2.5	2.5	2.5
Lane Grp Cap (vph)	716	581	505	2335	1612	721
v/s Ratio Prot	c0.13		0.07	c0.39	0.05	
v/s Ratio Perm		0.01				0.04
v/c Ratio	0.61	0.04	0.50	0.59	0.11	0.10
Uniform Delay, d1	25.1	22.1	27.5	6.7	10.9	10.9
Progression Factor	1.00	1.00	1.00	1.00	0.73	0.69
Incremental Delay, d2	2.2	0.1	2.1	1.1	0.1	0.3
Delay (s)	27.4	22.2	29.6	7.8	8.1	7.8
Level of Service	C	C	C	A	A	A
Approach Delay (s)	26.3			11.1	8.0	
Approach LOS	C			B	A	

Intersection Summary

HCM 2000 Control Delay	14.1	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.64		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	13.2
Intersection Capacity Utilization	54.4%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
50: Greenville Rd & Patterson Pass Rd

BART to Livermore Extension Project
2040 Enhanced Bus + Garage PM



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	41	537	65	6	12	8	66	480	336	411	216	40
Future Volume (vph)	41	537	65	6	12	8	66	480	336	411	216	40
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.98		1.00	0.94		1.00	0.94		1.00	0.98	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1832		1770	1748		1770	1748		1770	1820	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	1832		1770	1748		1770	1748		1770	1820	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	45	584	71	7	13	9	72	522	365	447	235	43
RTOR Reduction (vph)	0	5	0	0	7	0	0	27	0	0	7	0
Lane Group Flow (vph)	45	650	0	7	15	0	72	860	0	447	271	0
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												
Actuated Green, G (s)	7.0	23.0		0.7	16.7		6.8	33.9		14.0	41.1	
Effective Green, g (s)	7.0	23.0		0.7	16.7		6.8	33.9		14.0	41.1	
Actuated g/C Ratio	0.08	0.26		0.01	0.19		0.08	0.39		0.16	0.47	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	141	481		14	333		137	676		282	853	
v/s Ratio Prot	c0.03	c0.35		0.00	0.01		0.04	c0.49		c0.25	0.15	
v/s Ratio Perm												
v/c Ratio	0.32	1.35		0.50	0.04		0.53	1.27		1.59	0.32	
Uniform Delay, d1	38.1	32.3		43.3	28.9		38.8	26.8		36.8	14.5	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	1.3	171.2		25.4	0.1		3.6	133.9		279.6	1.0	
Delay (s)	39.4	203.5		68.7	29.0		42.5	160.7		316.4	15.5	
Level of Service	D	F		E	C		D	F		F	B	
Approach Delay (s)		193.0			38.6			151.9			201.0	
Approach LOS		F			D			F			F	

Intersection Summary

HCM 2000 Control Delay	177.2	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.35		
Actuated Cycle Length (s)	87.6	Sum of lost time (s)	16.0
Intersection Capacity Utilization	110.8%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

Freeway Analysis

Westbound I-580 General Purpose Lanes, 2025

#	West	East	AM/ PM	General Purpose Lanes	Auxiliary Lanes	Freeway Main Lanes Capacity per Lane	Auxiliary Lane Capacity per Lane	Total Capacity	2025 No Project			2025 BART			2025 DMU			2025 Express Bus/BRT			2025 Enhanced Bus		
									Volum es	V/C	L O S	Volum es	V/C	L O S	Volum es	V/C	LOS	Volum es	V/C	L O S	Volum es	V/C	L O S
1	Dougherty Road/ Hopyard Road	Hacienda Drive	AM	4	1	2,000	1,000	9,000	8,738	0.971	E	8,769	0.974	E	8,787	0.976	E	8,762	0.974	E	8,795	0.977	E
			PM	4	1	2,000	1,000	9,000	5,703	0.634	C	5,755	0.639	C	5,721	0.636	C	5,724	0.636	C	5,729	0.637	C
2	Hacienda Drive	Tassajara Road/San ta Rita Road	AM	4	1	2,000	1,000	9,000	8,955	0.995	E	8,968	0.996	E	8,958	0.995	E	9,009	1.001	F	8,979	0.998	E
			PM	4	1	2,000	1,000	9,000	5,673	0.630	C	5,522	0.614	C	5,604	0.623	C	5,680	0.631	C	5,689	0.632	C
3	Tassajara Road/Santa Rita Road	Fallon Road/El Charro Road	AM	4	1	2,000	1,000	9,000	9,033	1.004	F	9,026	1.003	F	8,993	0.999	E	9,070	1.008	F	9,046	1.005	F
			PM	4	1	2,000	1,000	9,000	5,930	0.659	C	5,788	0.643	C	5,869	0.652	C	5,937	0.660	C	5,945	0.661	C
4	Fallon Road/El Charro Road	Airway Boulevard	AM	4	1	2,000	1,000	9,000	8,772	0.975	E	8,719	0.969	E	8,710	0.968	E	8,786	0.976	E	8,770	0.974	E
			PM	4	1	2,000	1,000	9,000	5,609	0.623	C	5,454	0.606	C	5,528	0.614	C	5,611	0.623	C	5,626	0.625	C
5	Airway Boulevard	Isabel Avenue	AM	4	1	2,000	1,000	9,000	9,337	1.037	F	8,952	0.993	E	9,170	1.017	F	9,339	1.038	F	9,337	1.037	F
			PM	4	1	2,000	1,000	9,000	4,909	0.545	B	4,682	0.520	B	4,794	0.533	B	4,950	0.550	B	4,953	0.550	B
6	Isabel Avenue	Livermore Ave	AM	4	1	2,000	1,000	9,000	9,457	1.051	F	9,397	1.051	F	9,486	1.061	F	9,489	1.054	F	9,466	1.052	F
			PM	4	1	2,000	1,000	9,000	5,728	0.636	C	5,502	0.611	C	5,657	0.629	C	5,742	0.638	C	5,730	0.637	C
7	Livermore Ave	Springtow n Boulevard /First Street	AM	4	1	2,000	1,000	9,000	8,859	0.984	E	8,809	0.992	E	8,893	0.995	E	8,900	0.989	E	8,859	0.984	E
			PM	4	1	2,000	1,000	9,000	4,621	0.513	B	4,631	0.515	B	4,650	0.517	B	4,620	0.513	B	4,604	0.512	B
8	Springtown Boulevard/ First Street	Vasco Road	AM	4	1	2,000	1,000	9,000	8,806	0.978	E	8,879	0.999	E	8,837	0.989	E	8,806	0.978	E	8,794	0.977	E
			PM	4	1	2,000	1,000	9,000	5,277	0.586	C	5,379	0.598	C	5,356	0.595	C	5,304	0.589	C	5,297	0.589	C
9	Vasco Road	Greenville Road	AM	4	0	2,000	1,000	8,000	7,816	0.977	E	7,853	0.996	F	7,894	0.995	E	7,839	0.980	E	7,805	0.976	E
			PM	4	0	2,000	1,000	8,000	4,627	0.578	B	4,633	0.579	B	4,620	0.578	B	4,617	0.577	B	4,623	0.578	B
10	Greenville Road	Carroll Road	AM	4	0	2,000	1,000	8,000	8,305	1.038	F	8,372	1.061	F	8,400	1.065	F	8,320	1.040	F	8,343	1.043	F
			PM	4	0	2,000	1,000	8,000	4,825	0.603	C	4,965	0.621	C	4,944	0.618	C	4,864	0.608	C	4,827	0.603	C

Freeway Analysis

Eastbound I-580 General Purpose Lanes, 2025

#	West	East	AM/ PM	General Purpose Lanes	Auxiliary Lanes	Freeway Main Lanes Capacity per Lane	Auxiliary Lane Capacity per Lane	Total Capacity	2025 No Project			2025 BART			2025 DMU			2025 Express Bus/BRT			2025 Enhanced Bus		
									Volum es	V/C	L O S	Volum es	V/C	L O S	Volum es	V/C	LOS	Volum es	V/C	L O S	Volum es	V/C	L O S
1	Dougherty Road/ Hopyard Road	Hacienda Drive	AM	5	2	2,000	1,000	12,000	5,653	0.471	B	5,632	0.469	B	5,643	0.470	B	5,636	0.470	B	5,651	0.471	B
			PM	5	2	2,000	1,000	12,000	8,571	0.714	C	8,566	0.714	C	8,547	0.712	C	8,544	0.712	C	8,538	0.712	C
2	Hacienda Drive	Tassajara Road/San ta Rita Road	AM	4	1	2,000	1,000	9,000	4,785	0.532	B	4,708	0.523	B	4,742	0.527	B	4,775	0.531	B	4,789	0.532	B
			PM	4	1	2,000	1,000	9,000	8,087	0.899	D	8,030	0.892	D	8,063	0.896	D	8,064	0.896	D	8,052	0.895	D
3	Tassajara Road/Santa Rita Road	Fallon Road/El Charro Road	AM	4	1	2,000	1,000	9,000	5,103	0.567	B	5,019	0.558	B	5,062	0.562	B	5,087	0.565	B	5,105	0.567	B
			PM	4	1	2,000	1,000	9,000	8,584	0.954	E	8,405	0.934	E	8,514	0.946	E	8,539	0.949	E	8,536	0.948	E
4	Fallon Road/El Charro Road	Airway Boulevard	AM	4	1	2,000	1,000	9,000	4,919	0.547	B	4,828	0.536	B	4,874	0.542	B	4,903	0.545	B	4,921	0.547	B
			PM	4	1	2,000	1,000	9,000	8,727	0.970	E	8,483	0.943	E	8,559	0.951	E	8,667	0.963	E	8,663	0.963	E
5	Airway Boulevard	Isabel Avenue	AM	4	1	2,000	1,000	9,000	4,393	0.488	B	4,159	0.462	B	4,293	0.477	B	4,385	0.487	B	4,386	0.487	B
			PM	4	1	2,000	1,000	9,000	8,576	0.953	E	8,411	0.927	E	8,499	0.943	E	8,541	0.949	E	8,537	0.949	E
6	Isabel Avenue	Livermore Ave	AM	4	1	2,000	1,000	9,000	4,832	0.537	B	4,819	0.535	B	4,815	0.535	B	4,824	0.536	B	4,839	0.538	B
			PM	4	1	2,000	1,000	9,000	9,329	1.037	F	9,193	1.039	F	9,260	1.050	F	9,281	1.031	F	9,307	1.034	F
7	Livermore Ave	Springtow n Boulevard /First Street	AM	4	1	2,000	1,000	9,000	4,674	0.519	B	4,801	0.533	B	4,733	0.526	B	4,671	0.519	B	4,683	0.520	B
			PM	4	1	2,000	1,000	9,000	8,298	0.922	E	8,318	0.939	E	8,298	0.938	E	8,233	0.915	E	8,284	0.920	E
8	Springtown Boulevard/ First Street	Vasco Road	AM	4	1	2,000	1,000	9,000	5,103	0.567	B	5,321	0.591	C	5,230	0.581	C	5,122	0.569	B	5,109	0.568	B
			PM	4	1	2,000	1,000	9,000	8,123	0.903	E	8,110	0.916	E	8,174	0.919	E	8,036	0.893	D	8,120	0.902	D
9	Vasco Road	Greenville Road	AM	4	0	2,000	1,000	8,000	4,566	0.571	B	4,633	0.579	B	4,638	0.580	C	4,578	0.572	B	4,569	0.571	B
			PM	4	0	2,000	1,000	8,000	7,134	0.892	D	7,153	0.911	E	7,165	0.908	E	7,106	0.888	D	7,089	0.886	D
10	Greenville Road	Carroll Road	AM	5	0	2,000	1,000	10,000	4,443	0.444	B	4,515	0.452	B	4,516	0.452	B	4,457	0.446	B	4,447	0.445	B
			PM	5	0	2,000	1,000	10,000	8,172	0.817	D	8,242	0.838	D	8,236	0.834	D	8,168	0.817	D	8,133	0.813	D

Freeway Analysis

Westbound I-580 General Purpose Lanes, 2040

#	West	East	AM/ PM	General Purpose Lanes	Auxiliary Lanes	Freeway Main Lanes Capacity per Lane	Auxiliary Lane Capacity per Lane	Total Capacity	2040 No Project			2040 BART			2040 DMU			2040 Express Bus/BRT			2040 Enhanced Bus		
									Volum es	V/C	L O S	Volumes	V/C	L O S	Volumes	V/C	L O S	Volumes	V/C	L O S	Volum es	V/C	L O S
1	Dougherty Road/ Hopyard Road	Hacienda Drive	AM	4	1	2,000	1,000	9,000	8,830	0.981	E	8,810	0.979	E	8,814	0.979	E	8,831	0.981	E	8,847	0.983	E
			PM	4	1	2,000	1,000	9,000	6,729	0.748	C	6,746	0.750	C	6,756	0.751	D	6,719	0.747	C	6,737	0.749	C
2	Hacienda Drive	Tassajara Road/San ta Rita Road	AM	4	1	2,000	1,000	9,000	9,032	1.004	F	8,954	0.995	E	8,981	0.998	E	9,069	1.008	F	9,061	1.007	F
			PM	4	1	2,000	1,000	9,000	6,819	0.758	D	6,710	0.746	C	6,709	0.745	C	6,799	0.755	D	6,814	0.757	D
3	Tassajara Road/Santa Rita Road	Fallon Road/El Charro Road	AM	4	1	2,000	1,000	9,000	9,181	1.020	F	9,128	1.014	F	9,104	1.012	F	9,171	1.019	F	9,198	1.022	F
			PM	4	1	2,000	1,000	9,000	7,018	0.780	D	6,966	0.774	D	6,971	0.775	D	6,991	0.777	D	7,023	0.780	D
4	Fallon Road/El Charro Road	Airway Boulevard	AM	4	1	2,000	1,000	9,000	8,953	0.995	E	8,699	0.967	E	8,757	0.973	E	8,954	0.995	E	8,972	0.997	E
			PM	4	1	2,000	1,000	9,000	6,786	0.754	D	6,572	0.730	C	6,634	0.737	C	6,765	0.752	D	6,806	0.756	D
5	Airway Boulevard	Isabel Avenue	AM	4	1	2,000	1,000	9,000	9,576	1.064	F	9,338	1.033	F	9,553	1.060	F	9,592	1.066	F	9,616	1.068	F
			PM	4	1	2,000	1,000	9,000	5,975	0.664	C	5,901	0.656	C	5,855	0.651	C	5,976	0.664	C	6,003	0.667	C
6	Isabel Avenue	Livermore Ave	AM	4	1	2,000	1,000	9,000	9,931	1.103	F	10,042	1.147	F	10,019	1.142	F	9,934	1.104	F	9,933	1.104	F
			PM	4	1	2,000	1,000	9,000	6,936	0.771	D	6,777	0.753	D	6,784	0.754	D	6,922	0.769	D	6,949	0.772	D
7	Livermore Ave	Springtow n Boulevard /First Street	AM	4	1	2,000	1,000	9,000	9,232	1.026	F	9,322	1.067	F	9,313	1.063	F	9,239	1.027	F	9,219	1.024	F
			PM	4	1	2,000	1,000	9,000	6,641	0.738	C	6,560	0.729	C	6,614	0.735	C	6,630	0.737	C	6,633	0.737	C
8	Springtown Boulevard/ First Street	Vasco Road	AM	4	1	2,000	1,000	9,000	9,337	1.037	F	9,538	1.069	F	9,471	1.086	F	9,315	1.035	F	9,336	1.037	F
			PM	4	1	2,000	1,000	9,000	7,436	0.826	D	7,512	0.835	D	7,502	0.834	D	7,434	0.826	D	7,440	0.827	D
9	Vasco Road	Greenville Road	AM	4	0	2,000	1,000	8,000	8,568	1.071	F	8,693	1.097	F	8,678	1.090	F	8,559	1.070	F	8,555	1.069	F
			PM	4	0	2,000	1,000	8,000	6,208	0.776	D	6,300	0.788	D	6,276	0.785	D	6,197	0.775	D	6,208	0.776	D
10	Greenville Road	Carroll Road	AM	4	0	2,000	1,000	8,000	8,450	1.056	F	8,623	1.078	F	8,572	1.072	F	8,486	1.061	F	8,482	1.060	F
			PM	4	0	2,000	1,000	8,000	6,003	0.750	D	6,097	0.762	D	6,074	0.759	D	6,005	0.751	D	6,000	0.750	D

Freeway Analysis

Eastbound I-580 General Purpose Lanes, 2040

#	West	East	AM/ PM	General Purpose Lanes	Auxiliary Lanes	Freeway Main Lanes Capacity per Lane	Auxiliary Lane Capacity per Lane	Total Capacity	2040 No Project			2040 BART			2040 DMU			2040 Express Bus/BRT			2040 Enhanced Bus		
									Volum es	V/C	L O S	Volum es	V/C	L O S	Volum es	V/C	L O S	Volum es	V/C	L O S	Volum es	V/C	L O S
1	Dougherty Road/ Hopyard Road	Hacienda Drive	AM	5	2	2,000	1,000	12,000	6,573	0.548	B	6,550	0.546	B	6,566	0.547	B	6,539	0.545	B	6,579	0.548	B
			PM	5	2	2,000	1,000	12,000	8,202	0.684	C	8,210	0.684	C	8,165	0.680	C	8,216	0.685	C	8,226	0.686	C
2	Hacienda Drive	Tassajara Road/San ta Rita Road	AM	4	1	2,000	1,000	9,000	5,862	0.651	C	5,693	0.633	C	5,693	0.633	C	5,835	0.648	C	5,869	0.652	C
			PM	4	1	2,000	1,000	9,000	8,461	0.940	E	8,377	0.931	E	8,416	0.935	E	8,474	0.942	E	8,467	0.941	E
3	Tassajara Road/Santa Rita Road	Fallon Road/El Charro Road	AM	4	1	2,000	1,000	9,000	6,009	0.668	C	5,852	0.650	C	5,858	0.651	C	5,982	0.665	C	6,017	0.669	C
			PM	4	1	2,000	1,000	9,000	8,780	0.976	E	8,646	0.961	E	8,737	0.971	E	8,794	0.977	E	8,810	0.979	E
4	Fallon Road/El Charro Road	Airway Boulevard	AM	4	1	2,000	1,000	9,000	5,880	0.653	C	5,722	0.636	C	5,731	0.637	C	5,856	0.651	C	5,892	0.655	C
			PM	4	1	2,000	1,000	9,000	8,727	0.970	E	8,617	0.957	E	8,703	0.967	E	8,735	0.971	E	8,732	0.970	E
5	Airway Boulevard	Isabel Avenue	AM	4	1	2,000	1,000	9,000	5,295	0.588	C	4,869	0.541	B	5,019	0.558	B	5,259	0.584	C	5,317	0.591	C
			PM	4	1	2,000	1,000	9,000	8,928	0.992	E	8,723	0.969	E	8,851	0.983	E	8,950	0.994	E	8,954	0.995	E
6	Isabel Avenue	Livermore Ave	AM	4	1	2,000	1,000	9,000	5,693	0.633	C	5,535	0.615	C	5,559	0.618	C	5,704	0.634	C	5,730	0.637	C
			PM	4	1	2,000	1,000	9,000	9,748	1.083	F	10,091	1.121	F	10,166	1.130	F	9,759	1.084	F	9,762	1.085	F
7	Livermore Ave	Springtow n Boulevard /First Street	AM	4	1	2,000	1,000	9,000	5,650	0.628	C	5,711	0.635	C	5,712	0.635	C	5,663	0.629	C	5,677	0.631	C
			PM	4	1	2,000	1,000	9,000	9,116	1.013	F	9,383	1.043	F	9,573	1.064	F	9,096	1.011	F	9,103	1.011	F
8	Springtown Boulevard/ First Street	Vasco Road	AM	4	1	2,000	1,000	9,000	6,892	0.766	D	6,950	0.772	D	6,928	0.770	D	6,863	0.763	D	6,888	0.765	D
			PM	4	1	2,000	1,000	9,000	9,141	1.016	F	9,442	1.049	F	9,603	1.067	F	9,155	1.017	F	9,180	1.020	F
9	Vasco Road	Greenville Road	AM	4	0	2,000	1,000	8,000	5,389	0.674	C	5,477	0.685	C	5,450	0.681	C	5,384	0.673	C	5,388	0.674	C
			PM	4	0	2,000	1,000	8,000	7,656	0.957	E	7,940	0.993	E	8,091	1.011	F	7,652	0.957	E	7,667	0.958	E
10	Greenville Road	Carroll Road	AM	5	0	2,000	1,000	10,000	5,668	0.567	B	5,760	0.576	B	5,729	0.573	B	5,668	0.567	B	5,666	0.567	B
			PM	5	0	2,000	1,000	10,000	8,159	0.816	D	8,464	0.846	D	8,593	0.859	D	8,167	0.817	D	8,165	0.817	D

Freeway Analysis

Westbound I-580 Express Lanes (HOT), 2025

#	West	East	AM / PM	Lanes	Capacity per Lane	Total Capacity	2025 No Project			2025 BART			2025 DMU			2025 Express Bus/BRT			2025 Enhanced Bus		
							Volumes	V/C	LOS	Volumes	V/C	LOS	Volumes	V/C	LOS	Volumes	V/C	LOS	Volumes	V/C	LOS
1	Dougherty Road/Hopyard Road	Hacienda Drive	AM	1	2,000	2,000	1,955	0.978	E	1,955	0.978	E	1,953	0.977	E	1,936	0.968	E	1,968	0.984	E
			PM	1	2,000	2,000	898	0.449	B	856	0.428	B	891	0.446	B	901	0.451	B	889	0.445	B
2	Hacienda Drive	Tassajara Road/Santa Rita Road	AM	1	2,000	2,000	2,028	1.014	F	2,024	1.012	F	2,026	1.013	F	2,026	1.013	F	2,027	1.014	F
			PM	1	2,000	2,000	895	0.448	B	853	0.427	B	888	0.444	B	897	0.449	B	886	0.443	B
3	Tassajara Road/Santa Rita Road	Fallon Road/El Charro Road	AM	1	2,000	2,000	2,047	1.024	F	2,040	1.020	F	2,038	1.019	F	2,039	1.020	F	2,052	1.026	F
			PM	1	2,000	2,000	948	0.474	B	891	0.446	B	934	0.467	B	947	0.474	B	940	0.470	B
4	Fallon Road/El Charro Road	Airway Boulevard	AM	1	2,000	2,000	1,980	0.990	E	1,957	0.979	E	1,976	0.988	E	1,965	0.983	E	1,989	0.995	E
			PM	1	2,000	2,000	946	0.473	B	891	0.446	B	934	0.467	B	946	0.473	B	937	0.469	B
5	Airway Boulevard	Isabel Avenue	AM	1	2,000	2,000	2,087	1.044	F	1,997	0.999	F	2,068	1.034	F	2,071	1.036	F	2,081	1.041	F
			PM	1	2,000	2,000	852	0.426	B	836	0.418	B	846	0.423	B	856	0.428	B	846	0.423	B
6	Isabel Avenue	Livermore Ave	AM	1	2,000	2,000	2,110	1.055	F	2,097	1.049	F	2,130	1.065	F	2,102	1.051	F	2,115	1.058	F
			PM	1	2,000	2,000	842	0.421	B	824	0.412	B	836	0.418	B	845	0.423	B	832	0.416	B
7	Livermore Ave	Springtown Boulevard/First Street	AM	1	2,000	2,000	1,988	0.994	E	1,979	0.990	E	2,005	1.003	F	1,968	0.984	E	1,986	0.993	E
			PM	1	2,000	2,000	731	0.366	B	728	0.364	B	732	0.366	B	736	0.368	B	722	0.361	B
8	Springtown Boulevard/First Street	Vasco Road	AM	1	2,000	2,000	1,962	0.981	E	1,979	0.990	E	1,992	0.996	F	1,942	0.971	E	1,969	0.985	E
			PM	1	2,000	2,000	712	0.356	B	711	0.356	B	713	0.357	B	716	0.358	B	702	0.351	B
9	Vasco Road	Greenville Road	AM	1	2,000	2,000	1,731	0.866	D	1,744	0.872	D	1,677	0.839	D	1,687	0.844	D	1,718	0.859	D
			PM	1	2,000	2,000	359	0.180	A	453	0.227	A	439	0.220	A	401	0.201	A	374	0.187	A
10	Greenville Road	Carroll Road	AM	0	2,000	0	0	n/a	n/a	0	n/a	n/a	0	n/a	n/a	0	n/a	n/a	0	n/a	n/a
			PM	0	2,000	0	0	n/a	n/a	0	n/a	n/a	0	n/a	n/a	0	n/a	n/a	0	n/a	n/a

Freeway Analysis

Eastbound I-580 Express Lanes (HOT), 2025

#	West	East	AM / PM	Lanes	Capacity per Lane	Total Capacity	2025 No Project			2025 BART			2025 DMU			2025 Express Bus/BRT			2025 Enhanced Bus		
							Volumes	V/C	LOS	Volumes	V/C	LOS	Volumes	V/C	LOS	Volumes	V/C	LOS	Volumes	V/C	LOS
1	Dougherty Road/Hopyard Road	Hacienda Drive	AM	0	2,000	0	0	n/a	n/a	0	n/a	n/a	0	n/a	n/a	0	n/a	n/a	0	n/a	n/a
			PM	0	2,000	0	0	n/a	n/a	0	n/a	n/a	0	n/a	n/a	0	n/a	n/a	0	n/a	n/a
2	Hacienda Drive	Tassajara Road/Santa Rita Road	AM	1	2,000	2,000	582	0.291	A	430	0.215	A	531	0.266	A	565	0.283	A	573	0.287	A
			PM	1	2,000	2,000	1,653	0.827	D	1,624	0.812	D	1,626	0.813	D	1,667	0.834	D	1,637	0.819	D
3	Tassajara Road/Santa Rita Road	Fallon Road/El Charro Road	AM	1	2,000	2,000	586	0.293	A	433	0.217	A	534	0.267	A	568	0.284	A	578	0.289	A
			PM	1	2,000	2,000	1,692	0.846	D	1,662	0.831	D	1,670	0.835	D	1,707	0.854	D	1,674	0.837	D
4	Fallon Road/El Charro Road	Airway Boulevard	AM	1	2,000	2,000	588	0.147	A	435	0.109	A	537	0.134	A	570	0.143	A	580	0.145	A
			PM	1	2,000	2,000	1,766	0.442	B	1,720	0.430	B	1,734	0.434	B	1,779	0.445	B	1,745	0.436	B
5	Airway Boulevard	Isabel Avenue	AM	1	2,000	2,000	588	0.147	A	435	0.109	A	537	0.134	A	570	0.143	A	580	0.145	A
			PM	1	2,000	2,000	1,591	0.398	B	1,558	0.390	B	1,564	0.391	B	1,607	0.402	B	1,574	0.394	B
6	Isabel Avenue	Livermore Ave	AM	1	2,000	2,000	589	0.147	A	436	0.109	A	538	0.135	A	571	0.143	A	581	0.145	A
			PM	1	2,000	2,000	1,732	0.433	B	1,705	0.426	B	1,710	0.428	B	1,746	0.437	B	1,714	0.429	B
7	Livermore Ave	Springtown Boulevard/First Street	AM	1	2,000	2,000	587	0.147	A	434	0.109	A	536	0.134	A	569	0.142	A	579	0.145	A
			PM	1	2,000	2,000	1,606	0.402	B	1,555	0.389	B	1,575	0.394	B	1,632	0.408	B	1,587	0.397	B
8	Springtown Boulevard/First Street	Vasco Road	AM	1	2,000	2,000	583	0.146	A	431	0.108	A	532	0.133	A	566	0.142	A	573	0.143	A
			PM	1	2,000	2,000	1,455	0.364	B	1,426	0.357	B	1,428	0.357	B	1,481	0.370	B	1,440	0.360	B
9	Vasco Road	Greenville Road	AM	1	2,000	2,000	0	0.000	A	0	0.000	A	0	0.000	A	0	0.000	A	0	0.000	A
			PM	1	2,000	2,000	1,247	0.624	C	1,228	0.614	C	1,219	0.610	C	1,274	0.637	C	1,235	0.618	C
10	Greenville Road	Carroll Road	AM	0	2,000	0	0	n/a	n/a	0	n/a	n/a	0	n/a	n/a	0	n/a	n/a	0	n/a	n/a
			PM	0	2,000	0	0	n/a	n/a	0	n/a	n/a	0	n/a	n/a	0	n/a	n/a	0	n/a	n/a

Freeway Analysis

Westbound I-580 Express Lanes (HOT), 2040

#	West	East	AM / PM	Lanes	Capacity per Lane	Total Capacity	2040 No Project			2040 BART			2040 DMU			2040 Express Bus/BRT			2040 Enhanced Bus		
							Volumes	V/C	LOS	Volumes	V/C	LOS	Volumes	V/C	LOS	Volumes	V/C	LOS	Volumes	V/C	LOS
1	Dougherty Road/Hopyard Road	Hacienda Drive	AM	1	2,000	2,000	931	0.466	B	907	0.454	B	920	0.460	B	919	0.460	B	930	0.465	B
			PM	1	2,000	2,000	427	0.214	A	420	0.210	A	429	0.215	A	420	0.210	A	430	0.215	A
2	Hacienda Drive	Tassajara Road/Santa Rita Road	AM	1	2,000	2,000	900	0.450	B	875	0.438	B	889	0.445	B	888	0.444	B	899	0.450	B
			PM	1	2,000	2,000	441	0.221	A	435	0.218	A	444	0.222	A	435	0.218	A	445	0.223	A
3	Tassajara Road/Santa Rita Road	Fallon Road/El Charro Road	AM	1	2,000	2,000	892	0.446	B	867	0.434	B	882	0.441	B	880	0.440	B	891	0.446	B
			PM	1	2,000	2,000	444	0.222	A	440	0.220	A	442	0.221	A	443	0.222	A	444	0.222	A
4	Fallon Road/El Charro Road	Airway Boulevard	AM	1	2,000	2,000	870	0.435	B	842	0.421	B	863	0.432	B	862	0.431	B	871	0.436	B
			PM	1	2,000	2,000	432	0.216	A	421	0.211	A	427	0.214	A	432	0.216	A	432	0.216	A
5	Airway Boulevard	Isabel Avenue	AM	1	2,000	2,000	797	0.399	B	778	0.389	B	792	0.396	B	785	0.393	B	795	0.398	B
			PM	1	2,000	2,000	403	0.202	A	404	0.202	A	402	0.201	A	402	0.201	A	403	0.202	A
6	Isabel Avenue	Livermore Ave	AM	1	2,000	2,000	791	0.396	B	771	0.386	B	787	0.394	B	775	0.388	B	788	0.394	B
			PM	1	2,000	2,000	397	0.199	A	385	0.193	A	389	0.195	A	397	0.199	A	396	0.198	A
7	Livermore Ave	Springtown Boulevard/First Street	AM	1	2,000	2,000	756	0.378	B	743	0.372	B	754	0.377	B	742	0.371	B	755	0.378	B
			PM	1	2,000	2,000	361	0.181	A	356	0.178	A	358	0.179	A	362	0.181	A	361	0.181	A
8	Springtown Boulevard/First Street	Vasco Road	AM	1	2,000	2,000	697	0.349	A	684	0.342	A	689	0.345	A	685	0.343	A	712	0.356	B
			PM	1	2,000	2,000	348	0.174	A	346	0.173	A	347	0.174	A	348	0.174	A	348	0.174	A
9	Vasco Road	Greenville Road	AM	1	2,000	2,000	559	0.280	A	557	0.279	A	557	0.279	A	559	0.280	A	549	0.275	A
			PM	1	2,000	2,000	262	0.131	A	260	0.130	A	260	0.130	A	261	0.131	A	261	0.131	A
10	Greenville Road	Carroll Road	AM	0	2,000	0	0	n/a	n/a	0	n/a	n/a	0	n/a	n/a	0	n/a	n/a	0	n/a	n/a
			PM	0	2,000	0	0	n/a	n/a	0	n/a	n/a	0	n/a	n/a	0	n/a	n/a	0	n/a	n/a

Freeway Analysis

Eastbound I-580 Express Lanes (HOT), 2040

#	West	East	AM / PM	Lanes	Capacity per Lane	Total Capacity	2040 No Project			2040 BART			2040 DMU			2040 Express Bus/BRT			2040 Enhanced Bus		
							Volumes	V/C	LOS	Volumes	V/C	LOS	Volumes	V/C	LOS	Volumes	V/C	LOS	Volumes	V/C	LOS
1	Dougherty Road/Hopyard Road	Hacienda Drive	AM	0	2,000	0	0	n/a	n/a	0	n/a	n/a	0	n/a	n/a	0	n/a	n/a	0	n/a	n/a
			PM	0	2,000	0	0	n/a	n/a	0	n/a	n/a	0	n/a	n/a	0	n/a	n/a	0	n/a	n/a
2	Hacienda Drive	Tassajara Road/Santa Rita Road	AM	1	2,000	2,000	383	0.192	A	365	0.183	A	371	0.186	A	368	0.184	A	381	0.191	A
			PM	1	2,000	2,000	464	0.232	A	449	0.225	A	447	0.224	A	461	0.231	A	463	0.232	A
3	Tassajara Road/Santa Rita Road	Fallon Road/El Charro Road	AM	1	2,000	2,000	396	0.198	A	376	0.188	A	383	0.192	A	381	0.191	A	394	0.197	A
			PM	1	2,000	2,000	477	0.239	A	464	0.232	A	462	0.231	A	475	0.238	A	476	0.238	A
4	Fallon Road/El Charro Road	Airway Boulevard	AM	1	2,000	2,000	418	0.105	A	398	0.100	A	405	0.101	A	406	0.102	A	417	0.104	A
			PM	1	2,000	2,000	516	0.129	A	508	0.127	A	514	0.129	A	514	0.129	A	511	0.128	A
5	Airway Boulevard	Isabel Avenue	AM	1	2,000	2,000	407	0.102	A	386	0.097	A	393	0.098	A	394	0.099	A	405	0.101	A
			PM	1	2,000	2,000	494	0.124	A	491	0.123	A	493	0.123	A	490	0.123	A	488	0.122	A
6	Isabel Avenue	Livermore Ave	AM	1	2,000	2,000	392	0.098	A	389	0.097	A	388	0.097	A	390	0.098	A	391	0.098	A
			PM	1	2,000	2,000	510	0.128	A	510	0.128	A	510	0.128	A	510	0.128	A	511	0.128	A
7	Livermore Ave	Springtown Boulevard/First Street	AM	1	2,000	2,000	391	0.098	A	392	0.098	A	390	0.098	A	390	0.098	A	390	0.098	A
			PM	1	2,000	2,000	476	0.119	A	472	0.118	A	479	0.120	A	474	0.119	A	474	0.119	A
8	Springtown Boulevard/First Street	Vasco Road	AM	1	2,000	2,000	383	0.096	A	383	0.096	A	382	0.096	A	381	0.095	A	382	0.096	A
			PM	1	2,000	2,000	434	0.109	A	432	0.108	A	441	0.110	A	435	0.109	A	434	0.109	A
9	Vasco Road	Greenville Road	AM	1	2,000	2,000	347	0.174	A	348	0.174	A	347	0.174	A	346	0.173	A	346	0.173	A
			PM	1	2,000	2,000	334	0.167	A	329	0.165	A	332	0.166	A	333	0.167	A	333	0.167	A
10	Greenville Road	Carroll Road	AM	0	2,000	0	0	n/a	n/a	0	n/a	n/a	0	n/a	n/a	0	n/a	n/a	0	n/a	n/a
			PM	0	2,000	0	0	n/a	n/a	0	n/a	n/a	0	n/a	n/a	0	n/a	n/a	0	n/a	n/a

Freeway Analysis

Westbound I-580 General Purpose Lanes, 2025 Cumulative

#	West	East	AM/PM	General Purpose Lanes	Auxiliary Lanes	Freeway Main Lanes Capacity per Lane	Auxiliary Lane Capacity per Lane	Total Capacity	2025 BART Cumulative			2025 DMU Cumulative			2025 Express Bus/BRT			2025 Enhanced Bus		
									Volumes	V/C	LOS	Volumes	V/C	LOS	Volumes	V/C	LOS	Volumes	V/C	LOS
1	Dougherty Road/Hopyard Road	Hacienda Drive	AM	4	1	2,000	1,000	9,000	8,836	0.982	E	8,816	0.980	E	8,756	0.973	E	8,765	0.974	E
			PM	4	1	2,000	1,000	9,000	5,750	0.639	C	5,767	0.641	C	5,717	0.635	C	5,781	0.642	C
2	Hacienda Drive	Tassajara Road/Santa Rita Road	AM	4	1	2,000	1,000	9,000	8,976	0.997	E	8,993	0.999	E	9,010	1.001	F	9,017	1.002	F
			PM	4	1	2,000	1,000	9,000	5,523	0.614	C	5,654	0.628	C	5,692	0.632	C	5,746	0.638	C
3	Tassajara Road/Santa Rita Road	Fallon Road/El Charro Road	AM	4	1	2,000	1,000	9,000	9,055	1.006	F	9,060	1.007	F	9,067	1.007	F	9,074	1.008	F
			PM	4	1	2,000	1,000	9,000	5,801	0.645	C	5,928	0.659	C	5,945	0.661	C	5,993	0.666	C
4	Fallon Road/El Charro Road	Airway Boulevard	AM	4	1	2,000	1,000	9,000	8,725	0.969	E	8,770	0.974	E	8,800	0.978	E	8,788	0.976	E
			PM	4	1	2,000	1,000	9,000	5,480	0.609	C	5,601	0.622	C	5,625	0.625	C	5,675	0.631	C
5	Airway Boulevard	Isabel Avenue	AM	4	1	2,000	1,000	9,000	8,987	0.997	E	9,236	1.025	F	9,397	1.044	F	9,368	1.041	F
			PM	4	1	2,000	1,000	9,000	4,723	0.525	B	4,869	0.541	B	4,958	0.551	B	4,972	0.552	B
6	Isabel Avenue	Livermore Ave	AM	4	1	2,000	1,000	9,000	9,404	1.035	F	9,478	1.043	F	9,491	1.055	F	9,498	1.055	F
			PM	4	1	2,000	1,000	9,000	5,594	0.622	C	5,637	0.626	C	5,749	0.639	C	5,659	0.629	C
7	Livermore Ave	Springtown Boulevard/First Street	AM	4	1	2,000	1,000	9,000	8,834	0.975	E	8,861	0.976	E	8,882	0.987	E	8,896	0.988	E
			PM	4	1	2,000	1,000	9,000	4,721	0.525	B	4,726	0.525	B	4,614	0.513	B	4,669	0.519	B
8	Springtown Boulevard/First Street	Vasco Road	AM	4	1	2,000	1,000	9,000	8,851	0.980	E	8,823	0.972	E	8,812	0.979	E	8,826	0.981	E
			PM	4	1	2,000	1,000	9,000	5,427	0.603	C	5,446	0.605	C	5,299	0.589	C	5,421	0.602	C
9	Vasco Road	Greenville Road	AM	4	0	2,000	1,000	8,000	7,813	0.973	E	7,836	0.974	E	7,834	0.979	E	7,819	0.977	E
			PM	4	0	2,000	1,000	8,000	4,626	0.578	B	4,633	0.579	B	4,615	0.577	B	4,668	0.584	C
10	Greenville Road	Carroll Road	AM	4	0	2,000	1,000	8,000	8,332	1.038	F	8,292	1.031	F	8,313	1.039	F	8,327	1.041	F
			PM	4	0	2,000	1,000	8,000	4,983	0.623	C	4,998	0.625	C	4,856	0.607	C	4,908	0.614	C

Freeway Analysis

Eastbound I-580 General Purpose Lanes, 2025 Cumulative

									2025 BART Cumulative			2025 DMU Cumulative			2025 Express Bus/BRT Cumulative			2025 Enhanced Bus Cumulative		
#	West	East	AM/PM	General Purpose Lanes	Auxiliary Lanes	Freeway Main Lanes Capacity per Lane	Auxiliary Lane Capacity per Lane	Total Capacity	Volumes	V/C	LOS	Volumes	V/C	LOS	Volumes	V/C	LOS	Volumes	V/C	LOS
1	Dougherty Road/Hopyard Road	Hacienda Drive	AM	5	2	2,000	1,000	12,000	5,588	0.466	B	5,596	0.466	B	5,636	0.470	B	5,663	0.472	B
			PM	5	2	2,000	1,000	12,000	8,513	0.709	C	8,484	0.707	C	8,552	0.713	C	8,632	0.719	C
2	Hacienda Drive	Tassajara Road/Santa Rita Road	AM	4	1	2,000	1,000	9,000	4,702	0.522	B	4,750	0.528	B	4,766	0.530	B	4,811	0.535	B
			PM	4	1	2,000	1,000	9,000	8,052	0.895	D	8,049	0.894	D	8,025	0.892	D	8,110	0.901	D
3	Tassajara Road/Santa Rita Road	Fallon Road/El Charro Road	AM	4	1	2,000	1,000	9,000	5,013	0.557	B	5,071	0.563	B	5,078	0.564	B	5,127	0.570	B
			PM	4	1	2,000	1,000	9,000	8,448	0.939	E	8,561	0.951	E	8,510	0.946	E	8,578	0.953	E
4	Fallon Road/El Charro Road	Alrway Boulevard	AM	4	1	2,000	1,000	9,000	4,829	0.537	B	4,890	0.543	B	4,893	0.544	B	4,942	0.549	B
			PM	4	1	2,000	1,000	9,000	8,517	0.946	E	8,679	0.964	E	8,652	0.961	E	8,763	0.974	E
5	Alrway Boulevard	Isabel Avenue	AM	4	1	2,000	1,000	9,000	4,135	0.459	B	4,338	0.482	B	4,376	0.486	B	4,412	0.490	B
			PM	4	1	2,000	1,000	9,000	8,452	0.933	E	8,611	0.953	E	8,539	0.949	E	8,618	0.958	E
6	Isabel Avenue	Livermore Ave	AM	4	1	2,000	1,000	9,000	4,821	0.545	B	4,826	0.543	B	4,823	0.536	B	4,830	0.537	B
			PM	4	1	2,000	1,000	9,000	9,242	1.042	F	9,369	1.050	F	9,337	1.037	F	9,378	1.042	F
7	Livermore Ave	Springtown Boulevard/First Street	AM	4	1	2,000	1,000	9,000	4,810	0.544	B	4,753	0.535	B	4,669	0.519	B	4,666	0.518	B
			PM	4	1	2,000	1,000	9,000	8,334	0.941	E	8,413	0.944	E	8,281	0.920	E	8,376	0.931	E
8	Springtown Boulevard/First Street	Vasco Road	AM	4	1	2,000	1,000	9,000	5,331	0.602	C	5,244	0.583	C	5,090	0.566	B	5,113	0.568	B
			PM	4	1	2,000	1,000	9,000	8,164	0.922	E	8,201	0.920	E	8,118	0.902	D	8,194	0.910	E
9	Vasco Road	Greenville Road	AM	4	0	2,000	1,000	8,000	4,588	0.584	C	4,590	0.574	B	4,580	0.573	B	4,580	0.573	B
			PM	4	0	2,000	1,000	8,000	7,212	0.918	E	7,244	0.916	E	7,123	0.890	D	7,232	0.904	D
10	Greenville Road	Carroll Road	AM	5	0	2,000	1,000	10,000	4,466	0.455	B	4,460	0.446	B	4,465	0.447	B	4,457	0.446	B
			PM	5	0	2,000	1,000	10,000	8,219	0.835	D	8,236	0.832	D	8,169	0.817	D	8,232	0.823	D

Freeway Analysis

Westbound I-580 General Purpose Lanes, 2040 Cumulative

#	West	East	AM/ PM	General Purpose Lanes	Auxiliary Lanes	Freeway Main Lanes Capacity per Lane	Auxiliary Lane Capacity per Lane	Total Capacity	2040 BART Cumulative			2040 DMU Cumulative			2040 Express Bus/BRT Cumulative			2040 Enhanced Bus Cumulative		
									Volumes	V/C	LOS	Volumes	V/C	LOS	Volumes	V/C	LOS	Volumes	V/C	LOS
1	Dougherty Road/ Hopyard Road	Hacienda Drive	AM	4	1	2,000	1,000	9,000	8,802	0.978	E	8,824	0.980	E	8,850	0.983	E	8,847	0.983	E
			PM	4	1	2,000	1,000	9,000	6,886	0.765	D	6,923	0.769	D	6,717	0.746	C	6,737	0.749	C
2	Hacienda Drive	Tassajara Road/Santa Rita Road	AM	4	1	2,000	1,000	9,000	8,948	0.994	E	8,965	0.996	E	9,057	1.006	F	9,061	1.007	F
			PM	4	1	2,000	1,000	9,000	6,879	0.764	D	6,908	0.768	D	6,813	0.757	D	6,814	0.757	D
3	Tassajara Road/Santa Rita Road	Fallon Road/El Charro Road	AM	4	1	2,000	1,000	9,000	9,096	1.011	F	9,120	1.013	F	9,207	1.023	F	9,198	1.022	F
			PM	4	1	2,000	1,000	9,000	7,165	0.796	D	7,197	0.800	D	7,007	0.779	D	7,023	0.780	D
4	Fallon Road/El Charro Road	Airway Boulevard	AM	4	1	2,000	1,000	9,000	8,700	0.967	E	8,814	0.979	E	8,977	0.997	E	8,972	0.997	E
			PM	4	1	2,000	1,000	9,000	6,992	0.777	D	7,090	0.788	D	6,752	0.750	D	6,806	0.756	D
5	Airway Boulevard	Isabel Avenue	AM	4	1	2,000	1,000	9,000	9,308	1.027	F	9,452	1.050	F	9,603	1.067	F	9,616	1.068	F
			PM	4	1	2,000	1,000	9,000	6,144	0.683	C	6,180	0.687	C	5,986	0.665	C	6,003	0.667	C
6	Isabel Avenue	Livermore Ave	AM	4	1	2,000	1,000	9,000	10,159	1.166	F	10,171	1.157	F	9,945	1.105	F	9,933	1.104	F
			PM	4	1	2,000	1,000	9,000	6,867	0.763	D	6,910	0.768	D	6,913	0.768	D	6,949	0.772	D
7	Livermore Ave	Springtown Boulevard/First Street	AM	4	1	2,000	1,000	9,000	9,459	1.086	F	9,400	1.065	F	9,235	1.026	F	9,219	1.024	F
			PM	4	1	2,000	1,000	9,000	6,470	0.719	C	6,587	0.732	C	6,642	0.738	C	6,633	0.737	C
8	Springtown Boulevard/First Street	Vasco Road	AM	4	1	2,000	1,000	9,000	9,580	1.092	F	9,463	1.072	F	9,318	1.035	F	9,336	1.037	F
			PM	4	1	2,000	1,000	9,000	7,535	0.837	D	7,526	0.836	D	7,453	0.828	D	7,440	0.827	D
9	Vasco Road	Greenville Road	AM	4	0	2,000	1,000	8,000	8,792	1.130	F	8,693	1.099	F	8,544	1.068	F	8,555	1.069	F
			PM	4	0	2,000	1,000	8,000	6,331	0.791	D	6,318	0.790	D	6,222	0.778	D	6,208	0.776	D
10	Greenville Road	Carroll Road	AM	4	0	2,000	1,000	8,000	8,714	1.120	F	8,622	1.084	F	8,485	1.061	F	8,482	1.060	F
			PM	4	0	2,000	1,000	8,000	6,111	0.764	D	6,084	0.761	D	6,013	0.752	D	6,000	0.750	C

Freeway Analysis

Eastbound I-580 General Purpose Lanes, 2040 Cumulative

									2040 BART Cumulative			2040 DMU Cumulative			2040 Express Bus/BRT Cumulative			2040 Enhanced Bus Cumulative		
#	West	East	AM/PM	General Purpose Lanes	Auxiliary Lanes	Freeway Main Lanes Capacity per Lane	Auxiliary Lane Capacity per Lane	Total Capacity	Volumes	V/C	LOS	Volumes	V/C	LOS	Volumes	V/C	LOS	Volumes	V/C	LOS
1	Dougherty Road/Hopyard Road	Hacienda Drive	AM	5	2	2,000	1,000	12,000	6,798	0.567	B	6,848	0.571	B	6,540	0.545	B	6,579	0.548	B
			PM	5	2	2,000	1,000	12,000	8,206	0.684	C	8,170	0.681	C	8,212	0.684	C	8,226	0.686	C
2	Hacienda Drive	Tassajara Road/Santa Rita Road	AM	4	1	2,000	1,000	9,000	5,961	0.662	C	5,991	0.666	C	5,848	0.650	C	5,869	0.652	C
			PM	4	1	2,000	1,000	9,000	8,432	0.937	E	8,421	0.936	E	8,461	0.940	E	8,467	0.941	E
3	Tassajara Road/Santa Rita Road	Fallon Road/El Charro Road	AM	4	1	2,000	1,000	9,000	6,156	0.684	C	6,201	0.689	C	5,995	0.666	C	6,017	0.669	C
			PM	4	1	2,000	1,000	9,000	8,784	0.976	E	8,786	0.976	E	8,798	0.978	E	8,810	0.979	E
4	Fallon Road/El Charro Road	Alrway Boulevard	AM	4	1	2,000	1,000	9,000	6,123	0.680	C	6,182	0.687	C	5,866	0.652	C	5,892	0.655	C
			PM	4	1	2,000	1,000	9,000	8,765	0.974	E	8,765	0.974	E	8,705	0.967	E	8,732	0.970	E
5	Alrway Boulevard	Isabel Avenue	AM	4	1	2,000	1,000	9,000	5,083	0.565	B	5,206	0.578	B	5,295	0.588	C	5,317	0.591	C
			PM	4	1	2,000	1,000	9,000	9,071	0.995	E	9,102	1.008	F	8,931	0.992	E	8,954	0.995	E
6	Isabel Avenue	Livermore Ave	AM	4	1	2,000	1,000	9,000	5,552	0.617	C	5,610	0.623	C	5,725	0.636	C	5,730	0.637	C
			PM	4	1	2,000	1,000	9,000	9,990	1.145	F	9,942	1.150	F	9,774	1.086	F	9,762	1.085	F
7	Livermore Ave	Springtown Boulevard/First Street	AM	4	1	2,000	1,000	9,000	5,798	0.644	C	5,762	0.640	C	5,681	0.631	C	5,677	0.631	C
			PM	4	1	2,000	1,000	9,000	9,245	1.057	F	9,269	1.075	F	9,102	1.011	F	9,103	1.011	F
8	Springtown Boulevard/First Street	Vasco Road	AM	4	1	2,000	1,000	9,000	7,010	0.779	D	6,981	0.776	D	6,890	0.766	D	6,888	0.765	D
			PM	4	1	2,000	1,000	9,000	9,270	1.060	F	9,249	1.073	F	9,155	1.017	F	9,180	1.020	F
9	Vasco Road	Greenville Road	AM	4	0	2,000	1,000	8,000	5,516	0.690	C	5,478	0.685	C	5,399	0.600	C	5,388	0.674	C
			PM	4	0	2,000	1,000	8,000	7,674	0.993	E	7,684	1.011	F	7,603	0.950	E	7,667	0.958	E
10	Greenville Road	Carroll Road	AM	5	0	2,000	1,000	10,000	5,788	0.579	B	5,759	0.576	B	5,678	0.568	B	5,666	0.567	B
			PM	5	0	2,000	1,000	10,000	8,187	0.845	D	8,171	0.858	D	8,174	0.817	D	8,165	0.817	D

Freeway Analysis

Westbound I-580 Express Lanes (HOT), 2025 Cumulative

							2025 BART Cumulative			2025 DMU Cumulative			2025 Express Bus/BRT Cumulative			2025 Enhanced Bus Cumulative		
#	West	East	AM/PM	Lanes	Capacity per Lane	Total Capacity	Volumes	V/C	LOS	Volumes	V/C	LOS	Volumes	V/C	LOS	Volumes	V/C	LOS
1	Dougherty Road/Hopyard Road	Hacienda Drive	AM	1	2,000	2,000	1,936	0.968	E	1,947	0.974	E	1,930	0.965	E	1,952	0.976	E
			PM	1	2,000	2,000	861	0.431	B	861	0.431	B	902	0.451	B	841	0.421	B
2	Hacienda Drive	Tassajara Road/Santa Rita Road	AM	1	2,000	2,000	2,008	1.004	F	2,025	1.013	F	2,002	1.001	F	2,029	1.015	F
			PM	1	2,000	2,000	857	0.429	B	857	0.429	B	899	0.450	B	837	0.419	B
3	Tassajara Road/Santa Rita Road	Fallon Road/El Charro Road	AM	1	2,000	2,000	2,022	1.011	F	2,038	1.019	F	2,020	1.010	F	2,060	1.030	F
			PM	1	2,000	2,000	899	0.450	B	909	0.455	B	951	0.476	B	899	0.450	B
4	Fallon Road/El Charro Road	Airway Boulevard	AM	1	2,000	2,000	1,948	0.974	E	1,975	0.988	E	1,963	0.982	E	1,986	0.993	E
			PM	1	2,000	2,000	897	0.449	B	906	0.453	B	950	0.475	B	894	0.447	B
5	Airway Boulevard	Isabel Avenue	AM	1	2,000	2,000	1,988	0.994	E	2,063	1.032	F	2,060	1.030	F	2,090	1.045	F
			PM	1	2,000	2,000	828	0.414	B	820	0.410	B	860	0.430	B	812	0.406	B
6	Isabel Avenue	Livermore Ave	AM	1	2,000	2,000	2,089	1.045	F	2,109	1.055	F	2,094	1.047	F	2,123	1.062	F
			PM	1	2,000	2,000	821	0.411	B	808	0.404	B	849	0.425	B	799	0.400	B
7	Livermore Ave	Springtown Boulevard/First Street	AM	1	2,000	2,000	1,986	0.993	E	1,987	0.994	E	1,973	0.987	E	1,988	0.994	E
			PM	1	2,000	2,000	723	0.362	B	711	0.356	B	736	0.368	B	691	0.346	A
8	Springtown Boulevard/First Street	Vasco Road	AM	1	2,000	2,000	1,981	0.991	E	1,970	0.985	E	1,950	0.975	E	1,979	0.990	E
			PM	1	2,000	2,000	705	0.353	B	692	0.346	A	717	0.359	B	672	0.336	A
9	Vasco Road	Greenville Road	AM	1	2,000	2,000	1,738	0.869	D	1,738	0.869	D	1,708	0.854	D	1,719	0.860	D
			PM	1	2,000	2,000	480	0.240	A	488	0.244	A	397	0.199	A	413	0.207	A
10	Greenville Road	Carroll Road	AM	0	2,000	0	0	n/a	n/a	0	n/a	n/a	0	n/a	n/a	0	n/a	n/a
			PM	0	2,000	0	0	n/a	n/a	0	n/a	n/a	0	n/a	n/a	0	n/a	n/a

Freeway Analysis

Eastbound I-580 Express Lanes (HOT), 2025 Cumulative

							2025 BART Cumulative			2025 DMU Cumulative			2025 Express Bus/BRT Cumulative			2025 Enhanced Bus Cumulative		
#	West	East	AM/PM	Lanes	Capacity per Lane	Total Capacity	Volumes	V/C	LOS	Volumes	V/C	LOS	Volumes	V/C	LOS	Volumes	V/C	LOS
1	Dougherty Road/Hopyard Road	Hacienda Drive	AM	1	2,000	2,000	1,936	0.968	E	1,947	0.974	E	1,930	0.965	E	1,952	0.976	E
			PM	1	2,000	2,000	861	0.431	B	861	0.431	B	902	0.451	B	841	0.421	B
2	Hacienda Drive	Tassajara Road/Santa Rita Road	AM	1	2,000	2,000	2,008	1.004	F	2,025	1.013	F	2,002	1.001	F	2,029	1.015	F
			PM	1	2,000	2,000	857	0.429	B	857	0.429	B	899	0.450	B	837	0.419	B
3	Tassajara Road/Santa Rita Road	Fallon Road/El Charro Road	AM	1	2,000	2,000	2,022	1.011	F	2,038	1.019	F	2,020	1.010	F	2,060	1.030	F
			PM	1	2,000	2,000	899	0.450	B	909	0.455	B	951	0.476	B	899	0.450	B
4	Fallon Road/El Charro Road	Airway Boulevard	AM	1	2,000	2,000	1,948	0.974	E	1,975	0.988	E	1,963	0.982	E	1,986	0.993	E
			PM	1	2,000	2,000	897	0.449	B	906	0.453	B	950	0.475	B	894	0.447	B
5	Airway Boulevard	Isabel Avenue	AM	1	2,000	2,000	1,988	0.994	E	2,063	1.032	F	2,060	1.030	F	2,090	1.045	F
			PM	1	2,000	2,000	828	0.414	B	820	0.410	B	860	0.430	B	812	0.406	B
6	Isabel Avenue	Livermore Ave	AM	1	2,000	2,000	2,089	1.045	F	2,109	1.055	F	2,094	1.047	F	2,123	1.062	F
			PM	1	2,000	2,000	821	0.411	B	808	0.404	B	849	0.425	B	799	0.400	B
7	Livermore Ave	Springtown Boulevard/First Street	AM	1	2,000	2,000	1,986	0.993	E	1,987	0.994	E	1,973	0.987	E	1,988	0.994	E
			PM	1	2,000	2,000	723	0.362	B	711	0.356	B	736	0.368	B	691	0.346	A
8	Springtown Boulevard/First Street	Vasco Road	AM	1	2,000	2,000	1,981	0.991	E	1,970	0.985	E	1,950	0.975	E	1,979	0.990	E
			PM	1	2,000	2,000	705	0.353	B	692	0.346	A	717	0.359	B	672	0.336	A
9	Vasco Road	Greenville Road	AM	1	2,000	2,000	1,738	0.869	D	1,738	0.869	D	1,708	0.854	D	1,719	0.860	D
			PM	1	2,000	2,000	480	0.240	A	488	0.244	A	397	0.199	A	413	0.207	A
10	Greenville Road	Carroll Road	AM	0	2,000	0	0	n/a	n/a	0	n/a	n/a	0	n/a	n/a	0	n/a	n/a
			PM	0	2,000	0	0	n/a	n/a	0	n/a	n/a	0	n/a	n/a	0	n/a	n/a

Freeway Analysis

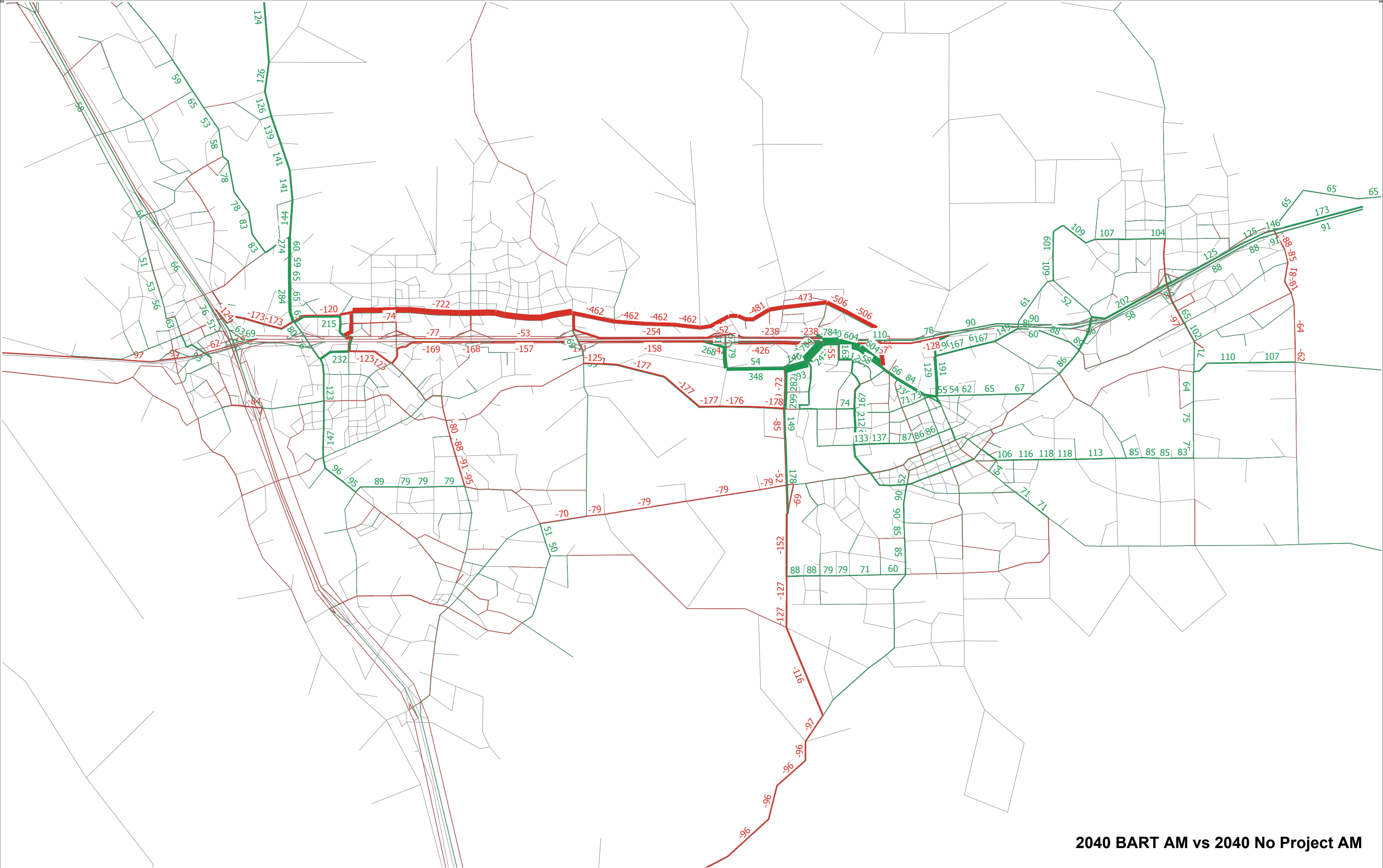
Westbound I-580 Express Lanes (HOT), 2040 Cumulative

							2040 BART Cumulative			2040 DMU Cumulative			2040 Express Bus/BRT Cumulative			2040 Enhanced Bus Cumulative		
#	West	East	AM/PM	Lanes	Capacity per Lane	Total Capacity	Volumes	V/C	LOS	Volumes	V/C	LOS	Volumes	V/C	LOS	Volumes	V/C	LOS
1	Dougherty Road/Hopyard Road	Hacienda Drive	AM	1	2,000	2,000	888	0.444	B	910	0.455	B	925	0.463	B	930	0.465	B
			PM	1	2,000	2,000	446	0.223	A	441	0.221	A	423	0.212	A	430	0.215	A
2	Hacienda Drive	Tassajara Road/Santa Rita Road	AM	1	2,000	2,000	858	0.429	B	880	0.440	B	894	0.447	B	899	0.450	B
			PM	1	2,000	2,000	461	0.231	A	455	0.228	A	437	0.219	A	445	0.223	A
3	Tassajara Road/Santa Rita Road	Fallon Road/El Charro Road	AM	1	2,000	2,000	849	0.425	B	874	0.437	B	886	0.443	B	891	0.446	B
			PM	1	2,000	2,000	457	0.229	A	452	0.226	A	442	0.221	A	444	0.222	A
4	Fallon Road/El Charro Road	Airway Boulevard	AM	1	2,000	2,000	831	0.416	B	851	0.426	B	867	0.434	B	871	0.436	B
			PM	1	2,000	2,000	445	0.223	A	441	0.221	A	430	0.215	A	432	0.216	A
5	Airway Boulevard	Isabel Avenue	AM	1	2,000	2,000	772	0.386	B	790	0.395	B	790	0.395	B	795	0.398	B
			PM	1	2,000	2,000	410	0.205	A	408	0.204	A	401	0.201	A	403	0.202	A
6	Isabel Avenue	Livermore Ave	AM	1	2,000	2,000	766	0.383	B	796	0.398	B	787	0.394	B	788	0.394	B
			PM	1	2,000	2,000	392	0.196	A	398	0.199	A	392	0.196	A	396	0.198	A
7	Livermore Ave	Springtown Boulevard/First Street	AM	1	2,000	2,000	730	0.365	B	755	0.378	B	749	0.375	B	755	0.378	B
			PM	1	2,000	2,000	357	0.179	A	359	0.180	A	361	0.181	A	361	0.181	A
8	Springtown Boulevard/First Street	Vasco Road	AM	1	2,000	2,000	669	0.335	A	689	0.345	A	699	0.350	A	712	0.356	B
			PM	1	2,000	2,000	345	0.173	A	346	0.173	A	347	0.174	A	348	0.174	A
9	Vasco Road	Greenville Road	AM	1	2,000	2,000	572	0.286	A	559	0.280	A	553	0.277	A	549	0.275	A
			PM	1	2,000	2,000	261	0.131	A	261	0.131	A	261	0.131	A	261	0.131	A
10	Greenville Road	Carroll Road	AM	0	2,000	0	0	n/a	n/a	0	n/a	n/a	0	n/a	n/a	0	n/a	n/a
			PM	0	2,000	0	0	n/a	n/a	0	n/a	n/a	0	n/a	n/a	0	n/a	n/a

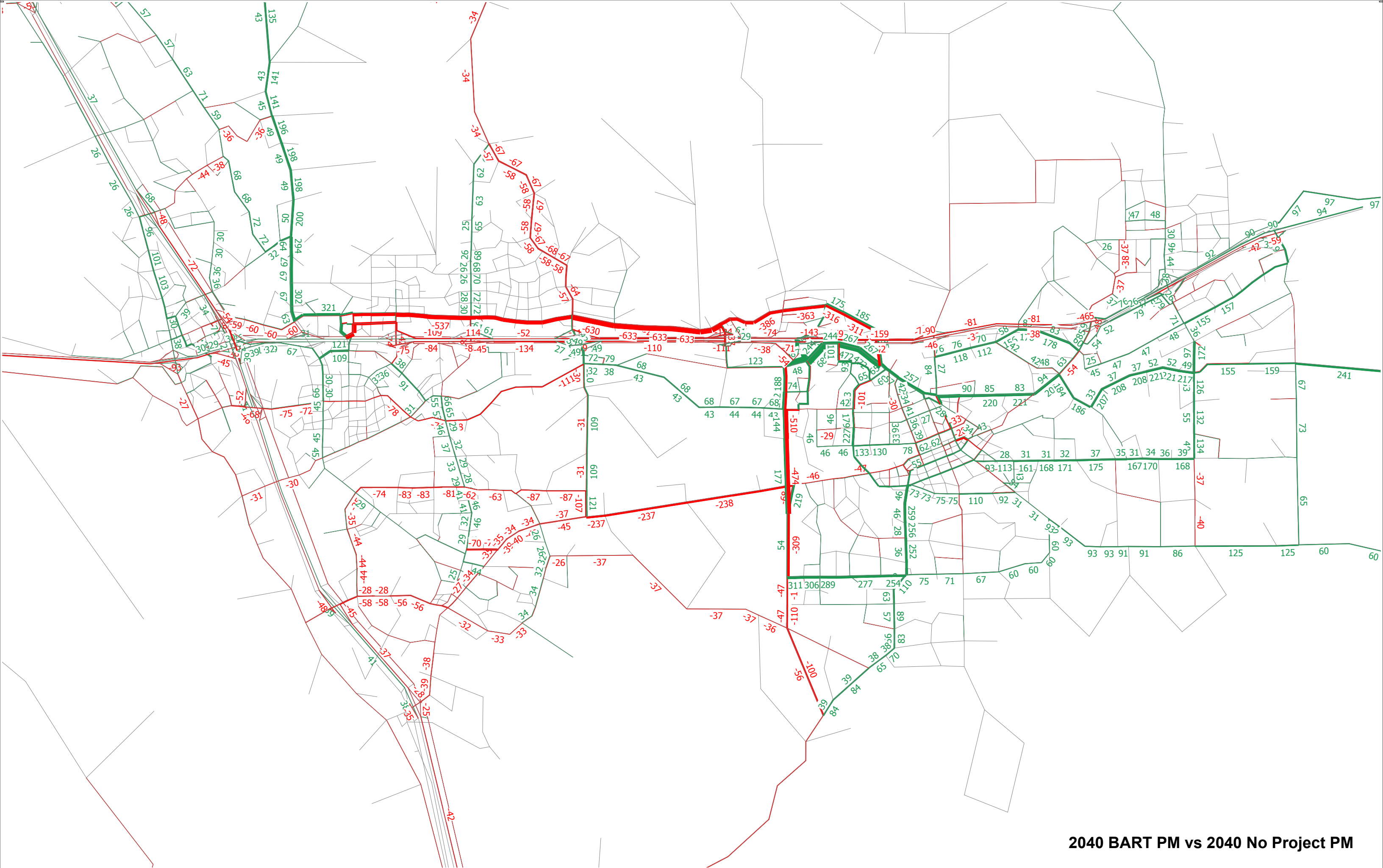
Freeway Analysis

Eastbound I-580 Express Lanes (HOT), 2040 Cumulative

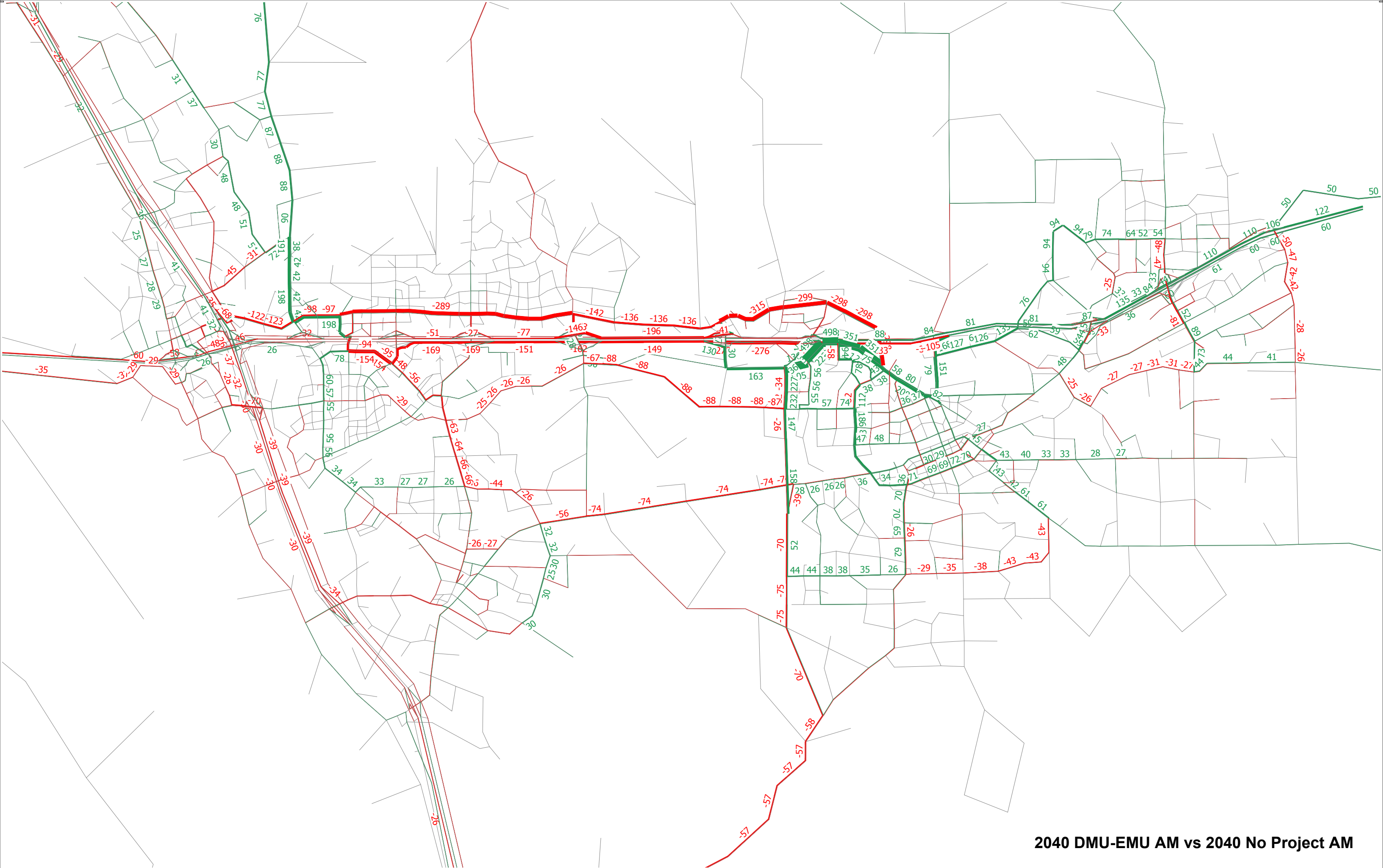
							2040 BART Cumulative			2040 DMU Cumulative			2040 Express Bus/BRT Cumulative			2040 Enhanced Bus Cumulative		
#	West	East	AM/PM	Lanes	Capacity per Lane	Total Capacity	Volumes	V/C	LOS	Volumes	V/C	LOS	Volumes	V/C	LOS	Volumes	V/C	LOS
1	Dougherty Road/Hopyard Road	Hacienda Drive	AM	0	2,000	0	0	n/a	n/a	0	n/a	n/a	0	n/a	n/a	0	n/a	n/a
			PM	0	2,000	0	0	n/a	n/a	0	n/a	n/a	0	n/a	n/a	0	n/a	n/a
2	Hacienda Drive	Tassajara Road/Santa Rita Road	AM	1	2,000	2,000	388	0.194	A	394	0.197	A	375	0.188	A	381	0.191	A
			PM	1	2,000	2,000	453	0.227	A	451	0.226	A	468	0.234	A	463	0.232	A
3	Tassajara Road/Santa Rita Road	Fallon Road/El Charro Road	AM	1	2,000	2,000	406	0.203	A	412	0.206	A	388	0.194	A	394	0.197	A
			PM	1	2,000	2,000	467	0.234	A	465	0.233	A	481	0.241	A	476	0.238	A
4	Fallon Road/El Charro Road	Airway Boulevard	AM	1	2,000	2,000	429	0.107	A	435	0.109	A	411	0.103	A	417	0.104	A
			PM	1	2,000	2,000	511	0.128	A	506	0.127	A	509	0.127	A	511	0.128	A
5	Airway Boulevard	Isabel Avenue	AM	1	2,000	2,000	397	0.099	A	410	0.103	A	399	0.100	A	405	0.101	A
			PM	1	2,000	2,000	496	0.124	A	498	0.125	A	487	0.122	A	488	0.122	A
6	Isabel Avenue	Livermore Ave	AM	1	2,000	2,000	386	0.097	A	395	0.099	A	389	0.097	A	391	0.098	A
			PM	1	2,000	2,000	541	0.135	A	540	0.135	A	508	0.127	A	511	0.128	A
7	Livermore Ave	Springtown Boulevard/First Street	AM	1	2,000	2,000	386	0.097	A	395	0.099	A	388	0.097	A	390	0.098	A
			PM	1	2,000	2,000	491	0.123	A	491	0.123	A	478	0.120	A	474	0.119	A
8	Springtown Boulevard/First Street	Vasco Road	AM	1	2,000	2,000	379	0.095	A	386	0.097	A	379	0.095	A	382	0.096	A
			PM	1	2,000	2,000	443	0.111	A	442	0.111	A	437	0.109	A	434	0.109	A
9	Vasco Road	Greenville Road	AM	1	2,000	2,000	343	0.172	A	350	0.175	A	345	0.173	A	346	0.173	A
			PM	1	2,000	2,000	331	0.166	A	333	0.167	A	331	0.166	A	333	0.167	A
10	Greenville Road	Carroll Road	AM	0	2,000	0	0	n/a	n/a	0	n/a	n/a	0	n/a	n/a	0	n/a	n/a
			PM	0	2,000	0	0	n/a	n/a	0	n/a	n/a	0	n/a	n/a	0	n/a	n/a



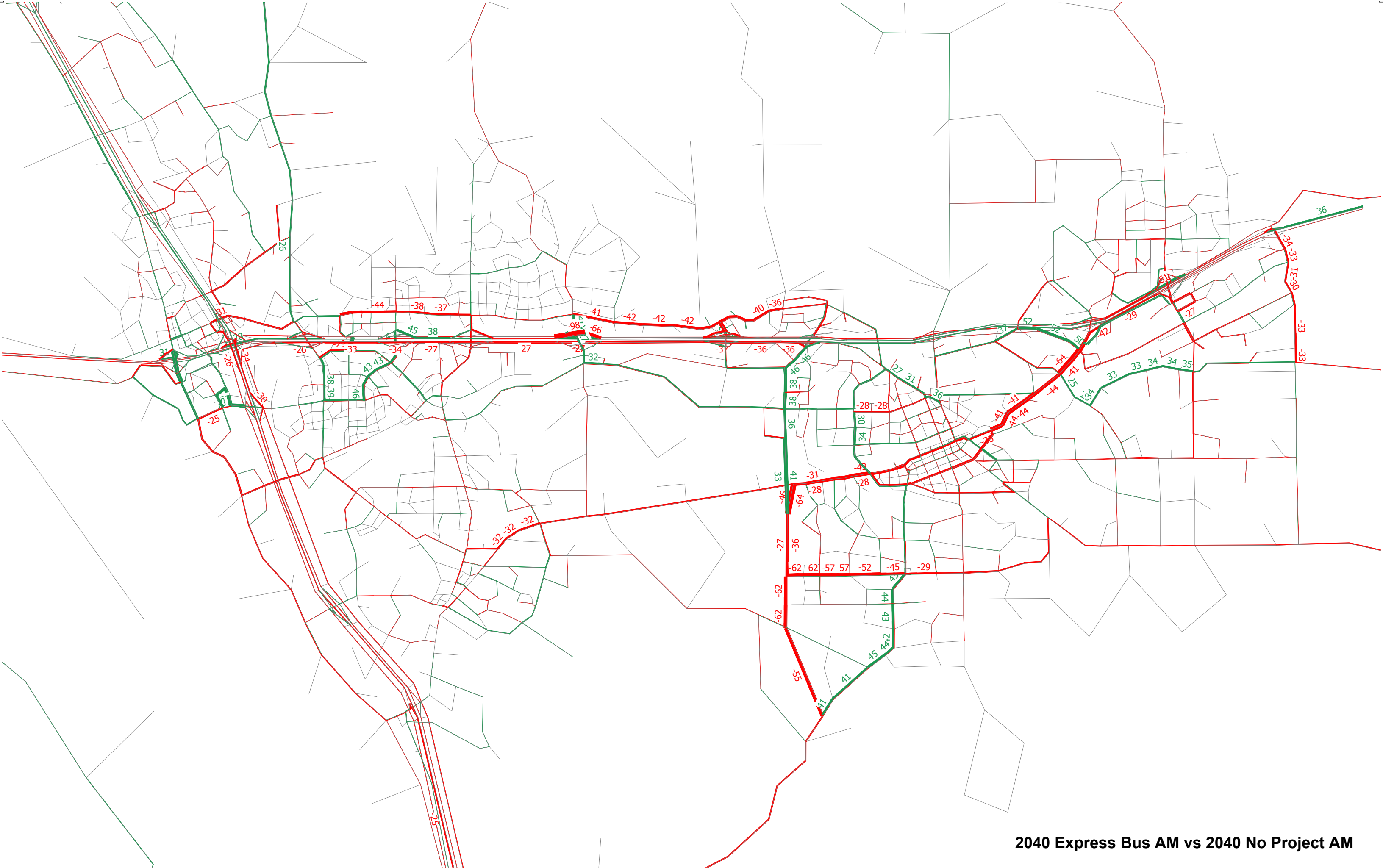
2040 BART AM vs 2040 No Project AM



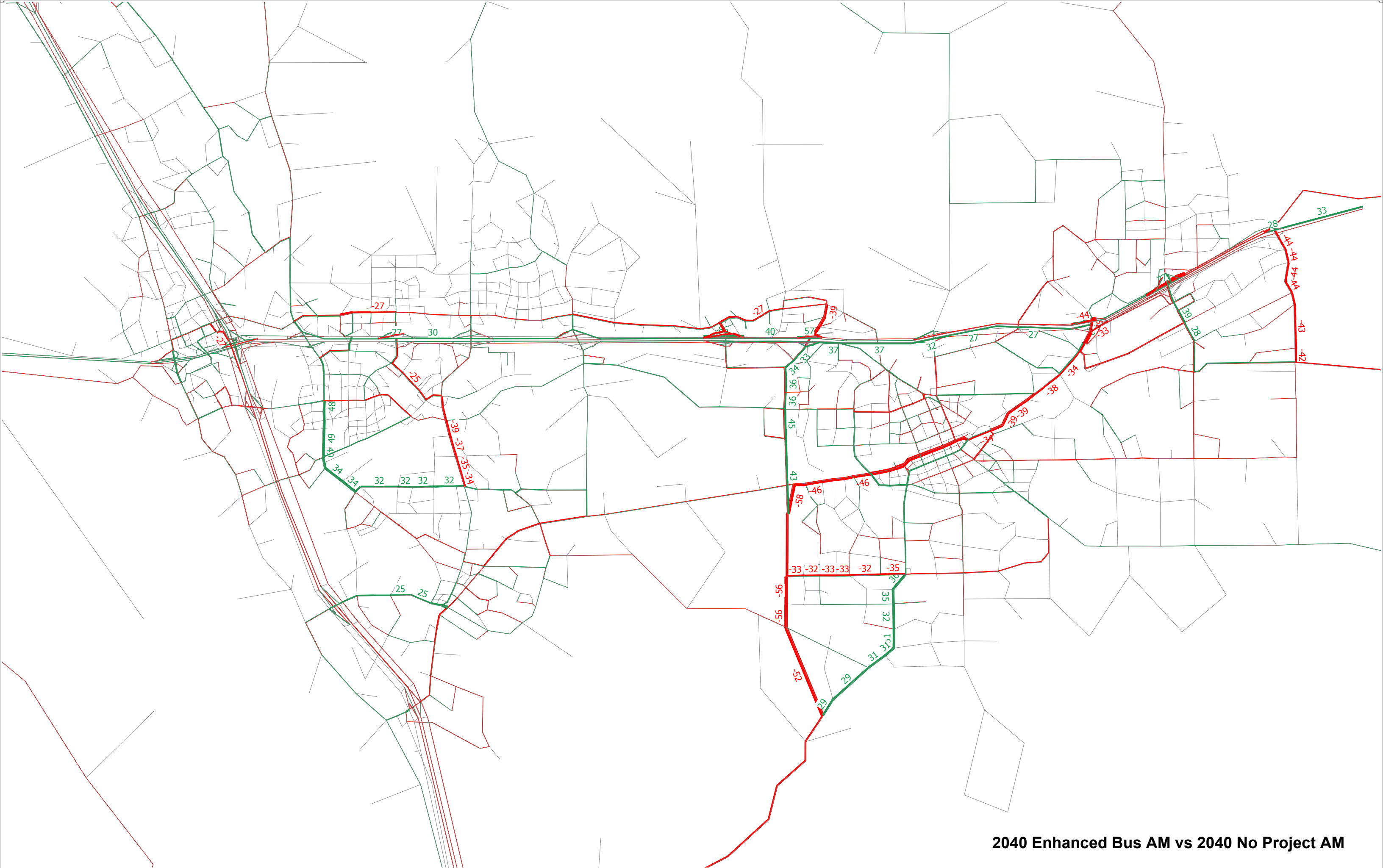
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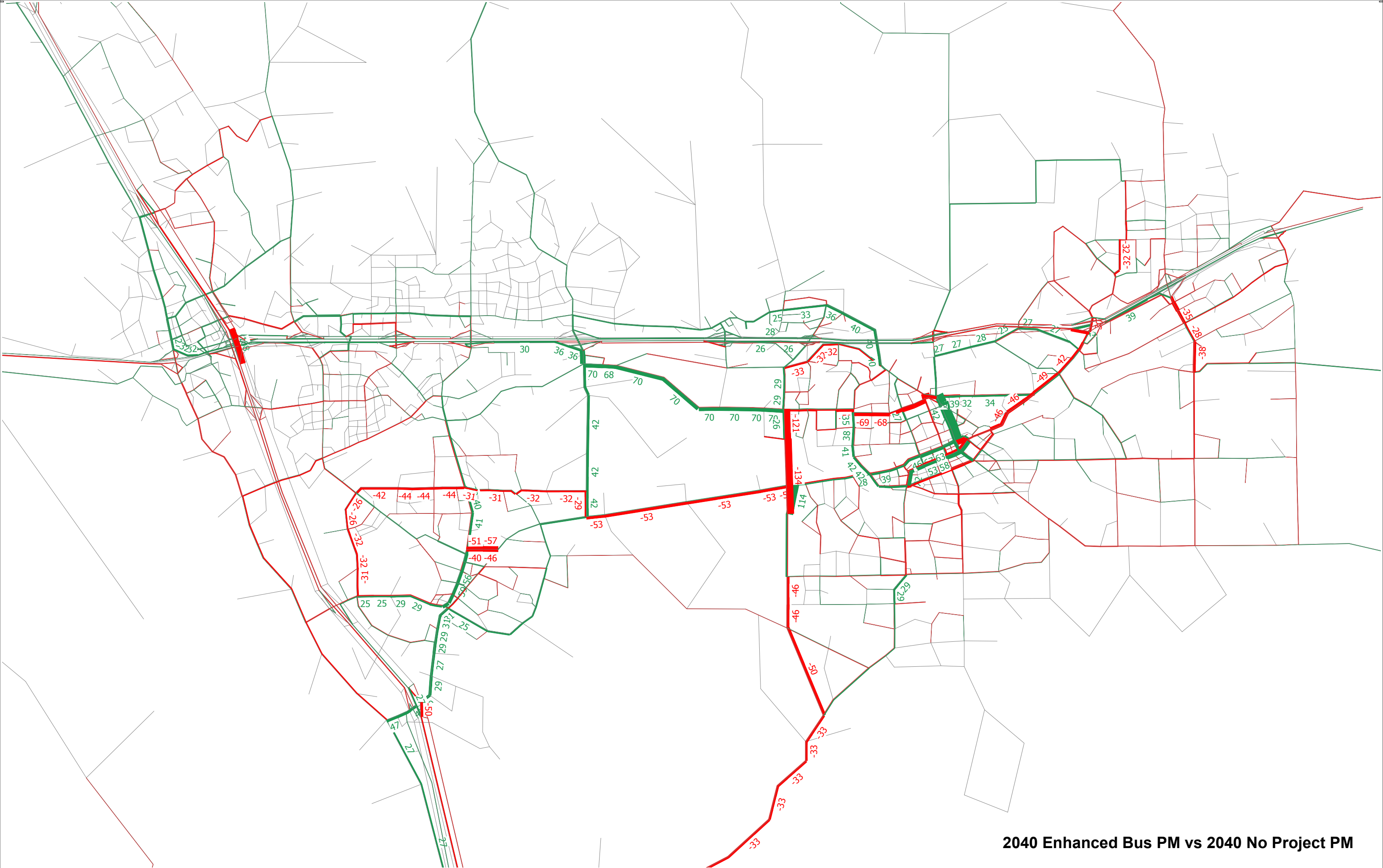
2040 DMU-EMU AM vs 2040 No Project AM



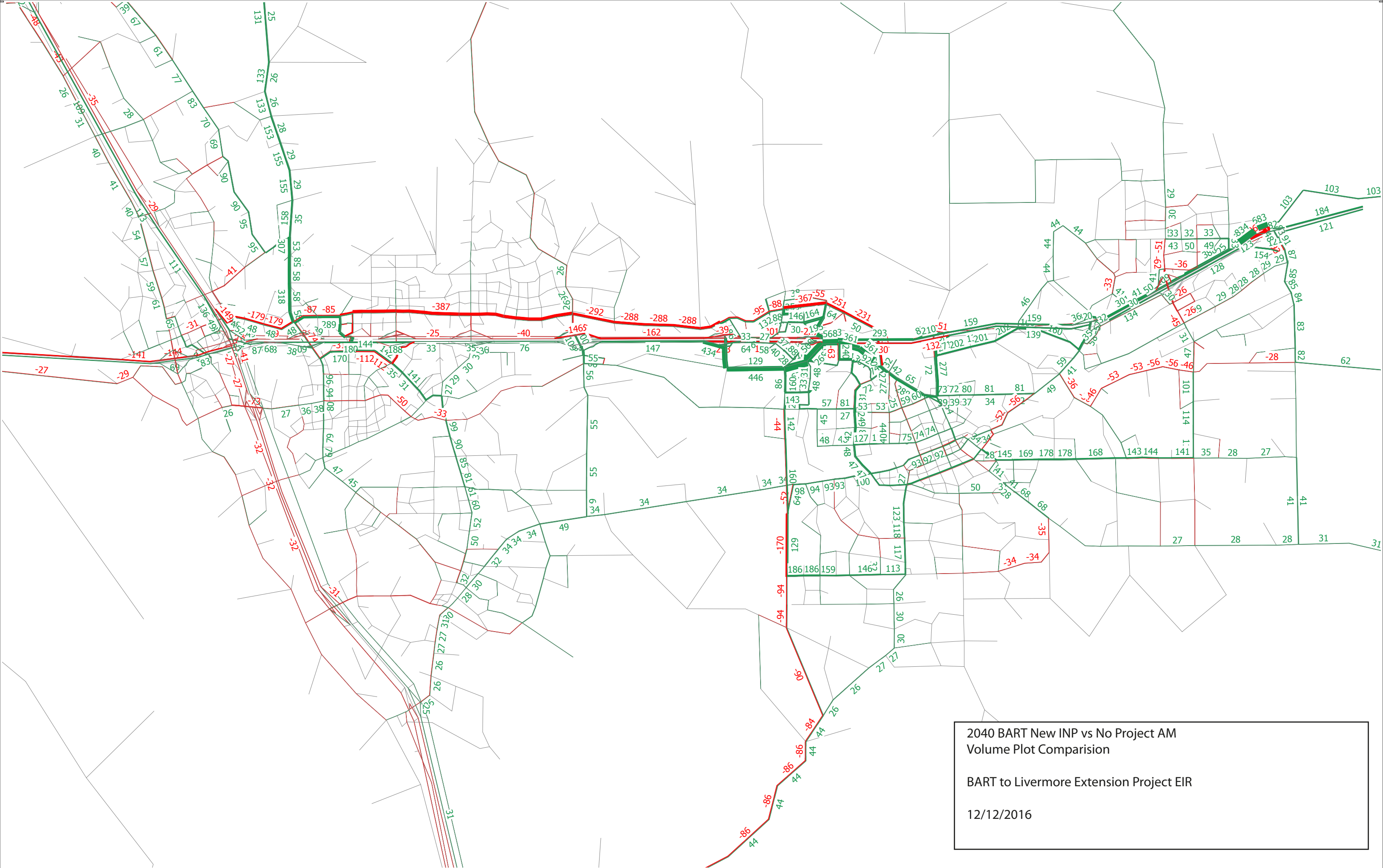
2040 Express Bus AM vs 2040 No Project AM



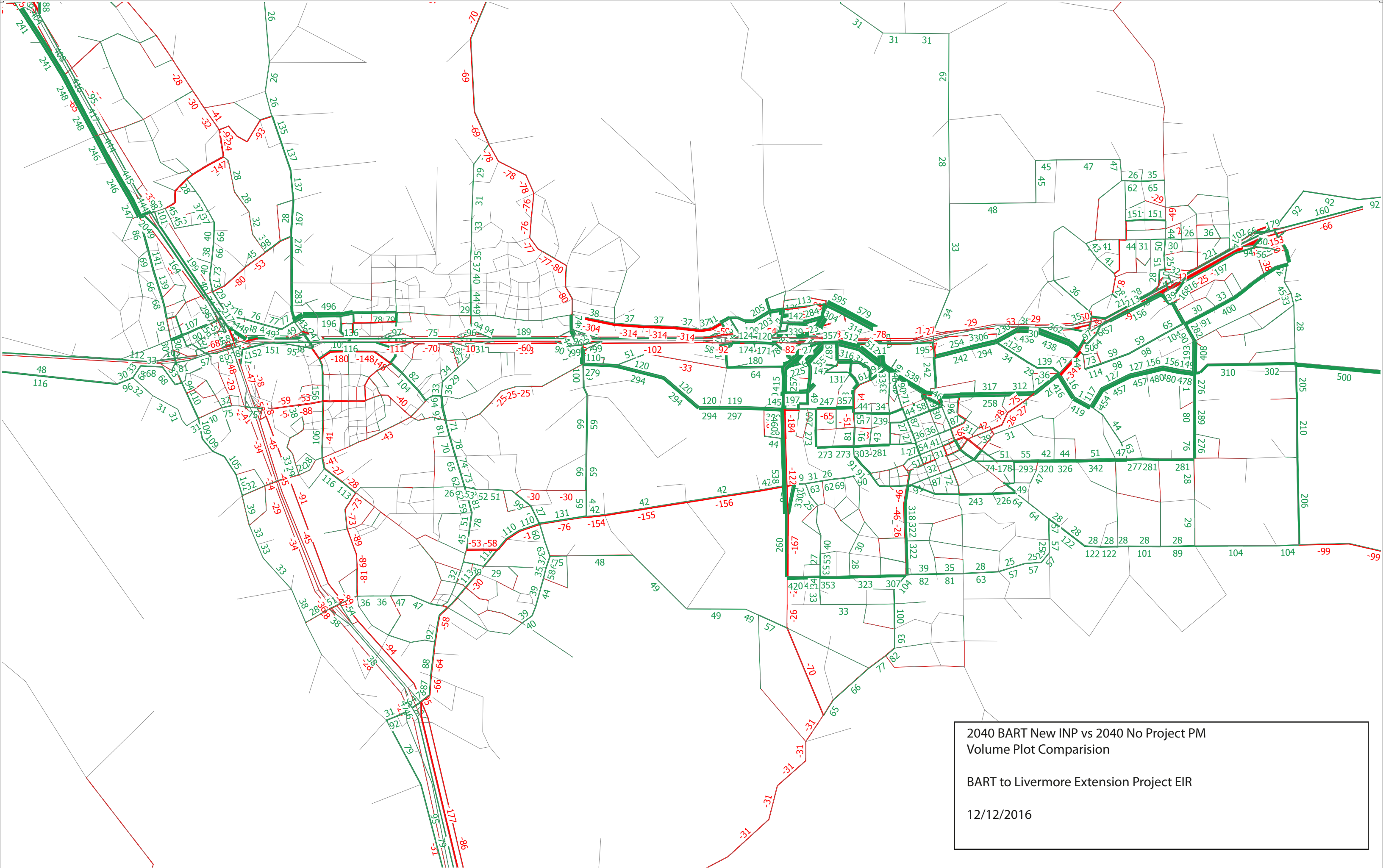
2040 Enhanced Bus AM vs 2040 No Project AM



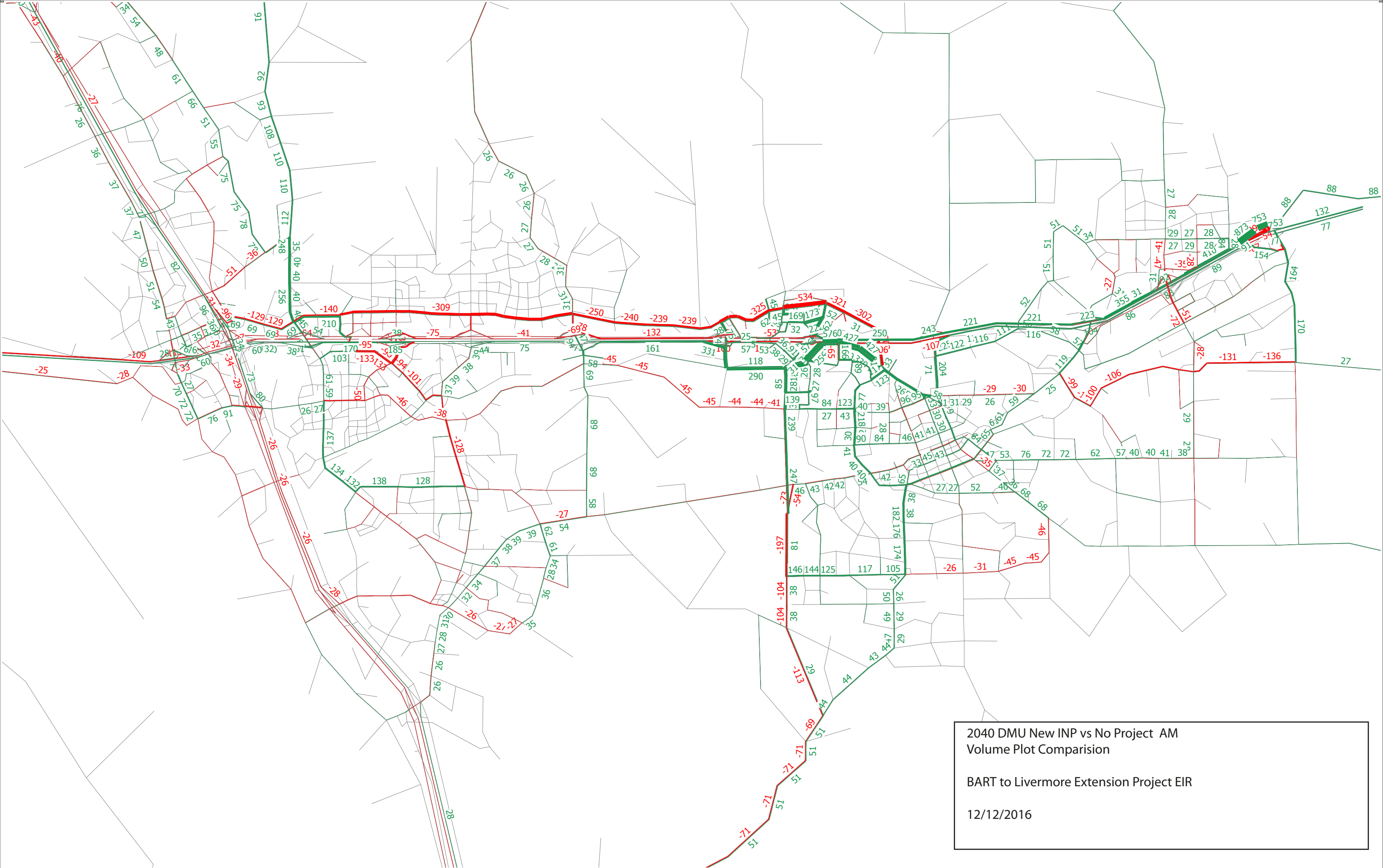
2040 Enhanced Bus PM vs 2040 No Project PM



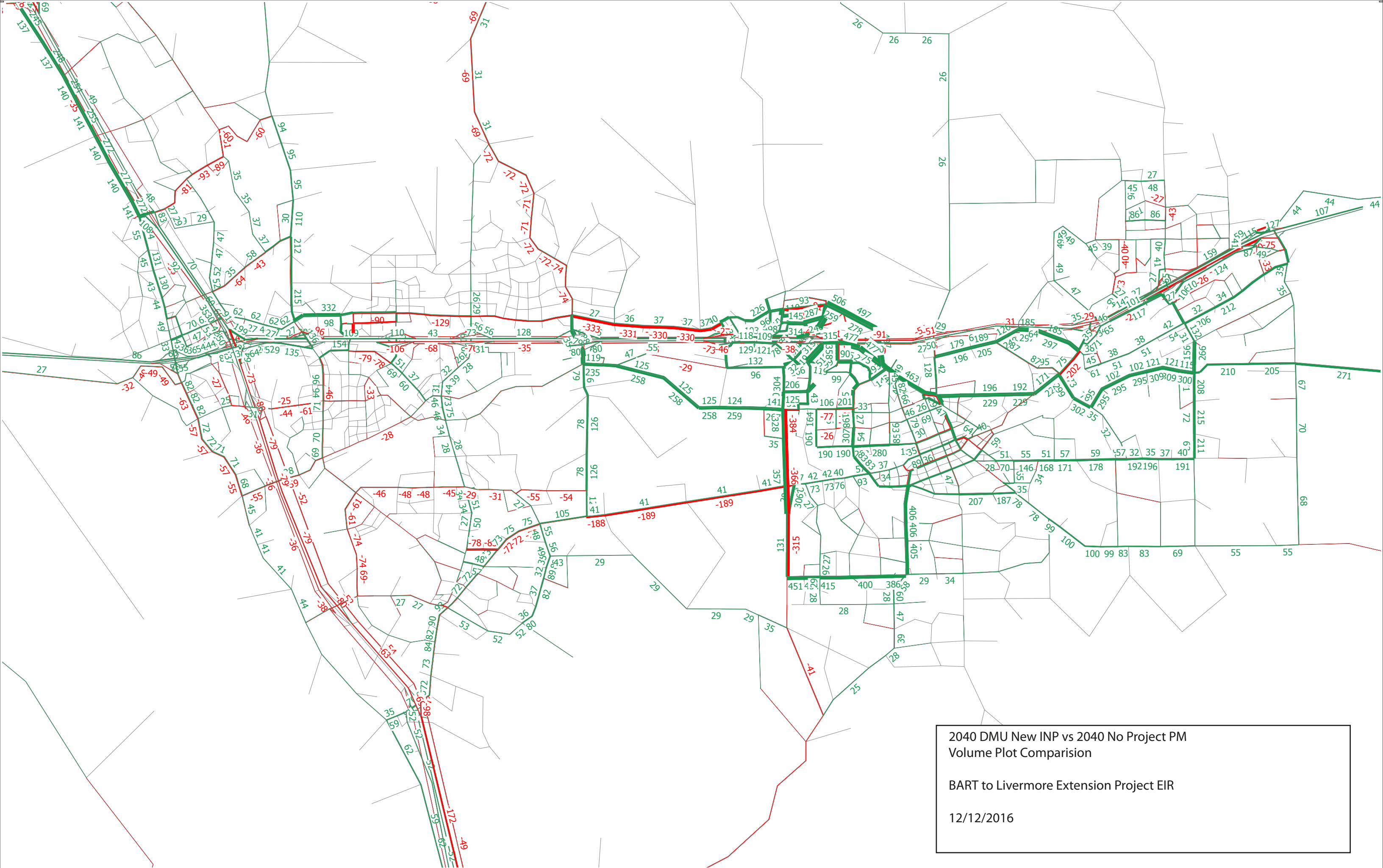
2040 BART New INP vs No Project AM
Volume Plot Comparison
BART to Livermore Extension Project EIR
12/12/2016



2040 BART New INP vs 2040 No Project PM
Volume Plot Comparison
BART to Livermore Extension Project EIR
12/12/2016



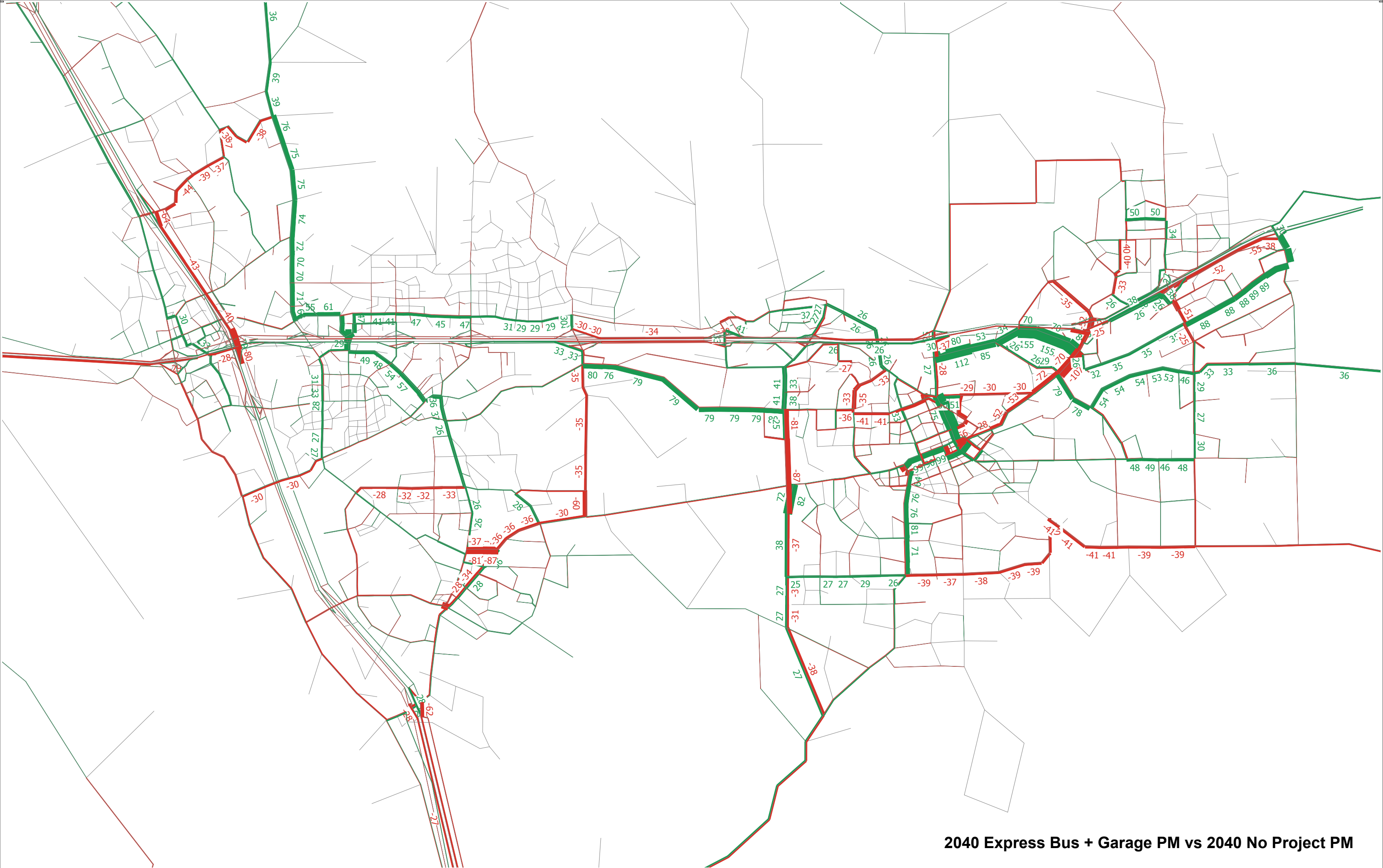
2040 DMU New INP vs No Project AM
Volume Plot Comparison
BART to Livermore Extension Project EIR
12/12/2016



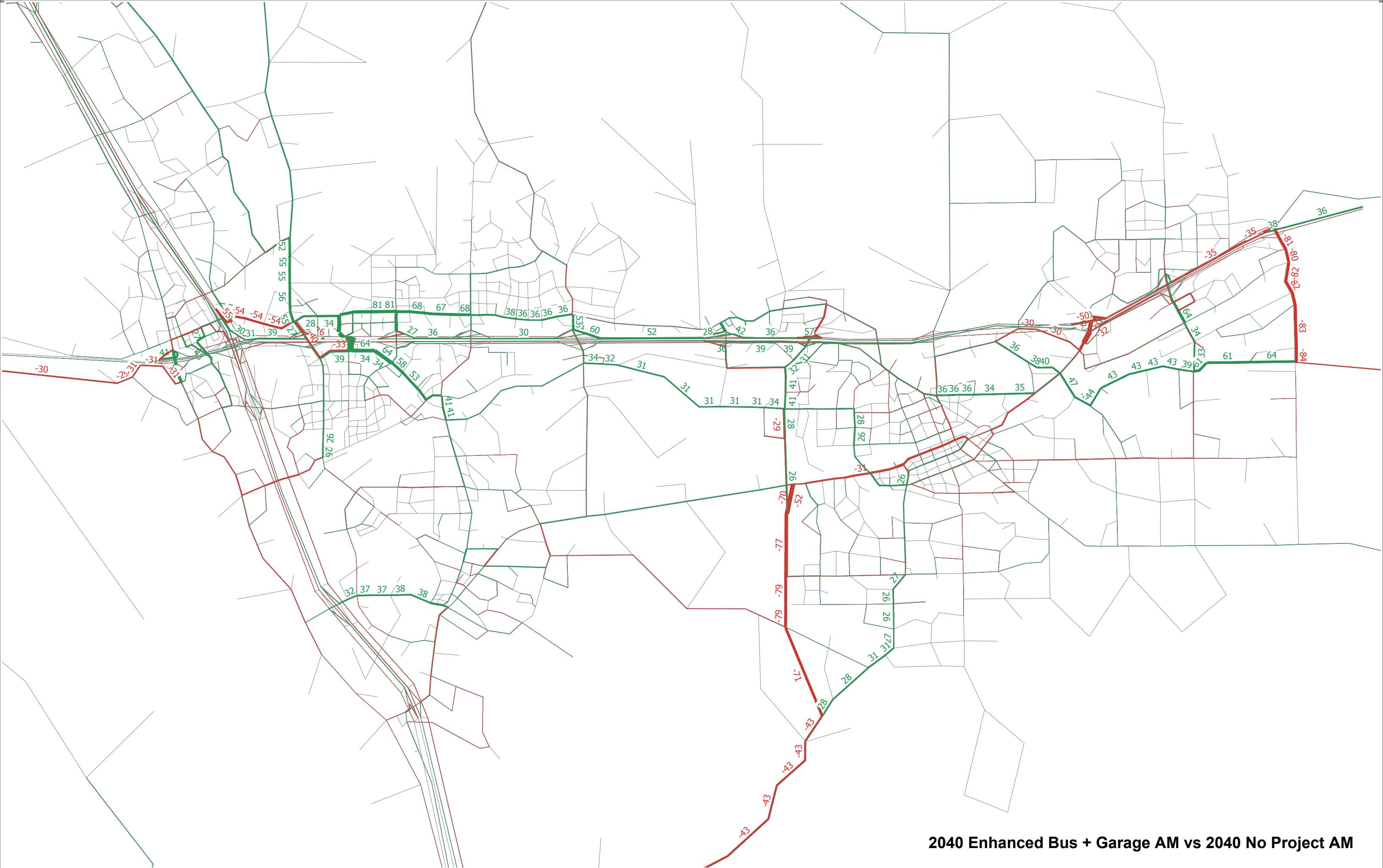
2040 DMU New INP vs 2040 No Project PM
Volume Plot Comparison

BART to Livermore Extension Project EIR

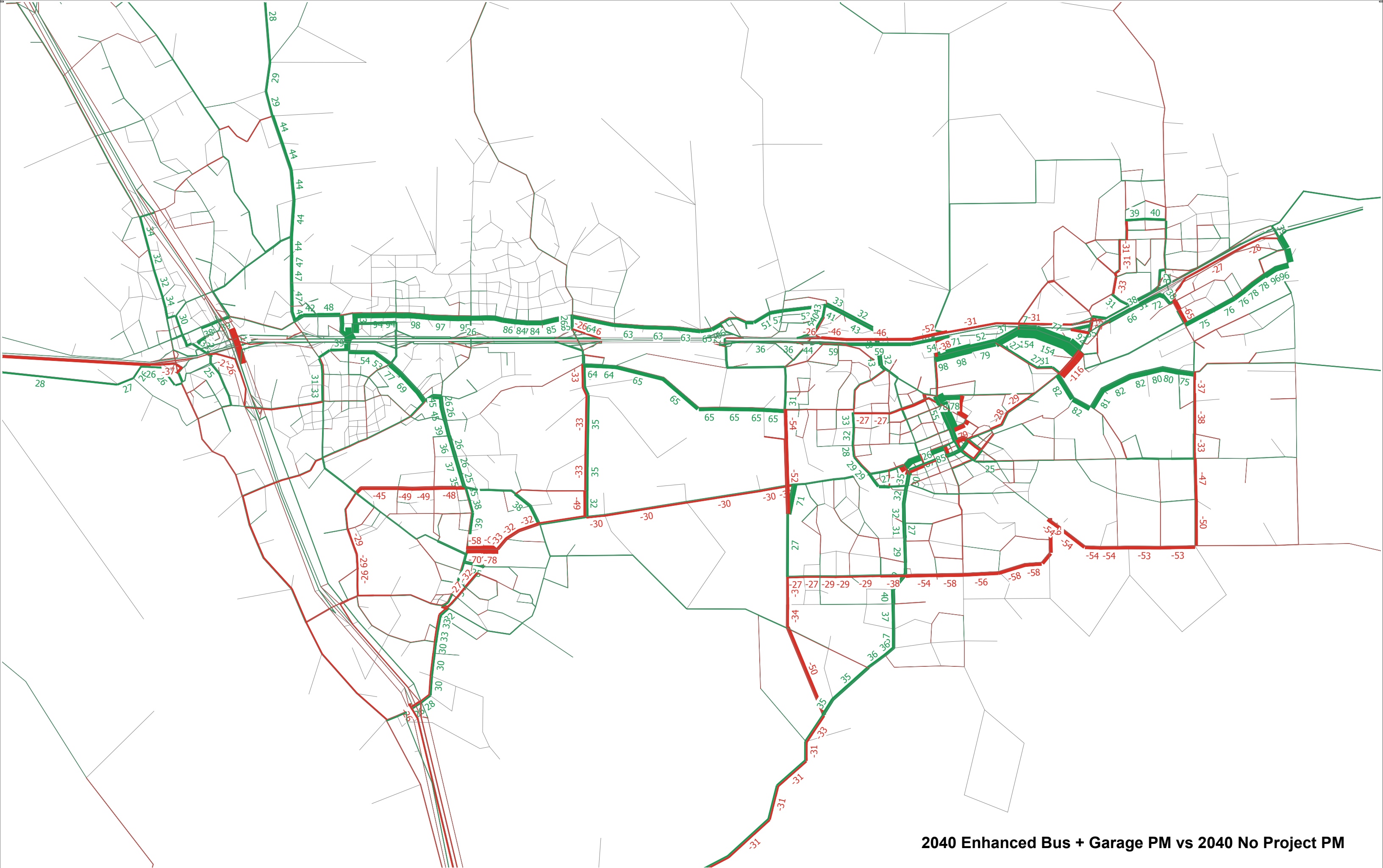
12/12/2016



2040 Express Bus + Garage PM vs 2040 No Project PM



2040 Enhanced Bus + Garage AM vs 2040 No Project AM



2040 Enhanced Bus + Garage PM vs 2040 No Project PM

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F.2 Transportation – Transit Ridership and Vehicle Miles Travelled Under Alternative Land Use Assumptions

BART TO LIVERMORE EXTENSION PROJECT EIR
APPENDIX F: TRANSPORTATION
F.2 TRANSIT RIDERSHIP AND VEHICLE MILES TRAVELLED
UNDER ALTERNATIVE LAND USE ASSUMPTIONS

JULY 2017

APPENDIX F.2 TRANSIT RIDERSHIP AND VEHICLE MILES TRAVELED UNDER ALTERNATIVE LAND USE ASSUMPTIONS

A. INTRODUCTION

This appendix compares project and land use alternatives of specific interest to the City of Livermore relating to land use assumptions under No Project conditions that were not considered in the main body of the BART to Livermore Extension EIR. Specifically, this appendix compares the scenarios of the main body of the EIR, which assume land uses associated with Plan Bay Area projections, to a scenario that assumes a different set of land uses in Livermore – those reflecting the Livermore General Plan. Transit ridership and vehicle miles traveled are presented below.

B. ALTERNATIVES

For the 2025 forecast year, four project + land use alternatives were compared against a No Project alternative (No Project + Existing Livermore General Plan Zoning):

- Proposed Project (Conventional BART) + Isabel Neighborhood Plan (INP) zoning
- DMU Alternative + INP zoning
- Express Bus / BRT Alternative + Existing Livermore General Plan zoning
- Enhanced Bus Alternative + Existing Livermore General Plan zoning

For the 2040 forecast year, four project + land use alternatives were compared against a No Project alternative (No Project + Existing Livermore General Plan Zoning):

- Proposed Project (Conventional BART) + INP zoning
- DMU Alternative + INP zoning
- Express Bus / BRT Alternative + Existing Livermore General Plan zoning
- Enhanced Bus Alternative + Existing Livermore General Plan zoning

C. TRANSIT RIDERSHIP

1. Results

Systemwide average weekday transit ridership estimates are provided for four transit operators below:

- BART
- Altamont Corridor Express (ACE)
- Livermore Amador Valley Transit Authority (LAVTA)
- San Joaquin Regional Transit District (RTD)

TABLE 1: TRANSIT RIDERSHIP (WEEKDAY BOARDINGS), BY OPERATOR (CHANGE FROM NO PROJECT)

Scenario	Operator			
	BART	ACE	LAVTA	RTD
2025				
No Project	472,200	5,600	10,400	370
Conventional BART + INP Zoning	479,600 (+7,400)	4,600 (-1,000)	10,800 (+400)	30 (-340)
DMU Alternative + INP Zoning	478,000 (+5,800)	4,700 (-900)	11,200 (+800)	70 (-300)
Express Bus/BRT Alternative + Existing Livermore General Plan	473,900 (+1,700)	5,500 (-100)	11,700 (+1,300)	60 (-310)
Enhanced Bus Alternative + Existing Livermore General Plan	472,200 (0)	5,600 (0)	10,700 (+300)	360 (-10)
2040				
No Project	657,300	6,900	14,500	340
Conventional BART + INP Zoning	670,700 (+13,400)	5,500 (-1,400)	15,400 (+900)	50 (-290)
DMU Alternative + INP Zoning	665,600 (+8,300)	5,900 (-1,000)	15,700 (+1,200)	50 (-290)
Express Bus/BRT Alternative + Existing Livermore General Plan	660,800 (+3,500)	6,600 (-300)	17,000 (+2,500)	70 (-270)
Enhanced Bus Alternative + Existing Livermore General Plan	657,300 (0)	6,900 (0)	14,700 (+200)	340 (0)

Notes:

Ridership refers to the number of linked trips on each respective transit system; a passenger boarding the Dublin/Pleasanton-Daly City line at the Dublin/Pleasanton Station and transferring at the Coliseum Station to the Richmond-Fremont line would count as one trip on BART.

ACE ridership numbers only include boardings in San Joaquin County and the Bay Area. These numbers do not reflect boardings along potential future ACE extensions into Stanislaus and Merced Counties.

Source: Cambridge Systematics, 2017. BART to Livermore Ridership Projections (Draft). July

*Source for 2016 Existing Conditions data: BART, 2016.

2. Discussion

The Proposed Project results in the highest increases to BART ridership in both 2025 and 2040, reflecting the relatively high appeal of a direct connection to the BART system from the Isabel area that eliminates the need for additional transfers. In 2040 the Proposed Project generates 13,400 more BART trips compared to the No Project scenario. The ridership increase is partly due to extending BART to Livermore and partly due to the intensified land use from the INP. The DMU Alternative is less attractive as a rail option due to the required transfer at the Dublin/Pleasanton Station, and adds fewer new BART trips (8,300) in 2040. The Express Bus/BRT Alternative adds even fewer BART trips (3,500). While the bus-only lane on I-580 enables faster travel times than buses traveling with other traffic, the bus service is still less attractive than rail and requires a transfer at the Dublin/Pleasanton Station for entrance into the BART system. The Express Bus/BRT Alternative also assumes a continuation of zoning consistent with the existing Livermore General Plan, and does not benefit from the intensified land use from the INP. Finally, the Enhanced Bus Alternative results in negligible changes in BART ridership, a reflection of the lower reliability and speed of bus service on surface streets compared with exclusive transit-ways as well as continuation of zoning consistent with the existing Livermore General Plan.

ACE ridership is expected to drop under the Proposed Project and DMU Alternative, as some ACE riders traveling to southern Alameda County and Santa Clara County who might have taken BART once it's extended to Santa Clara County, but are unable to find parking at Dublin/Pleasanton BART station, would choose to park at the new Isabel station and take BART/DMU instead. For the same reason, RTD ridership would also drop under multiple build alternatives. LAVTA ridership is expected to increase under the Proposed Project and DMU Alternative, as extended rail service increases the draw of connecting bus service. The intensified land use from the INP also increases LAVTA ridership. LAVTA ridership is expected to increase the most under the Express Bus/BRT Alternative, as the assumed LAVTA bus routes using the I-580 express lanes and direct bus-only ramps to the Dublin/Pleasanton Station would attract some of the riders that would have taken the extended rail service.

D. VEHICLE-MILES TRAVELED

1. Results

Reductions in vehicle-miles traveled are presented below (VMT), compared to the No Project scenario for each forecast year:

TABLE 2: VMT REDUCTIONS SUMMARY, AVERAGE WEEKDAY

Scenario	Auto VMT Reduction Compared With No Project Conditions	Bus VMT Increase Relative to No Project Conditions	Total VMT Reduction
2025			
Conventional BART + INP Zoning	112,900	1,900	111,000
DMU Alternative + INP Zoning	65,000	1,900	63,100
Express Bus/BRT Alternative + Existing Livermore General Plan	40,000	2,700	37,000
Enhanced Bus Alternative + Existing Livermore General Plan	5,100	2,600	2,500
2040			
Conventional BART + INP Zoning	294,900	1,900	293,000
DMU Alternative + INP Zoning	186,600	1,900	184,700
Express Bus/BRT Alternative + Existing Livermore General Plan	86,900	2,700	84,200
Enhanced Bus Alternative + Existing Livermore General Plan	500	2,600	(2,100)

Source: Cambridge Systematics, 2017. BART to Livermore Ridership Projections (Draft). July

2. Discussion

The Proposed Project and all Build Alternatives result in VMT reductions compared with No Project Conditions, except for the Enhanced Bus Alternative in 2040. The Proposed Project results in the highest VMT reductions; by attracting the most new BART riders, it reduces auto vehicle trips the most. The DMU Alternative has the second-highest amount of VMT reductions – a lower reduction than under the Proposed Project, likely because this Alternative requires passengers starting at the Isabel DMU station to transfer at the Dublin/Pleasanton Station, whereas under the Proposed Project, passengers don't need to transfer. Express Bus/BRT provides the next highest VMT reduction, as bus service is less attractive to transit riders than rail service. The Express Bus/BRT Alternative also does not benefit from the intensified land use associated with the INP, and assumes a continuation of the less intense land use allowed under zoning consistent with the existing Livermore General Plan.

The Enhanced Bus Alternative results in negligible VMT reductions. The difference in VMT reduction under the Express Bus/BRT Alternative and the Enhanced Bus Alternative may be because while the Enhanced Bus Alternative includes improvements to bus service, it does not provide any major capital improvements to improve bus travel times and results in fewer additional transit riders. VMT reductions under the Enhanced Bus Alternative for 2040 are especially minor, eclipsed by the increase in the bus VMT (due to the bus service improvements proposed under the Alternative) – overall leading to a small increase in VMT for 2040 project conditions. It is the only scenario under which there is an increase in VMT.

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APPENDIX G: NOISE MODEL DATA

- G.1 FTA Noise Calculations**
- G.2 Traffic Noise Input Assumptions
and Modeling Output**
- G.3 Construction Noise Calculations**
- G.4 Construction Vibration Calculations**
- G.5 Noise Monitoring Summary Sheets**
- G.6 Sound Level Meter Certification**

G.1 Noise Model Data – FTA Noise Calculations

Calculation of BART Train Noise at reference Distance - Proposed Project

$$\text{LeqC (h)} = \text{SELref} + 10 \log (\text{Ncars}) + 20 \log (S/50) + 10 \log (V) - 35.6 \quad \text{Where;}$$

SEL ref = reference SEL

N = Number of cars

S = train speed in MPH

V = trains per hour

Daytime

SELref	79	BART to Livermore Extension Table 3.10-7	
Ncars	7.5	average number of cars per train	
S	80	train speed	
Vd	7.6	average hourly daytime volume of train traffic, in trains per hour (7am to 10 pm)	(number of trains between 7-10)/15

Leq, dBA **63** at 50 ft

Nighttime

SELref	79		
Ncars	8.5	average number of cars per train	
S	80	train speed	
Vn	7.3	average hourly nighttime volume of train traffic, in trains per hour (10 pm to 7 am)	(number of trains between 10-7)/9

Leq, dBA **63** at 50 ft

Calculation of reference Ldn

Ldn **69** at 50 ft

Calculation of DMU Noise at Reference Distance - DMU Alternative

$$LeqC (h) = SEL_{ref} + 10 \log (N_{cars}) + 20 \log (S/50) + 10 \log (V) - 35.6$$

Where

SEL_{ref} = reference SEL

N = Number of cars

S = train speed in MPH

V = trains per hour

Daytime

SEL _{ref}	85	FTA Table 5-1 DMU, Diesel-powered, 1200 hp	
N _{cars}	7.5	average number of cars per train	
S	75	train speed	
V _d	7.6	average hourly daytime volume of train traffic, in trains per hour (7am to 10 pm)	(number of trains between 7-10)/15

Leq, dBA **67** at 50 ft
 Less 3 dBA reduction for ballast instead of concrete

Adjusted Leq = 64 at 50 feet

Nighttime

SEL _{ref}	85		
N _{cars}	8.5	average number of cars per train	
S	75	train speed	
V _n	7.3	average hourly nighttime volume of train traffic, in trains per hour (10 pm to 7 am)	(number of trains between 10-7)/9

Leq, dBA **68** at 50 ft
 Less 3 dBA reduction for ballast instead of concrete

Adjusted Leq = 65 at 50 feet

Calculation of reference Ldn

Ldn **71** at 50 ft

BRT Express Bus Alternative - Calculation of Bus Noise

(diesel-powered: 82 SEL (dBA); hybrid: case by case)
 Per Roth, 2007 Hybrid bus 3 dBA less than diesel
 Hybrid SEL = 79 dBA

$Leq(h) = SEL_{ref} + 10 \log \log (S/50) + 10 \log (V) - 35.6$ Where:

- Sel ref = reference SEL
- N = Number of cars
- S = Bus speed in MPH
- V = Buses per hour

Daytime

SELref	79 hybrid	
S	65 bus speed	
Vd	7.5 average hourly daytime volume of bus traffic per hour (7am to 10 pm)	(number of buses between 7-10)/15

Leq, dBA **54** at 50 ft

Nighttime

SELref	85	
S	65 bus speed	
Vn	1.6 average hourly daytime volume of bus traffic per hour (10 pm to 7 am)	(number of buses between 10-7)/9

Leq, dBA **53** at 50 ft

Ldn **60** at 50 ft

Calculation of Noise Level at Receptors using Reference SEL at 50 feet

BART Alternative		DMU Alternative		BUS Alternative	
Ref Ldn	69	Ref Ldn	71	Ref Ldn	60
Ref Distance	50	Ref Distance	50	Ref Distance	50
LT-2 Distance	1100	LT-1 Distance	370	LT-1 Distance	320
	-13.4		-8.7		-8.1
LT-2 Ldn	56	LT-1 Ldn	62	LT-1 Ldn	52
	10 barrier reduction		5 barrier		5 barrier
LT-2 Ldn	46 with barrier	LT-1 Ldn	57 with barrier	LT-1 Ldn	47 with barrier
Ref Ldn	69	Ref Ldn	71	Ref Ldn	60
Ref Distance	50	Ref Distance	50	Ref Distance	50
LT-2 Distance	170	LT-1 Distance	320	LT-1 Distance	370
	-5.3		-8.1		-8.7
LT-2 Ldn	64	LT-1 Ldn	63	LT-1 Ldn	51
	10 barrier reduction		5 barrier		5 barrier
LT-2 Ldn	54 with barrier	LT-1 Ldn	58 with barrier	LT-1 Ldn	46 with barrier
Ref Ldn	69	Ref Ldn	71	Ref Ldn	60
Ref Distance	50	Ref Distance	50	Ref Distance	50
ST-1 Distance	680	LT-2 Distance	1100	LT-5 Distance	400
	-11.3		-13.4		-9.0
ST-1 Ldn	58	LT-2 Ldn	58	LT-5 Ldn	51
	5 barrier reduction		10 barrier		
ST-1 Ldn	53 with barrier	LT-2 Ldn	48 with barrier		
Ref Ldn	69	Ref Ldn	71	Ref Ldn	60
Ref Distance	50	Ref Distance	50	Ref Distance	50
LT-3 Distance	1000	LT-2 Distance	170	LT-4 Distance	100
	-13.0		-5.3		-3.0
LT-3 Ldn	56	LT-2 Ldn	66	LT-4 Ldn	57
			10 barrier		
		LT-2 Ldn	56 with barrier		
Ref Ldn	69	Ref Ldn	71		
Ref Distance	50	Ref Distance	50		
LT-5 Distance	370	ST-1 Distance	680		
	-8.7		-11.3		
LT-5 Ldn	60	ST-1 Ldn	60		
	5 barrier reduction		5 barrier reduction		
LT-5 Ldn	55 with barrier	ST-1 Ldn	55 with barrier		
		Ref Ldn	71		
		Ref Distance	50		
		LT-3 Distance	1000		
			-13.0		
		LT-3 Ldn	58		
		Ref Ldn	71		
		Ref Distance	50		
		LT-5 Distance	370		
			-8.7		
		LT-5 Ldn	62		
			5 barrier reduction		
		LT-5 Ldn	57 with barrier		

Calculation of Noise Contribution -Switch (Crossover)

Per FTA Guidance Stationary Source Noise calculation is :

Leq = SELref +Cn - 35.6 where
 Selref = Source reference level at 50 feet
 Cn = volume adjustment (Number of trans per hour)

Daytime Leq Calculation

SELref	100	FTA table 5-5, crossover
Train	8.9	number of train per hour
Cn	9	
Leq, dBA	74	at 50 ft

Nighttime Leq Calculation

SELref	100	FTA table 5-5, crossover
Train	6.8	number of train per hour
Cn	8	
Leq, dBA	73	at 50 ft

Calculated noise levels at distance (D)		
D1 (ref)	50	feet
D2	680	feet
Reduction =	-23	
Ldn at D2 =	57	

Calculation of Ldn contribution at reference distance

Ldn	79	at 50 ft
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Calculation of Horn Noise for Proposed Project and DMU Alternative

Daytime

SELref	83.1	Highest Monitored Value at Colma BART Station (outdoors)
Train	7.6	number of train per hour
Cn	9	
Leq, dBA	56	at 50 ft

Nighttime

SELref	83.1	Highest Monitored Value at Colma BART Station (outdoors)
Train	7.3	number of train per hour
Cn	9	
Leq, dBA	56	at 50 ft

Ldn **63** at 50 ft

Calculated noise levels at distance (D)		
D1 (ref)	50	feet
D2	1000	feet
Reduction =	-26	
Ldn at D2 =	37	

BART Train operations (from separate sheet) = 56 Ldn
 Add horn noise 37 Ldn
 Total noise BART and Switch) = 56 Ldn

DMU Train operations (from separate sheet) = 58 Ldn
 Add switch noise 37 Ldn
 Total noise BART and Switch) = 58 Ldn

Calculation of noise from storage and maintenance facility

Nearest receptor = 1343 Hartman Road
 Distance of Receptor = 600 feet

Reference SEL = 118 dBA Source: FTA Table 5-5

Computation of Leq Equation

hourly Leq = SEL(reference) + Cn - 35.6 Source: FTA Table 5-6
 Where Cn = Volume adjustment

For yard and shops Cn = $10\text{LOG}(Nt/20)$ Source of Volume adjustment: FTA table 5-6
 Where Nt = number of trains per hour

Nt = 5 Assume Worst case (12 minute) headways in bound

Cn = -6.0206

Hourly Leq at 50 feet = 76.4 dBA

Distance correction value at 600 feet = 27 dBA From FTA Figure 5-2 for stationary source)

Hourly Leq at receptor = 49.4 dBA

G.2 Noise Model Data – Traffic Noise Input Assumptions and Modeling Output

Existing Conditions AM Peak Hour

ROAD SEGMENT	TOTAL # VEHICLES	VEHICLE TYPE %						VEHICLE SPEED				NOISE LEVEL (dBA)			CALCULATED NOISE LEVEL 15 meters from roadway center)		
		Auto	MT	HT	Auto k/h	MT k/h	HT k/h	Auto	MT	HT							
Calveno Peak																	
Owens	904	95	858.8	3	27.12	2	18.1	40	64	40	64	40	64	65.3	59.3	63.8	68.2
Martinelli	440	95	418	3	13.2	2	8.8	40	64	40	64	40	64	62.2	56.1	60.7	65.1
Dublin	1441	95	1369	3	43.23	2	28.8	45	72	45	72	45	72	68.8	62.1	66.3	71.3
Campus Hill	580	97	562.6	2	11.6	1	5.8	40	64	40	64	40	64	63.5	55.6	58.9	65.3
Murietta	1328	97	1288.2	2	26.56	1	13.3	35	56	35	56	35	56	65.4	58.3	62.0	67.6
Vasco	1261	97	1223.2	2	25.22	1	12.6	45	72	45	72	45	72	68.3	59.8	62.8	69.8

Assumptions: AM peak hour traffic data from ARUP

2025 Baseline Condition AM Peak Hour

ROAD SEGMENT	TOTAL # VEHICLES	VEHICLE TYPE %						VEHICLE SPEED				NOISE LEVEL (dBA)			CALCULATED NOISE LEVEL 15 meters from roadway center)		
		Auto	MT	HT	Auto k/h	MT k/h	HT k/h	Auto	MT	HT							
Calveno Peak																	
Owens	1041	95	988.95	3	31.23	2	20.8	40	64	40	64	40	64	65.9	59.9	64.5	68.9
Martinelli	498	95	473.1	3	14.94	2	9.96	40	64	40	64	40	64	62.7	56.7	61.3	65.7
Dublin	1534	95	1457.3	3	46.02	2	30.7	45	72	45	72	45	72	69.1	62.4	66.6	71.6
Campus Hill	639	97	619.83	2	12.78	1	6.39	40	64	40	64	40	64	63.9	56.0	59.3	65.7
Murietta	1332	97	1292	2	26.64	1	13.3	35	56	35	56	35	56	65.4	58.3	62.0	67.6
Vasco	1341	97	1300.8	2	26.82	1	13.4	45	72	45	72	45	72	68.6	60.0	63.0	70.1
Airway	423	97	410.31	2	8.46	1	4.23	35	56	35	56	35	56	60.4	53.3	57.0	62.6

Assumptions: AM peak hour traffic data from ARUP

2025 Baseline +Project AM Peak Hour

ROAD SEGMENT	TOTAL # VEHICLES	VEHICLE TYPE %						VEHICLE SPEED				NOISE LEVEL (dBA)			CALCULATED NOISE LEVEL 15 meters from roadway center)		
		Auto	MT	HT	Auto k/h	MT k/h	HT k/h	Auto	MT	HT							
Calveno Peak																	
			%	Auto	%	MT	%	HT									
Owens	981	95	931.95	3	29.43	2	19.6	40	64	40	64	40	64	65.7	59.6	64.2	68.6
Martinelli	495	95	470.25	3	14.85	2	9.9	40	64	40	64	40	64	62.7	56.7	61.2	65.6
Dublin	1534	95	1457.3	3	46.02	2	30.7	45	72	45	72	45	72	69.1	62.4	66.6	71.6
Campus Hill	640	97	620.8	2	12.8	1	6.4	40	64	40	64	40	64	63.9	56.0	59.3	65.7
Murietta	1342	97	1301.7	2	26.84	1	13.4	35	56	35	56	35	56	65.5	58.3	62.0	67.6
Vasco	1253	97	1215.4	2	25.06	1	12.5	45	72	45	72	45	72	68.3	59.7	62.7	69.8
Airway	1004	97	973.88	2	20.08	1	10	35	56	35	56	35	56	64.2	57.1	60.8	66.4

Assumptions: AM peak hour traffic data from ARUP

2025 Baseline + DMU Alternative AM Peak Hour

ROAD SEGMENT	TOTAL # VEHICLES	VEHICLE TYPE %						VEHICLE SPEED				NOISE LEVEL (dBA)			CALCULATED NOISE LEVEL 15 meters from roadway center)		
		Auto	MT	HT	Auto k/h	MT k/h	HT k/h	Auto	MT	HT							
Calveno Peak																	
			%	Auto	%	MT	%	HT									
Owens	982	95	932.9	3	29.46	2	19.6	40	64	40	64	40	64	65.7	59.6	64.2	68.6
Martinelli	499	95	474.05	3	14.97	2	9.98	40	64	40	64	40	64	62.7	56.7	61.3	65.7
Dublin	1537	95	1460.2	3	46.11	2	30.7	45	72	45	72	45	72	69.1	62.4	66.6	71.6
Campus Hill	650	97	630.5	2	13	1	6.5	40	64	40	64	40	64	64.0	56.1	59.4	65.8
Murietta	1336	97	1295.9	2	26.72	1	13.4	35	56	35	56	35	56	65.4	58.3	62.0	67.6
Vasco	1340	97	1299.8	2	26.8	1	13.4	45	72	45	72	45	72	68.6	60.0	63.0	70.1
Airway	786	97	762.42	2	15.72	1	7.86	35	56	35	56	35	56	63.1	56.0	59.7	65.3

Assumptions: AM peak hour traffic data from ARUP

2025 Baseline + BRT Alternative AM Peak Hour

ROAD SEGMENT	TOTAL # VEHICLES	VEHICLE TYPE %						VEHICLE SPEED				NOISE LEVEL (dBA)			CALCULATED NOISE LEVEL 15 meters from roadway center)		
		Auto	MT	HT	Auto k/h	MT k/h	HT k/h	Auto	MT	HT							
Calveno Peak																	
		%	Auto	%	MT	%	HT										
Owens	1037	95	985.15	3	31.11	2	20.7	40	64	40	64	40	64	65.9	59.9	64.4	68.8
Martinelli	496	95	471.2	3	14.88	2	9.92	40	64	40	64	40	64	62.7	56.7	61.2	65.6
Dublin	1535	95	1458.3	3	46.05	2	30.7	45	72	45	72	45	72	69.1	62.4	66.6	71.6
Campus Hill	636	97	616.92	2	12.72	1	6.36	40	64	40	64	40	64	63.9	56.0	59.3	65.7
Murietta	1330	97	1290.1	2	26.6	1	13.3	35	56	35	56	35	56	65.4	58.3	62.0	67.6
Vasco	1344	97	1303.7	2	26.88	1	13.4	45	72	45	72	45	72	68.6	60.0	63.0	70.1
Airway	422	97	409.34	2	8.44	1	4.22	35	56	35	56	35	56	60.4	53.3	57.0	62.6

Assumptions: AM peak hour traffic data from ARUP

2025 Baseline + Enhanced Bus Alternative AM Peak Hour

ROAD SEGMENT	TOTAL # VEHICLES	VEHICLE TYPE %						VEHICLE SPEED				NOISE LEVEL (dBA)			CALCULATED NOISE LEVEL 15 meters from roadway center)		
		Auto	MT	HT	Auto k/h	MT k/h	HT k/h	Auto	MT	HT							
Calveno Peak																	
		%	Auto	%	MT	%	HT										
Owens	1039	95	987.05	3	31.17	2	20.8	40	64	40	64	40	64	65.9	59.9	64.5	68.8
Martinelli	498	95	473.1	3	14.94	2	9.96	40	64	40	64	40	64	62.7	56.7	61.3	65.7
Dublin	1533	95	1456.4	3	45.99	2	30.7	45	72	45	72	45	72	69.1	62.4	66.6	71.6
Campus Hill	637	97	617.89	2	12.74	1	6.37	40	64	40	64	40	64	63.9	56.0	59.3	65.7
Murietta	1331	97	1291.1	2	26.62	1	13.3	35	56	35	56	35	56	65.4	58.3	62.0	67.6
Vasco	1339	97	1298.8	2	26.78	1	13.4	45	72	45	72	45	72	68.6	60.0	63.0	70.1

Assumptions: AM peak hour traffic data from ARUP

Existing Conditions PM Peak Hour

ROAD SEGMENT	TOTAL # VEHICLES	VEHICLE TYPE %						VEHICLE SPEED				NOISE LEVEL (dBA)			CALCULATED NOISE LEVEL 15 meters from roadway center)		
		Auto	MT	HT	Auto k/h	MT k/h	HT k/h	Auto	MT	HT							
Calveno Peak																	
		%	Auto	%	MT	%	HT										
Owens	1344	95	1276.8	3	40.32	2	26.9	40	64	40	64	40	64	67.0	61.0	65.6	70.0
Martinelli	828	95	786.6	3	24.84	2	16.6	40	64	40	64	40	64	64.9	58.9	63.5	67.9
Dublin	1962	95	1863.9	3	58.86	2	39.2	45	72	45	72	45	72	70.2	63.4	67.7	72.7
Campus Hill	658	97	638.26	2	13.16	1	6.58	40	64	40	64	40	64	64.0	56.1	59.5	65.8
Murietta	1491	97	1446.3	2	29.82	1	14.9	35	56	35	56	35	56	65.9	58.8	62.5	68.1
Vasco	1552	97	1505.4	2	31.04	1	15.5	45	72	45	72	45	72	69.2	60.7	63.7	70.7

Assumptions: PM peak hour traffic data from ARUP

2025 Baseline Condition PM Peak Hour

ROAD SEGMENT	TOTAL # VEHICLES	VEHICLE TYPE %						VEHICLE SPEED				NOISE LEVEL (dBA)			CALCULATED NOISE LEVEL 15 meters from roadway center)		
		Auto	MT	HT	Auto k/h	MT k/h	HT k/h	Auto	MT	HT							
Calveno Peak																	
		%	Auto	%	MT	%	HT										
Owens	1630	95	1548.5	3	48.9	2	32.6	40	64	40	64	40	64	67.9	61.8	66.4	70.8
Martinelli	1001	95	950.95	3	30.03	2	20	40	64	40	64	40	64	65.8	59.7	64.3	68.7
Dublin	2070	95	1966.5	3	62.1	2	41.4	45	72	45	72	45	72	70.4	63.7	67.9	72.9
Campus Hill	854	97	828.38	2	17.08	1	8.54	40	64	40	64	40	64	65.2	57.3	60.6	67.0
Murietta	1710	97	1658.7	2	34.2	1	17.1	35	56	35	56	35	56	66.5	59.4	63.1	68.7
Vasco	1772	97	1718.8	2	35.44	1	17.7	45	72	45	72	45	72	69.8	61.2	64.2	71.3
Airway	924	97	896.28	2	18.48	1	9.24	35	56	35	56	35	56	63.8	56.7	60.4	66.0

Assumptions: PM peak hour traffic data from ARUP

2025 Baseline + Project PM Peak Hour

ROAD SEGMENT	TOTAL # VEHICLES	VEHICLE TYPE %						VEHICLE SPEED				NOISE LEVEL (dBA)			CALCULATED NOISE LEVEL 15 meters from roadway center)		
		Auto	MT	HT	Auto k/h	MT k/h	HT k/h	Auto	MT	HT							
Calveno Peak																	
		%	Auto	%	MT	%	HT										
Owens	1590	95	1510.5	3	47.7	2	31.8	40	64	40	64	40	64	67.8	61.7	66.3	70.7
Martinelli	840	95	798	3	25.2	2	16.8	40	64	40	64	40	64	65.0	59.0	63.5	67.9
Dublin	2075	95	1971.3	3	62.25	2	41.5	45	72	45	72	45	72	70.4	63.7	67.9	72.9
Campus Hill	858	97	832.26	2	17.16	1	8.58	40	64	40	64	40	64	65.2	57.3	60.6	67.0
Murietta	1842	97	1786.7	2	36.84	1	18.4	35	56	35	56	35	56	66.8	59.7	63.4	69.0
Vasco	1774	97	1720.8	2	35.48	1	17.7	45	72	45	72	45	72	69.8	61.2	64.2	71.3
Airway	1507	97	1461.8	2	30.14	1	15.1	35	56	35	56	35	56	66.0	58.8	62.5	68.1

Assumptions: PM peak hour traffic data from ARUP

2025 Baseline + DMU Alternative PM Peak Hour

ROAD SEGMENT	TOTAL # VEHICLES	VEHICLE TYPE %						VEHICLE SPEED				NOISE LEVEL (dBA)			CALCULATED NOISE LEVEL 15 meters from roadway center)		
		Auto	MT	HT	Auto k/h	MT k/h	HT k/h	Auto	MT	HT							
Calveno Peak																	
		%	Auto	%	MT	%	HT										
Owens	1621	95	1540	3	48.63	2	32.4	40	64	40	64	40	64	67.9	61.8	66.4	70.8
Martinelli	900	95	855	3	27	2	18	40	64	40	64	40	64	65.3	59.3	63.8	68.2
Dublin	2072	95	1968.4	3	62.16	2	41.4	45	72	45	72	45	72	70.4	63.7	67.9	72.9
Campus Hill	864	97	838.08	2	17.28	1	8.64	40	64	40	64	40	64	65.2	57.3	60.6	67.0
Murietta	1813	97	1758.6	2	36.26	1	18.1	35	56	35	56	35	56	66.8	59.6	63.3	68.9
Vasco	1724	97	1672.3	2	34.48	1	17.2	45	72	45	72	45	72	69.7	61.1	64.1	71.2
Airway	1245	97	1207.7	2	24.9	1	12.5	35	56	35	56	35	56	65.1	58.0	61.7	67.3

Assumptions: PM peak hour traffic data from ARUP

2025 Baseline + BRT Alternative PM Peak Hour

ROAD SEGMENT	TOTAL # VEHICLES	VEHICLE TYPE %						VEHICLE SPEED				NOISE LEVEL (dBA)			CALCULATED NOISE LEVEL 15 meters from roadway center)			
		Auto	MT	HT	Auto k/h	MT k/h	HT k/h	Auto	MT	HT								
Calveno Peak																		
Owens	from: Willow to: Hacienda	1608	95	1527.6	3	48.24	2	32.2	40	64	40	64	40	64	67.8	61.8	66.4	70.7
Martinelli	Hacienda BART	982	95	932.9	3	29.46	2	19.6	40	64	40	64	40	64	65.7	59.6	64.2	68.6
Dublin	Hacienda Iron Horse	2074	95	1970.3	3	62.22	2	41.5	45	72	45	72	45	72	70.4	63.7	67.9	72.9
Campus Hill	Portola Campus Loop	851	97	825.47	2	17.02	1	8.51	40	64	40	64	40	64	65.1	57.2	60.6	66.9
Murietta	J. London Stanley	1674	97	1623.8	2	33.48	1	16.7	35	56	35	56	35	56	66.4	59.3	63.0	68.6
Vasco	East Ave. Telsa Rd.	1803	97	1748.9	2	36.06	1	18	45	72	45	72	45	72	69.9	61.3	64.3	71.4
Airway	Portola Sutter	925	97	897.25	2	18.5	1	9.25	35	56	35	56	35	56	63.8	56.7	60.4	66.0

Assumptions: PM peak hour traffic data from ARUP

2025 Baseline + Enhanced Bus Alternative PM Peak Hour

ROAD SEGMENT	# VEHICLES	VEHICLE TYPE %						VEHICLE SPEED				NOISE LEVEL (dBA)			CALCULATED NOISE LEVEL 15 meters from roadway center)			
		Auto	MT	HT	Auto k/h	MT k/h	HT k/h	Auto	MT	HT								
Calveno Peak																		
Owens	from: Willow to: Hacienda	1631	95	1549.5	3	48.93	2	32.6	40	64	40	64	40	64	67.9	61.8	66.4	70.8
Martinelli	Hacienda BART	991	95	941.45	3	29.73	2	19.8	40	64	40	64	40	64	65.7	59.7	64.2	68.6
Dublin	Hacienda Iron Horse	2068	95	1964.6	3	62.04	2	41.4	45	72	45	72	45	72	70.4	63.7	67.9	72.9
Campus Hill	Portola Campus Loop	853	97	827.41	2	17.06	1	8.53	40	64	40	64	40	64	65.2	57.3	60.6	67.0
Murietta	J. London Stanley	1710	97	1658.7	2	34.2	1	17.1	35	56	35	56	35	56	66.5	59.4	63.1	68.7
Vasco	East Ave. Telsa Rd.	1762	97	1709.1	2	35.24	1	17.6	45	72	45	72	45	72	69.8	61.2	64.2	71.3

Assumptions: PM peak hour traffic data from ARUP

Existing Conditions AM Peak Hour

ROAD SEGMENT	TOTAL # VEHICLES	VEHICLE TYPE %						VEHICLE SPEED				NOISE LEVEL (dBA)			CALCULATED NOISE LEVEL 15 meters from roadway center)		
		Auto	MT	HT	Auto k/h	MT k/h	HT k/h	Auto	MT	HT							
Calveno Peak																	
		%	Auto	%	MT	%	HT										
Owens	904	95	858.8	3	27.12	2	18.1	40	64	40	64	40	64	65.3	59.3	63.8	68.2
Martinelli	440	95	418	3	13.2	2	8.8	40	64	40	64	40	64	62.2	56.1	60.7	65.1
Dublin	1441	95	1369	3	43.23	2	28.8	45	72	45	72	45	72	68.8	62.1	66.3	71.3
Campus Hill	580	97	562.6	2	11.6	1	5.8	40	64	40	64	40	64	63.5	55.6	58.9	65.3
Murietta	1328	97	1288.2	2	26.56	1	13.3	35	56	35	56	35	56	65.4	58.3	62.0	67.6
Vasco	1261	97	1223.2	2	25.22	1	12.6	45	72	45	72	45	72	68.3	59.8	62.8	69.8

Assumptions: AM peak hour traffic data from ARUP

2040 Baseline Condition AM Peak Hour

ROAD SEGMENT	TOTAL # VEHICLES	VEHICLE TYPE %						VEHICLE SPEED				NOISE LEVEL (dBA)			CALCULATED NOISE LEVEL 15 meters from roadway center)		
		Auto	MT	HT	Auto k/h	MT k/h	HT k/h	Auto	MT	HT							
Calveno Peak																	
		%	Auto	%	MT	%	HT										
Owens	1166	95	1107.7	3	34.98	2	23.3	40	64	40	64	40	64	66.4	60.4	65.0	69.3
Martinelli	577	95	548.15	3	17.31	2	11.5	40	64	40	64	40	64	63.4	57.3	61.9	66.3
Dublin	1722	95	1635.9	3	51.66	2	34.4	45	72	45	72	45	72	69.6	62.9	67.1	72.1
Campus Hill	718	97	696.46	2	14.36	1	7.18	40	64	40	64	40	64	64.4	56.5	59.8	66.2
Murietta	1628	97	1579.2	2	32.56	1	16.3	35	56	35	56	35	56	66.3	59.2	62.9	68.5
Vasco	1431	97	1388.1	2	28.62	1	14.3	45	72	45	72	45	72	68.9	60.3	63.3	70.4
Airway	415	97	402.55	2	8.3	1	4.15	35	56	35	56	35	56	60.4	53.2	56.9	62.5

Assumptions: AM peak hour traffic data from ARUP

2040 Baseline +Project AM Peak Hour

ROAD SEGMENT	TOTAL # VEHICLES	VEHICLE TYPE %						VEHICLE SPEED				NOISE LEVEL (dBA)			CALCULATED NOISE LEVEL 15 meters from roadway center)		
		Auto	MT	HT	Auto k/h	MT k/h	HT k/h	Auto	MT	HT							
Calveno Peak																	
		%	Auto	%	MT	%	HT										
Owens	1093	95	1038.4	3	32.79	2	21.9	40	64	40	64	40	64	66.1	60.1	64.7	69.1
Martinelli	572	95	543.4	3	17.16	2	11.4	40	64	40	64	40	64	63.3	57.3	61.9	66.3
Dublin	1683	95	1598.9	3	50.49	2	33.7	45	72	45	72	45	72	69.5	62.8	67.0	72.0
Campus Hill	727	97	705.19	2	14.54	1	7.27	40	64	40	64	40	64	64.5	56.6	59.9	66.3
Murietta	1873	97	1816.8	2	37.46	1	18.7	35	56	35	56	35	56	66.9	59.8	63.5	69.1
Vasco	1414	97	1371.6	2	28.28	1	14.1	45	72	45	72	45	72	68.8	60.3	63.3	70.3
Airway	1111	97	1077.7	2	22.22	1	11.1	35	56	35	56	35	56	64.6	57.5	61.2	66.8

Assumptions: AM peak hour traffic data from ARUP

2040 Baseline + DMU Alternative AM Peak Hour

ROAD SEGMENT	TOTAL # VEHICLES	VEHICLE TYPE %						VEHICLE SPEED				NOISE LEVEL (dBA)			CALCULATED NOISE LEVEL 15 meters from roadway center)		
		Auto	MT	HT	Auto k/h	MT k/h	HT k/h	Auto	MT	HT							
Calveno Peak																	
		%	Auto	%	MT	%	HT										
Owens	1102	95	1046.9	3	33.06	2	22	40	64	40	64	40	64	66.2	60.1	64.7	69.1
Martinelli	575	95	546.25	3	17.25	2	11.5	40	64	40	64	40	64	63.4	57.3	61.9	66.3
Dublin	1676	95	1592.2	3	50.28	2	33.5	45	72	45	72	45	72	69.5	62.7	67.0	72.0
Campus Hill	722	97	700.34	2	14.44	1	7.22	40	64	40	64	40	64	64.4	56.5	59.9	66.2
Murietta	1820	97	1765.4	2	36.4	1	18.2	35	56	35	56	35	56	66.8	59.6	63.3	68.9
Vasco	1433	97	1390	2	28.66	1	14.3	45	72	45	72	45	72	68.9	60.3	63.3	70.4
Airway	737	97	714.89	2	14.74	1	7.37	35	56	35	56	35	56	62.9	55.7	59.4	65.0

Assumptions: AM peak hour traffic data from ARUP

2040 Baseline + BRT Alternative AM Peak Hour

ROAD SEGMENT	TOTAL # VEHICLES	VEHICLE TYPE %						VEHICLE SPEED				NOISE LEVEL (dBA)			CALCULATED NOISE LEVEL 15 meters from roadway center)		
		Auto	MT	HT	Auto k/h	MT k/h	HT k/h	Auto	MT	HT							
Calveno Peak																	
		%	Auto	%	MT	%	HT										
Owens	1155	95	1097.3	3	34.65	2	23.1	40	64	40	64	40	64	66.4	60.3	64.9	69.3
Martinelli	576	95	547.2	3	17.28	2	11.5	40	64	40	64	40	64	63.4	57.3	61.9	66.3
Dublin	1683	95	1598.9	3	50.49	2	33.7	45	72	45	72	45	72	69.5	62.8	67.0	72.0
Campus Hill	709	97	687.73	2	14.18	1	7.09	40	64	40	64	40	64	64.4	56.5	59.8	66.1
Murietta	1622	97	1573.3	2	32.44	1	16.2	35	56	35	56	35	56	66.3	59.1	62.8	68.4
Vasco	1417	97	1374.5	2	28.34	1	14.2	45	72	45	72	45	72	68.8	60.3	63.3	70.3
Airway	418	97	405.46	2	8.36	1	4.18	35	56	35	56	35	56	60.4	53.3	57.0	62.6

Assumptions: AM peak hour traffic data from ARUP

2040 Baseline + Enhanced Bus Alternative AM Peak Hour

ROAD SEGMENT	TOTAL # VEHICLES	VEHICLE TYPE %						VEHICLE SPEED				NOISE LEVEL (dBA)			CALCULATED NOISE LEVEL 15 meters from roadway center)		
		Auto	MT	HT	Auto k/h	MT k/h	HT k/h	Auto	MT	HT							
Calveno Peak																	
		%	Auto	%	MT	%	HT										
Owens	1158	95	1100.1	3	34.74	2	23.2	40	64	40	64	40	64	66.4	60.3	64.9	69.3
Martinelli	577	95	548.15	3	17.31	2	11.5	40	64	40	64	40	64	63.4	57.3	61.9	66.3
Dublin	1699	95	1614.1	3	50.97	2	34	45	72	45	72	45	72	69.5	62.8	67.1	72.0
Campus Hill	709	97	687.73	2	14.18	1	7.09	40	64	40	64	40	64	64.4	56.5	59.8	66.1
Murietta	1621	97	1572.4	2	32.42	1	16.2	35	56	35	56	35	56	66.3	59.1	62.8	68.4
Vasco	1425	97	1382.3	2	28.5	1	14.3	45	72	45	72	45	72	68.9	60.3	63.3	70.4

Assumptions: AM peak hour traffic data from ARUP

Existing Conditions PM Peak Hour

ROAD SEGMENT	TOTAL # VEHICLES	VEHICLE TYPE %						VEHICLE SPEED						NOISE LEVEL (dBA)			CALCULATED NOISE LEVEL 15 meters from roadway center)	
		Auto	MT	HT	Auto k/h	MT k/h	HT k/h	Auto	MT	HT								
Calveno Peak																		
Owens	from: Willow to: Hacienda	904	95	858.8	3	27.12	2	18.1	40	64	40	64	40	64	65.3	59.3	63.8	68.2
Martinelli	Hacienda BART	440	95	418	3	13.2	2	8.8	40	64	40	64	40	64	62.2	56.1	60.7	65.1
Dublin	Hacienda Iron Horse	1441	95	1369	3	43.23	2	28.8	45	72	45	72	45	72	68.8	62.1	66.3	71.3
Campus Hill	Portola Campus Loop	580	97	562.6	2	11.6	1	5.8	40	64	40	64	40	64	63.5	55.6	58.9	65.3
Murietta	J. London Stanley	1328	97	1288.2	2	26.56	1	13.3	35	56	35	56	35	56	65.4	58.3	62.0	67.6
Vasco	East Ave. Telsa Rd.	1261	97	1223.2	2	25.22	1	12.6	45	72	45	72	45	72	68.3	59.8	62.8	69.8

Assumptions: PM peak hour traffic data from ARUP

2040 Baseline Condition PM Peak Hour

ROAD SEGMENT	TOTAL # VEHICLES	VEHICLE TYPE %						VEHICLE SPEED						NOISE LEVEL (dBA)			CALCULATED NOISE LEVEL 15 meters from roadway center)	
		Auto	MT	HT	Auto k/h	MT k/h	HT k/h	Auto	MT	HT								
Calveno Peak																		
Owens	from: Willow to: Hacienda	1908	95	1812.6	3	57.24	2	38.2	40	64	40	64	40	64	68.6	62.5	67.1	71.5
Martinelli	Hacienda BART	1240	95	1178	3	37.2	2	24.8	40	64	40	64	40	64	66.7	60.6	65.2	69.6
Dublin	Hacienda Iron Horse	2509	95	2383.6	3	75.27	2	50.2	45	72	45	72	45	72	71.2	64.5	68.8	73.7
Campus Hill	Portola Campus Loop	889	97	862.33	2	17.78	1	8.89	40	64	40	64	40	64	65.3	57.4	60.8	67.1
Murietta	J. London Stanley	2319	97	2249.4	2	46.38	1	23.2	35	56	35	56	35	56	67.8	60.7	64.4	70.0
Vasco	East Ave. Telsa Rd.	2297	97	2228.1	2	45.94	1	23	45	72	45	72	45	72	70.9	62.4	65.4	72.4
Airway	Portola Sutter	986	97	956.42	2	19.72	1	9.86	35	56	35	56	35	56	64.1	57.0	60.7	66.3

Assumptions: PM peak hour traffic data from ARUP

2040 Baseline +Project PM Peak Hour

ROAD SEGMENT	TOTAL # VEHICLES	VEHICLE TYPE %						VEHICLE SPEED				NOISE LEVEL (dBA)			CALCULATED NOISE LEVEL 15 meters from roadway center)		
		Auto	MT	HT	Auto k/h	MT k/h	HT k/h	Auto	MT	HT							
Calveno Peak																	
		%	Auto	%	MT	%	HT										
Owens	2011	95	1910.5	3	60.33	2	40.2	40	64	40	64	40	64	68.8	62.7	67.3	71.7
Martinelli	936	95	889.2	3	28.08	2	18.7	40	64	40	64	40	64	65.5	59.4	64.0	68.4
Dublin	2506	95	2380.7	3	75.18	2	50.1	45	72	45	72	45	72	71.2	64.5	68.7	73.7
Campus Hill	893	97	866.21	2	17.86	1	8.93	40	64	40	64	40	64	65.4	57.5	60.8	67.1
Murietta	2507	97	2431.8	2	50.14	1	25.1	35	56	35	56	35	56	68.2	61.0	64.7	70.3
Vasco	2338	97	2267.9	2	46.76	1	23.4	45	72	45	72	45	72	71.0	62.4	65.4	72.5
Airway	1525	97	1479.3	2	30.5	1	15.3	35	56	35	56	35	56	66.0	58.9	62.6	68.2

Assumptions: PM peak hour traffic data from ARUP

2040 Baseline + DMU Alternative PM Peak Hour

ROAD SEGMENT	TOTAL # VEHICLES	VEHICLE TYPE %						VEHICLE SPEED				NOISE LEVEL (dBA)			CALCULATED NOISE LEVEL 15 meters from roadway center)		
		Auto	MT	HT	Auto k/h	MT k/h	HT k/h	Auto	MT	HT							
Calveno Peak																	
		%	Auto	%	MT	%	HT										
Owens	1974	95	1875.3	3	59.22	2	39.5	40	64	40	64	40	64	68.7	62.7	67.2	71.6
Martinelli	1069	95	1015.6	3	32.07	2	21.4	40	64	40	64	40	64	66.0	60.0	64.6	69.0
Dublin	2470	95	2346.5	3	74.1	2	49.4	45	72	45	72	45	72	71.2	64.4	68.7	73.7
Campus Hill	895	97	868.15	2	17.9	1	8.95	40	64	40	64	40	64	65.4	57.5	60.8	67.2
Murietta	2443	97	2369.7	2	48.86	1	24.4	35	56	35	56	35	56	68.1	60.9	64.6	70.2
Vasco	2269	97	2200.9	2	45.38	1	22.7	45	72	45	72	45	72	70.9	62.3	65.3	72.4
Airway	1270	97	1231.9	2	25.4	1	12.7	35	56	35	56	35	56	65.2	58.1	61.8	67.4

Assumptions: PM peak hour traffic data from ARUP

2040 Baseline + BRT Alternative PM Peak Hour

ROAD SEGMENT	TOTAL # VEHICLES	VEHICLE TYPE %						VEHICLE SPEED				NOISE LEVEL (dBA)			CALCULATED NOISE LEVEL 15 meters from roadway center)		
		Auto	MT	HT	Auto k/h	MT k/h	HT k/h	Auto	MT	HT							
Calveno Peak																	
		%	Auto	%	MT	%	HT										
Owens	1914	95	1818.3	3	57.42	2	38.3	40	64	40	64	40	64	68.6	62.5	67.1	71.5
Martinelli	1238	95	1176.1	3	37.14	2	24.8	40	64	40	64	40	64	66.7	60.6	65.2	69.6
Dublin	2468	95	2344.6	3	74.04	2	49.4	45	72	45	72	45	72	71.2	64.4	68.7	73.7
Campus Hill	885	97	858.45	2	17.7	1	8.85	40	64	40	64	40	64	65.3	57.4	60.7	67.1
Murietta	2234	97	2167	2	44.68	1	22.3	35	56	35	56	35	56	67.7	60.5	64.2	69.8
Vasco	2281	97	2212.6	2	45.62	1	22.8	45	72	45	72	45	72	70.9	62.3	65.3	72.4
Airway	975	97	945.75	2	19.5	1	9.75	35	56	35	56	35	56	64.1	56.9	60.6	66.2

Assumptions: PM peak hour traffic data from ARUP

2040 Baseline + Enhanced Bus Alternative PM Peak Hour

ROAD SEGMENT	TOTAL # VEHICLES	VEHICLE TYPE %						VEHICLE SPEED				NOISE LEVEL (dBA)			CALCULATED NOISE LEVEL 15 meters from roadway center)		
		Auto	MT	HT	Auto k/h	MT k/h	HT k/h	Auto	MT	HT							
Calveno Peak																	
		%	Auto	%	MT	%	HT										
Owens	1902	95	1806.9	3	57.06	2	38	40	64	40	64	40	64	68.5	62.5	67.1	71.5
Martinelli	1221	95	1160	3	36.63	2	24.4	40	64	40	64	40	64	66.6	60.6	65.2	69.5
Dublin	2534	95	2407.3	3	76.02	2	50.7	45	72	45	72	45	72	71.3	64.5	68.8	73.8
Campus Hill	879	97	852.63	2	17.58	1	8.79	40	64	40	64	40	64	65.3	57.4	60.7	67.1
Murietta	2288	97	2219.4	2	45.76	1	22.9	35	56	35	56	35	56	67.8	60.6	64.3	69.9
Vasco	2280	97	2211.6	2	45.6	1	22.8	45	72	45	72	45	72	70.9	62.3	65.3	72.4

Assumptions: PM peak hour traffic data from ARUP

Existing Conditions AM Peak Hour

ROAD SEGMENT	TOTAL # VEHICLES	VEHICLE TYPE %						VEHICLE SPEED				NOISE LEVEL (dBA)			CALCULATED NOISE LEVEL 15 meters from roadway center)			
		Auto	MT	HT	Auto k/h	MT k/h	HT k/h	Auto	MT	HT								
Calveno Peak																		
Owens	from: Willow to: Hacienda	904	95	858.8	3	27.12	2	18.1	40	64	40	64	40	64	65.3	59.3	63.8	68.2
Martinelli	Hacienda BART	440	95	418	3	13.2	2	8.8	40	64	40	64	40	64	62.2	56.1	60.7	65.1
Dublin	Hacienda Iron Horse	1441	95	1369	3	43.23	2	28.8	45	72	45	72	45	72	68.8	62.1	66.3	71.3
Campus Hill	Portola Campus Loop	580	97	562.6	2	11.6	1	5.8	40	64	40	64	40	64	63.5	55.6	58.9	65.3
Murietta	J. London Stanley	1328	97	1288.2	2	26.56	1	13.3	35	56	35	56	35	56	65.4	58.3	62.0	67.6
Vasco	East Ave. Telsa Rd.	1261	97	1223.2	2	25.22	1	12.6	45	72	45	72	45	72	68.3	59.8	62.8	69.8

Assumptions: AM peak hour traffic data from ARUP

2025 Baseline AM Peak Hour

ROAD SEGMENT	TOTAL # VEHICLES	VEHICLE TYPE %						VEHICLE SPEED				NOISE LEVEL (dBA)			CALCULATED NOISE LEVEL 15 meters from roadway center)			
		Auto	MT	HT	Auto k/h	MT k/h	HT k/h	Auto	MT	HT								
Calveno Peak																		
Owens	from: Willow to: Hacienda	1041	95	988.95	3	31.23	2	20.8	40	64	40	64	40	64	65.9	59.9	64.5	68.9
Martinelli	Hacienda BART	498	95	473.1	3	14.94	2	9.96	40	64	40	64	40	64	62.7	56.7	61.3	65.7
Dublin	Hacienda Iron Horse	1534	95	1457.3	3	46.02	2	30.7	45	72	45	72	45	72	69.1	62.4	66.6	71.6
Campus Hill	Portola Campus Loop	639	97	619.83	2	12.78	1	6.39	40	64	40	64	40	64	63.9	56.0	59.3	65.7
Murietta	J. London Stanley	1332	97	1292	2	26.64	1	13.3	35	56	35	56	35	56	65.4	58.3	62.0	67.6
Vasco	East Ave. Telsa Rd.	1341	97	1300.8	2	26.82	1	13.4	45	72	45	72	45	72	68.6	60.0	63.0	70.1
Airway	Portola Sutter	423	97	410.31	2	8.46	1	4.23	35	56	35	56	35	56	60.4	53.3	57.0	62.6

Assumptions: AM peak hour traffic data from ARUP

2025 Baseline + Proposed Project + Cumulative AM Peak Hour

ROAD SEGMENT	TOTAL # VEHICLES	VEHICLE TYPE %						VEHICLE SPEED				NOISE LEVEL (dBA)			CALCULATED NOISE LEVEL 15 meters from roadway center)		
		Auto	MT	HT	Auto k/h	MT k/h	HT k/h	Auto	MT	HT							
Calveno Peak																	
		%	Auto	%	MT	%	HT										
Owens	978	95	929.1	3	29.34	2	19.6	40	64	40	64	40	64	65.7	59.6	64.2	68.6
Martinelli	495	95	470.25	3	14.85	2	9.9	40	64	40	64	40	64	62.7	56.7	61.2	65.6
Dublin	1536	95	1459.2	3	46.08	2	30.7	45	72	45	72	45	72	69.1	62.4	66.6	71.6
Campus Hill	727	97	705.19	2	14.54	1	7.27	40	64	40	64	40	64	64.5	56.6	59.9	66.3
Murietta	1339	97	1298.8	2	26.78	1	13.4	35	56	35	56	35	56	65.4	58.3	62.0	67.6
Vasco	1339	97	1298.8	2	26.78	1	13.4	45	72	45	72	45	72	68.6	60.0	63.0	70.1
Airway	932	97	904.04	2	18.64	1	9.32	35	56	35	56	35	56	63.9	56.7	60.4	66.0

Assumptions: AM peak hour traffic data from ARUP

2025 Baseline + DMU Alternative + Cumulative AM Peak Hour

ROAD SEGMENT	TOTAL # VEHICLES	VEHICLE TYPE %						VEHICLE SPEED				NOISE LEVEL (dBA)			CALCULATED NOISE LEVEL 15 meters from roadway center)		
		Auto	MT	HT	Auto k/h	MT k/h	HT k/h	Auto	MT	HT							
Calveno Peak																	
		%	Auto	%	MT	%	HT										
Owens	980	95	931	3	29.4	2	19.6	40	64	40	64	40	64	65.7	59.6	64.2	68.6
Martinelli	499	95	474.05	3	14.97	2	9.98	40	64	40	64	40	64	62.7	56.7	61.3	65.7
Dublin	1538	95	1461.1	3	46.14	2	30.8	45	72	45	72	45	72	69.1	62.4	66.6	71.6
Campus Hill	721	97	699.37	2	14.42	1	7.21	40	64	40	64	40	64	64.4	56.5	59.9	66.2
Murietta	1332	97	1292	2	26.64	1	13.3	35	56	35	56	35	56	65.4	58.3	62.0	67.6
Vasco	1297	97	1258.1	2	25.94	1	13	45	72	45	72	45	72	68.4	59.9	62.9	70.0
Airway	519	97	503.43	2	10.38	1	5.19	35	56	35	56	35	56	61.3	54.2	57.9	63.5

Assumptions: AM peak hour traffic data from ARUP

2025 Baseline + BRT Alternative + Cumulative Plan AM Peak Hour

ROAD SEGMENT	TOTAL # VEHICLES	VEHICLE TYPE %			VEHICLE SPEED				NOISE LEVEL (dBA)			CALCULATED						
		Auto	MT	HT	Auto k/h	MT k/h	HT k/h	Auto	MT	HT	NOISE LEVEL 15 meters from roadway center)							
Calveno Peak																		
Owens	from: Willow to: Hacienda	1066	95	1012.7	3	31.98	2	21.3	40	64	40	64	40	64	66.0	60.0	64.6	69.0
Martinelli	Hacienda BART	496	95	471.2	3	14.88	2	9.92	40	64	40	64	40	64	62.7	56.7	61.2	65.6
Dublin	Hacienda Iron Horse	1536	95	1459.2	3	46.08	2	30.7	45	72	45	72	45	72	69.1	62.4	66.6	71.6
Campus Hill	Portola Campus Loop	637	97	617.89	2	12.74	1	6.37	40	64	40	64	40	64	63.9	56.0	59.3	65.7
Murietta	J. London Stanley	1332	97	1292	2	26.64	1	13.3	35	56	35	56	35	56	65.4	58.3	62.0	67.6
Vasco	East Ave. Telsa Rd.	1339	97	1298.8	2	26.78	1	13.4	45	72	45	72	45	72	68.6	60.0	63.0	70.1
Airway	Portola Sutter	422	97	409.34	2	8.44	1	4.22	35	56	35	56	35	56	60.4	53.3	57.0	62.6

Assumptions: AM peak hour traffic data from ARUP

2025 Baseline + Enhanced Bus Alternative + Cumulative AM Peak Hour

ROAD SEGMENT	TOTAL # VEHICLES	VEHICLE TYPE %			VEHICLE SPEED				NOISE LEVEL (dBA)			CALCULATED						
		Auto	MT	HT	Auto k/h	MT k/h	HT k/h	Auto	MT	HT	NOISE LEVEL 15 meters from roadway center)							
Calveno Peak																		
Owens	from: Willow to: Hacienda	1068	95	1014.6	3	32.04	2	21.4	40	64	40	64	40	64	66.0	60.0	64.6	69.0
Martinelli	Hacienda BART	499	95	474.05	3	14.97	2	9.98	40	64	40	64	40	64	62.7	56.7	61.3	65.7
Dublin	Hacienda Iron Horse	1536	95	1459.2	3	46.08	2	30.7	45	72	45	72	45	72	69.1	62.4	66.6	71.6
Campus Hill	Portola Campus Loop	637	97	617.89	2	12.74	1	6.37	40	64	40	64	40	64	63.9	56.0	59.3	65.7
Murietta	J. London Stanley	1331	97	1291.1	2	26.62	1	13.3	35	56	35	56	35	56	65.4	58.3	62.0	67.6
Vasco	East Ave. Telsa Rd.	1347	97	1306.6	2	26.94	1	13.5	45	72	45	72	45	72	68.6	60.0	63.0	70.1
Airway	Portola Sutter	422	97	409.34	2	8.44	1	4.22	35	56	35	56	35	56	60.4	53.3	57.0	62.6

Assumptions: AM peak hour traffic data from ARUP

Existing Conditions PM Peak Hour

ROAD SEGMENT	TOTAL # VEHICLES	VEHICLE TYPE %						VEHICLE SPEED				NOISE LEVEL (dBA)			CALCULATED NOISE LEVEL 15 meters from roadway center)		
		Auto	MT	HT	Auto k/h	MT k/h	HT k/h	Auto	MT	HT							
Calveno Peak																	
			%	Auto	%	MT	%	HT									
Owens	1344	95	1276.8	3	40.32	2	26.9	40	64	40	64	40	64	67.0	61.0	65.6	70.0
Martinelli	828	95	786.6	3	24.84	2	16.6	40	64	40	64	40	64	64.9	58.9	63.5	67.9
Dublin	1962	95	1863.9	3	58.86	2	39.2	45	72	45	72	45	72	70.2	63.4	67.7	72.7
Campus Hill	658	97	638.26	2	13.16	1	6.58	40	64	40	64	40	64	64.0	56.1	59.5	65.8
Murietta	1491	97	1446.3	2	29.82	1	14.9	35	56	35	56	35	56	65.9	58.8	62.5	68.1
Vasco	1552	97	1505.4	2	31.04	1	15.5	45	72	45	72	45	72	69.2	60.7	63.7	70.7

Assumptions: PM peak hour traffic data from ARUP

2025 Baseline PM Peak Hour

ROAD SEGMENT	TOTAL # VEHICLES	VEHICLE TYPE %						VEHICLE SPEED				NOISE LEVEL (dBA)			CALCULATED NOISE LEVEL 15 meters from roadway center)		
		Auto	MT	HT	Auto k/h	MT k/h	HT k/h	Auto	MT	HT							
Calveno Peak																	
			%	Auto	%	MT	%	HT									
Owens	1630	95	1548.5	3	48.9	2	32.6	40	64	40	64	40	64	67.9	61.8	66.4	70.8
Martinelli	1001	95	950.95	3	30.03	2	20	40	64	40	64	40	64	65.8	59.7	64.3	68.7
Dublin	2070	95	1966.5	3	62.1	2	41.4	45	72	45	72	45	72	70.4	63.7	67.9	72.9
Campus Hill	854	97	828.38	2	17.08	1	8.54	40	64	40	64	40	64	65.2	57.3	60.6	67.0
Murietta	1710	97	1658.7	2	34.2	1	17.1	35	56	35	56	35	56	66.5	59.4	63.1	68.7
Vasco	1772	97	1718.8	2	35.44	1	17.7	45	72	45	72	45	72	69.8	61.2	64.2	71.3
Airway	924	97	896.28	2	18.48	1	9.24	35	56	35	56	35	56	63.8	56.7	60.4	66.0

Assumptions: PM peak hour traffic data from ARUP

2025 Baseline + Project + Cumulative Plan PM Peak Hour

ROAD SEGMENT	TOTAL # VEHICLES	VEHICLE TYPE %						VEHICLE SPEED						NOISE LEVEL (dBA)			CALCULATED NOISE LEVEL 15 meters from roadway center)
		Auto	MT	HT	Auto k/h	MT k/h	HT k/h	Auto	MT	HT							
Calveno Peak																	
		%	Auto	%	MT	%	HT										
Owens	1609	95	1528.6	3	48.27	2	32.2	40	64	40	64	40	64	67.8	61.8	66.4	70.7
Martinelli	893	95	848.35	3	26.79	2	17.9	40	64	40	64	40	64	65.3	59.2	63.8	68.2
Dublin	2067	95	1963.7	3	62.01	2	41.3	45	72	45	72	45	72	70.4	63.7	67.9	72.9
Campus Hill	1079	97	1046.6	2	21.58	1	10.8	40	64	40	64	40	64	66.2	58.3	61.6	68.0
Murietta	1830	97	1775.1	2	36.6	1	18.3	35	56	35	56	35	56	66.8	59.7	63.4	69.0
Vasco	1779	97	1725.6	2	35.58	1	17.8	45	72	45	72	45	72	69.8	61.2	64.3	71.3
Airway	1424	97	1381.3	2	28.48	1	14.2	35	56	35	56	35	56	65.7	58.6	62.3	67.9

Assumptions: PM peak hour traffic data from ARUP

2025 Baseline + DMU Alternative + Cumulative PM Peak Hour

ROAD SEGMENT	TOTAL # VEHICLES	VEHICLE TYPE %						VEHICLE SPEED						NOISE LEVEL (dBA)			CALCULATED NOISE LEVEL 15 meters from roadway center)
		Auto	MT	HT	Auto k/h	MT k/h	HT k/h	Auto	MT	HT							
Calveno Peak																	
		%	Auto	%	MT	%	HT										
Owens	1589	95	1509.6	3	47.67	2	31.8	40	64	40	64	40	64	67.8	61.7	66.3	70.7
Martinelli	969	95	920.55	3	29.07	2	19.4	40	64	40	64	40	64	65.6	59.6	64.2	68.5
Dublin	2070	95	1966.5	3	62.1	2	41.4	45	72	45	72	45	72	70.4	63.7	67.9	72.9
Campus Hill	1066	97	1034	2	21.32	1	10.7	40	64	40	64	40	64	66.1	58.2	61.6	67.9
Murietta	1810	97	1755.7	2	36.2	1	18.1	35	56	35	56	35	56	66.8	59.6	63.3	68.9
Vasco	1780	97	1726.6	2	35.6	1	17.8	45	72	45	72	45	72	69.8	61.2	64.3	71.3
Airway	1012	97	981.64	2	20.24	1	10.1	35	56	35	56	35	56	64.2	57.1	60.8	66.4

Assumptions: PM peak hour traffic data from ARUP

2025 Baseline + BRT Alternative + Cumulative PM Peak Hour

ROAD SEGMENT	TOTAL # VEHICLES	VEHICLE TYPE %			VEHICLE SPEED				NOISE LEVEL (dBA)			CALCULATED NOISE LEVEL 15 meters from roadway center)					
		Auto	MT	HT	Auto k/h	MT k/h	HT k/h	Auto	MT	HT							
Calveno Peak																	
		%	Auto	%	MT	%	HT										
Owens	1583	95	1503.9	3	47.49	2	31.7	40	64	40	64	40	64	67.8	61.7	66.3	70.7
Martinelli	1012	95	961.4	3	30.36	2	20.2	40	64	40	64	40	64	65.8	59.8	64.3	68.7
Dublin	2076	95	1972.2	3	62.28	2	41.5	45	72	45	72	45	72	70.4	63.7	67.9	72.9
Campus Hill	849	97	823.53	2	16.98	1	8.49	40	64	40	64	40	64	65.1	57.2	60.6	66.9
Murietta	1699	97	1648	2	33.98	1	17	35	56	35	56	35	56	66.5	59.3	63.0	68.6
Vasco	1756	97	1703.3	2	35.12	1	17.6	45	72	45	72	45	72	69.8	61.2	64.2	71.3
Airway	925	97	897.25	2	18.5	1	9.25	35	56	35	56	35	56	63.8	56.7	60.4	66.0

Assumptions: PM peak hour traffic data from ARUP

2025 Baseline + Enhanced Bus Alternative + Cumulative PM Peak Hour

ROAD SEGMENT	TOTAL # VEHICLES	VEHICLE TYPE %			VEHICLE SPEED				NOISE LEVEL (dBA)			CALCULATED NOISE LEVEL 15 meters from roadway center)					
		Auto	MT	HT	Auto k/h	MT k/h	HT k/h	Auto	MT	HT							
Calveno Peak																	
		%	Auto	%	MT	%	HT										
Owens	1584	95	1504.8	3	47.52	2	31.7	40	64	40	64	40	64	67.8	61.7	66.3	70.7
Martinelli	1036	95	984.2	3	31.08	2	20.7	40	64	40	64	40	64	65.9	59.9	64.4	68.8
Dublin	2071	95	1967.5	3	62.13	2	41.4	45	72	45	72	45	72	70.4	63.7	67.9	72.9
Campus Hill	842	97	816.74	2	16.84	1	8.42	40	64	40	64	40	64	65.1	57.2	60.5	66.9
Murietta	1770	97	1716.9	2	35.4	1	17.7	35	56	35	56	35	56	66.7	59.5	63.2	68.8
Vasco	1767	97	1714	2	35.34	1	17.7	45	72	45	72	45	72	69.8	61.2	64.2	71.3
Altamont Pass	0	97	0	2	0	1	0	45	72	45	72	45	72	#####	#NUM!	#####	####
Airway	925	97	897.25	2	18.5	1	9.25	35	56	35	56	35	56	63.8	56.7	60.4	66.0

Assumptions: PM peak hour traffic data from ARUP

Existing Conditions AM Peak Hour

ROAD SEGMENT	TOTAL # VEHICLES	VEHICLE TYPE %						VEHICLE SPEED				NOISE LEVEL (dBA)			CALCULATED NOISE LEVEL 15 meters from roadway center)		
		Auto	MT	HT	Auto k/h	MT k/h	HT k/h	Auto	MT	HT							
Calveno Peak																	
		%	Auto	%	MT	%	HT										
Owens	904	95	858.8	3	27.12	2	18.1	40	64	40	64	40	64	65.3	59.3	63.8	68.2
Martinelli	440	95	418	3	13.2	2	8.8	40	64	40	64	40	64	62.2	56.1	60.7	65.1
Dublin	1441	95	1369	3	43.23	2	28.8	45	72	45	72	45	72	68.8	62.1	66.3	71.3
Campus Hill	580	97	562.6	2	11.6	1	5.8	40	64	40	64	40	64	63.5	55.6	58.9	65.3
Murietta	1328	97	1288.2	2	26.56	1	13.3	35	56	35	56	35	56	65.4	58.3	62.0	67.6
Vasco	1261	97	1223.2	2	25.22	1	12.6	45	72	45	72	45	72	68.3	59.8	62.8	69.8

Assumptions: AM peak hour traffic data from ARUP

2040 Baseline AM Peak Hour

ROAD SEGMENT	TOTAL # VEHICLES	VEHICLE TYPE %						VEHICLE SPEED				NOISE LEVEL (dBA)			CALCULATED NOISE LEVEL 15 meters from roadway center)		
		Auto	MT	HT	Auto k/h	MT k/h	HT k/h	Auto	MT	HT							
Calveno Peak																	
		%	Auto	%	MT	%	HT										
Owens	1166	95	1107.7	3	34.98	2	23.3	40	64	40	64	40	64	66.4	60.4	65.0	69.3
Martinelli	577	95	548.15	3	17.31	2	11.5	40	64	40	64	40	64	63.4	57.3	61.9	66.3
Dublin	1722	95	1635.9	3	51.66	2	34.4	45	72	45	72	45	72	69.6	62.9	67.1	72.1
Campus Hill	718	97	696.46	2	14.36	1	7.18	40	64	40	64	40	64	64.4	56.5	59.8	66.2
Murietta	1628	97	1579.2	2	32.56	1	16.3	35	56	35	56	35	56	66.3	59.2	62.9	68.5
Vasco	1431	97	1388.1	2	28.62	1	14.3	45	72	45	72	45	72	68.9	60.3	63.3	70.4
Airway	415	97	402.55	2	8.3	1	4.15	35	56	35	56	35	56	60.4	53.2	56.9	62.5

Assumptions: AM peak hour traffic data from ARUP

2040 Baseline + Project + Cumulative AM Peak Hour

ROAD SEGMENT	TOTAL # VEHICLES	VEHICLE TYPE %						VEHICLE SPEED				NOISE LEVEL (dBA)			CALCULATED NOISE LEVEL 15 meters from roadway center)				
		Auto	MT	HT	Auto	MT	HT	Auto	MT	HT	Auto	MT	HT						
Calveno Peak																			
	from:	to:	%	Auto	%	MT	%	HT											
Owens	Willow	Hacienda	1167	95	1108.7	3	35.01	2	23.3	40	64	40	64	40	64	66.4	60.4	65.0	69.4
Martinelli	Hacienda	BART	579	95	550.05	3	17.37	2	11.6	40	64	40	64	40	64	63.4	57.3	61.9	66.3
Dublin	Hacienda	Iron Horse	1675	95	1591.3	3	50.25	2	33.5	45	72	45	72	45	72	69.5	62.7	67.0	72.0
Campus Hill	Portola	Campus Loop	737	97	714.89	2	14.74	1	7.37	40	64	40	64	40	64	64.5	56.6	60.0	66.3
Murietta	J. London	Stanley	1960	97	1901.2	2	39.2	1	19.6	35	56	35	56	35	56	67.1	60.0	63.7	69.3
Vasco	East Ave.	Telsa Rd.	1414	97	1371.6	2	28.28	1	14.1	45	72	45	72	45	72	68.8	60.3	63.3	70.3
Airway	Portola	Sutter	1145	97	1110.7	2	22.9	1	11.5	35	56	35	56	35	56	64.8	57.6	61.3	66.9

Assumptions: AM peak hour traffic data from ARUP

2040 Baseline + DMU Alternative+ Cumulative AM Peak Hour

ROAD SEGMENT	TOTAL # VEHICLES	VEHICLE TYPE %						VEHICLE SPEED				NOISE LEVEL (dBA)			CALCULATED NOISE LEVEL 15 meters from roadway center)				
		Auto	MT	HT	Auto	MT	HT	Auto	MT	HT	Auto	MT	HT						
Calveno Peak																			
	from:	to:	%	Auto	%	MT	%	HT											
Owens	Willow	Hacienda	1116	95	1060.2	3	33.48	2	22.3	40	64	40	64	40	64	66.2	60.2	64.8	69.2
Martinelli	Hacienda	BART	584	95	554.8	3	17.52	2	11.7	40	64	40	64	40	64	63.4	57.4	62.0	66.3
Dublin	Hacienda	Iron Horse	1672	95	1588.4	3	50.16	2	33.4	45	72	45	72	45	72	69.5	62.7	67.0	72.0
Campus Hill	Portola	Campus Loop	736	97	713.92	2	14.72	1	7.36	40	64	40	64	40	64	64.5	56.6	59.9	66.3
Murietta	J. London	Stanley	1941	97	1882.8	2	38.82	1	19.4	35	56	35	56	35	56	67.1	59.9	63.6	69.2
Vasco	East Ave.	Telsa Rd.	1460	97	1416.2	2	29.2	1	14.6	45	72	45	72	45	72	69.0	60.4	63.4	70.5
Airway	Portola	Sutter	990	97	960.3	2	19.8	1	9.9	35	56	35	56	35	56	64.1	57.0	60.7	66.3

Assumptions: AM peak hour traffic data from ARUP

2040 Baseline + BRT Alternative + Cumulative AM Peak Hour

ROAD SEGMENT	TOTAL # VEHICLES	VEHICLE TYPE %						VEHICLE SPEED				NOISE LEVEL (dBA)			CALCULATED NOISE LEVEL 15 meters from roadway center)		
		Auto	MT	HT	Auto k/h	MT k/h	HT k/h	Auto	MT	HT							
Calveno Peak																	
Owens	1178	95	1119.1	3	35.34	2	23.6	40	64	40	64	40	64	66.5	60.4	65.0	69.4
Martinelli	576	95	547.2	3	17.28	2	11.5	40	64	40	64	40	64	63.4	57.3	61.9	66.3
Dublin	1737	95	1650.2	3	52.11	2	34.7	45	72	45	72	45	72	69.6	62.9	67.2	72.1
Campus Hill	709	97	687.73	2	14.18	1	7.09	40	64	40	64	40	64	64.4	56.5	59.8	66.1
Murietta	1614	97	1565.6	2	32.28	1	16.1	35	56	35	56	35	56	66.3	59.1	62.8	68.4
Vasco	1431	97	1388.1	2	28.62	1	14.3	45	72	45	72	45	72	68.9	60.3	63.3	70.4
Airway	412	97	399.64	2	8.24	1	4.12	35	56	35	56	35	56	60.3	53.2	56.9	62.5

Assumptions: AM peak hour traffic data from ARUP

2040 Baseline + Enhanced Bus Alternative + Cumulative AM Peak Hour

ROAD SEGMENT	TOTAL # VEHICLES	VEHICLE TYPE %						VEHICLE SPEED				NOISE LEVEL (dBA)			CALCULATED NOISE LEVEL 15 meters from roadway center)		
		Auto	MT	HT	Auto k/h	MT k/h	HT k/h	Auto	MT	HT							
Calveno Peak																	
Owens	1191	95	1131.5	3	35.73	2	23.8	40	64	40	64	40	64	66.5	60.5	65.0	69.4
Martinelli	581	95	551.95	3	17.43	2	11.6	40	64	40	64	40	64	63.4	57.4	61.9	66.3
Dublin	1803	95	1712.9	3	54.09	2	36.1	45	72	45	72	45	72	69.8	63.1	67.3	72.3
Campus Hill	708	97	686.76	2	14.16	1	7.08	40	64	40	64	40	64	64.3	56.4	59.8	66.1
Murietta	1657	97	1607.3	2	33.14	1	16.6	35	56	35	56	35	56	66.4	59.2	62.9	68.5
Vasco	1419	97	1376.4	2	28.38	1	14.2	45	72	45	72	45	72	68.8	60.3	63.3	70.4
Airway	412	97	399.64	2	8.24	1	4.12	35	56	35	56	35	56	60.3	53.2	56.9	62.5

Assumptions: AM peak hour traffic data from ARUP

2040 Cumulative Roadway Noise Analysis PM Peak Hour

Existing Conditions

ROAD SEGMENT	TOTAL # VEHICLES	VEHICLE TYPE %						VEHICLE SPEED						NOISE LEVEL (dBA)			CALCULATED NOISE LEVEL 15 meters from roadway center)	
		Auto	MT	HT	Auto k/h	MT k/h	HT k/h	Auto	MT	HT	Auto	MT	HT					
Calveno Peak																		
Owens	904	95	858.8	3	27.12	2	18.1	40	64	40	64	40	64	65.3	59.3	63.8	68.2	
Martinelli	440	95	418	3	13.2	2	8.8	40	64	40	64	40	64	62.2	56.1	60.7	65.1	
Dublin	1441	95	1369	3	43.23	2	28.8	45	72	45	72	45	72	68.8	62.1	66.3	71.3	
Campus Hill	580	97	562.6	2	11.6	1	5.8	40	64	40	64	40	64	63.5	55.6	58.9	65.3	
Murietta	1328	97	1288.2	2	26.56	1	13.3	35	56	35	56	35	56	65.4	58.3	62.0	67.6	
Vasco	1261	97	1223.2	2	25.22	1	12.6	45	72	45	72	45	72	68.3	59.8	62.8	69.8	

Assumptions: PM peak hour traffic data from ARUP

2040 Baseline PM Peak Hour

ROAD SEGMENT	TOTAL # VEHICLES	VEHICLE TYPE %						VEHICLE SPEED						NOISE LEVEL (dBA)			CALCULATED NOISE LEVEL 15 meters from roadway center)	
		Auto	MT	HT	Auto k/h	MT k/h	HT k/h	Auto	MT	HT	Auto	MT	HT					
Calveno Peak																		
Owens	1908	95	1812.6	3	57.24	2	38.2	40	64	40	64	40	64	68.6	62.5	67.1	71.5	
Martinelli	1240	95	1178	3	37.2	2	24.8	40	64	40	64	40	64	66.7	60.6	65.2	69.6	
Dublin	2509	95	2383.6	3	75.27	2	50.2	45	72	45	72	45	72	71.2	64.5	68.8	73.7	
Campus Hill	889	97	862.33	2	17.78	1	8.89	40	64	40	64	40	64	65.3	57.4	60.8	67.1	
Murietta	2319	97	2249.4	2	46.38	1	23.2	35	56	35	56	35	56	67.8	60.7	64.4	70.0	
Vasco	2297	97	2228.1	2	45.94	1	23	45	72	45	72	45	72	70.9	62.4	65.4	72.4	
Airway	986	97	956.42	2	19.72	1	9.86	35	56	35	56	35	56	64.1	57.0	60.7	66.3	

Assumptions: PM peak hour traffic data from ARUP

2040 Cumulative Roadway Noise Analysis PM Peak Hour

2040 Baseline + Proposed Project + Cumulative PM Peak Hour

ROAD SEGMENT	TOTAL # VEHICLES	VEHICLE TYPE %						VEHICLE SPEED						NOISE LEVEL (dBA)			CALCULATED NOISE LEVEL 15 meters from roadway center)		
		Auto	MT	HT	Auto k/h	MT k/h	HT k/h	Auto	MT	HT									
Calveno Peak																			
	from:	to:	%	Auto	%	MT	%	HT											
Owens	Willow	Hacienda	1955	95	1857.3	3	58.65	2	39.1	40	64	40	64	40	64	68.7	62.6	67.2	71.6
Martinelli	Hacienda	BART	1116	95	1060.2	3	33.48	2	22.3	40	64	40	64	40	64	66.2	60.2	64.8	69.2
Dublin	Hacienda	Iron Horse	2514	95	2388.3	3	75.42	2	50.3	45	72	45	72	45	72	71.2	64.5	68.8	73.7
Campus Hill	Portola	Campus Loop	854	97	828.38	2	17.08	1	8.54	40	64	40	64	40	64	65.2	57.3	60.6	67.0
Murietta	J. London	Stanley	2609	97	2530.7	2	52.18	1	26.1	35	56	35	56	35	56	68.3	61.2	64.9	70.5
Vasco	East Ave.	Telsa Rd.	2413	97	2340.6	2	48.26	1	24.1	45	72	45	72	45	72	71.1	62.6	65.6	72.7
Airway	Portola	Sutter	1818	97	1763.5	2	36.36	1	18.2	35	56	35	56	35	56	66.8	59.6	63.3	68.9

Assumptions: PM peak hour traffic data from ARUP

2040 Baseline + DMU Alternative+ Cumulative PM Peak Hour

ROAD SEGMENT	TOTAL # VEHICLES	VEHICLE TYPE %						VEHICLE SPEED						NOISE LEVEL (dBA)			CALCULATED NOISE LEVEL 15 meters from roadway center)		
		Auto	MT	HT	Auto k/h	MT k/h	HT k/h	Auto	MT	HT									
Calveno Peak																			
	from:	to:	%	Auto	%	MT	%	HT											
Owens	Willow	Hacienda	1970	95	1871.5	3	59.1	2	39.4	40	64	40	64	40	64	68.7	62.7	67.2	71.6
Martinelli	Hacienda	BART	1076	95	1022.2	3	32.28	2	21.5	40	64	40	64	40	64	66.1	60.0	64.6	69.0
Dublin	Hacienda	Iron Horse	2520	95	2394	3	75.6	2	50.4	45	72	45	72	45	72	71.2	64.5	68.8	73.7
Campus Hill	Portola	Campus Loop	863	97	837.11	2	17.26	1	8.63	40	64	40	64	40	64	65.2	57.3	60.6	67.0
Murietta	J. London	Stanley	2605	97	2526.9	2	52.1	1	26.1	35	56	35	56	35	56	68.3	61.2	64.9	70.5
Vasco	East Ave.	Telsa Rd.	2362	97	2291.1	2	47.24	1	23.6	45	72	45	72	45	72	71.1	62.5	65.5	72.6
Airway	Portola	Sutter	1484	97	1439.5	2	29.68	1	14.8	35	56	35	56	35	56	65.9	58.8	62.5	68.1

Assumptions: PM peak hour traffic data from ARUP

2040 Baseline + BRT Alternative + Cumulative PM Peak Hour

ROAD SEGMENT	TOTAL # VEHICLES	VEHICLE TYPE %						VEHICLE SPEED				NOISE LEVEL (dBA)			CALCULATED NOISE LEVEL 15 meters from roadway center)		
		Auto	MT	HT	Auto k/h	MT k/h	HT k/h	Auto	MT	HT							
Calveno Peak																	
		%	Auto	%	MT	%	HT										
Owens	1910	95	1814.5	3	57.3	2	38.2	40	64	40	64	40	64	68.6	62.5	67.1	71.5
Martinelli	1261	95	1198	3	37.83	2	25.2	40	64	40	64	40	64	66.8	60.7	65.3	69.7
Dublin	2553	95	2425.4	3	76.59	2	51.1	45	72	45	72	45	72	71.3	64.6	68.8	73.8
Campus Hill	879	97	852.63	2	17.58	1	8.79	40	64	40	64	40	64	65.3	57.4	60.7	67.1
Murietta	2279	97	2210.6	2	45.58	1	22.8	35	56	35	56	35	56	67.8	60.6	64.3	69.9
Vasco	2322	97	2252.3	2	46.44	1	23.2	45	72	45	72	45	72	71.0	62.4	65.4	72.5
Airway	985	97	955.45	2	19.7	1	9.85	35	56	35	56	35	56	64.1	57.0	60.7	66.3

Assumptions: PM peak hour traffic data from ARUP

2040 Baseline + Enhanced Bus Alternative + Cumulative PM Peak Hour

ROAD SEGMENT	TOTAL # VEHICLES	VEHICLE TYPE %						VEHICLE SPEED				NOISE LEVEL (dBA)			CALCULATED NOISE LEVEL 15 meters from roadway center)		
		Auto	MT	HT	Auto k/h	MT k/h	HT k/h	Auto	MT	HT							
Calveno Peak																	
		%	Auto	%	MT	%	HT										
Owens	1918	95	1822.1	3	57.54	2	38.4	40	64	40	64	40	64	68.6	62.5	67.1	71.5
Martinelli	1279	95	1215.1	3	38.37	2	25.6	40	64	40	64	40	64	66.8	60.8	65.4	69.8
Dublin	2593	95	2463.4	3	77.79	2	51.9	45	72	45	72	45	72	71.4	64.6	68.9	73.9
Campus Hill	881	97	854.57	2	17.62	1	8.81	40	64	40	64	40	64	65.3	57.4	60.7	67.1
Murietta	2320	97	2250.4	2	46.4	1	23.2	35	56	35	56	35	56	67.8	60.7	64.4	70.0
Vasco	2278	97	2209.7	2	45.56	1	22.8	45	72	45	72	45	72	70.9	62.3	65.3	72.4
Airway	985	97	955.45	2	19.7	1	9.85	35	56	35	56	35	56	64.1	57.0	60.7	66.3

Assumptions: PM peak hour traffic data from ARUP

BUS OPERATIONS AT TRANSIT PLAZA

ROAD SEGMENT	TOTAL # VEHICLES	VEHICLE TYPE %				VEHICLE SPEED				NOISE LEVEL (dBA)			CALCULATED NOISE LEVEL 15 meters from roadway center)	Receptor Dist. from Roadway Center (m.)	Adjusted Noise Level (dBA)				
		Auto	MT	HT		Auto k/h	MT k/h	HT k/h		Auto	MT	HT							
Calveno Peak																			
Plaza Crcl		%	Auto	%	MT	%	HT												
from: Turnout																			
to: Access Road	18	0.1	0.018	0	0.018	##	18	20	32	20	32	20	32	9.9	22.8	61.1	61.1	187	50.1

Assumptions: AM peak hour traffic data from ARUP

2040 Baseline

ROAD SEGMENT	TOTAL # VEHICLES	VEHICLE TYPE %						VEHICLE SPEED						NOISE LEVEL (dBA)			CALCULATED NOISE LEVEL 15 meters from roadway center)	
		Auto	MT	HT	Auto k/h	MT k/h	HT k/h	Auto	MT	HT	Auto	MT	HT					
Calveno Peak																		
		%	Auto	%	MT	%	HT											
from: Ramp	to: Laughlin	1256	95	1193.2	3	37.68	2	25.12	35	56	35	56	35	56	65.1	59.8	64.7	68.5
Nortfront	Laughlin	1999	95	1899.1	3	59.97	2	39.98	35	56	35	56	35	56	67.1	61.8	66.8	70.6

Assumptions: AM peak hour traffic for Ramp to Laughlin; PM peak hour traffic from Laughlin to Vasco

2040 + BRT

ROAD SEGMENT	TOTAL # VEHICLES	VEHICLE TYPE %						VEHICLE SPEED						NOISE LEVEL (dBA)			CALCULATED NOISE LEVEL 15 meters from roadway center)	
		Auto	MT	HT	Auto k/h	MT k/h	HT k/h	Auto	MT	HT	Auto	MT	HT					
Calveno Peak																		
		%	Auto	%	MT	%	HT											
from: Ramp	to: Laughlin	1255	95	1192.3	3	37.65	2	25.1	35	56	35	56	35	56	65.1	59.8	64.7	68.5
Nortfront	Laughlin	1999	95	1899.1	3	59.97	2	39.98	35	56	35	56	35	56	67.1	61.8	66.8	70.6

Assumptions: AM peak hour traffic for Ramp to Laughlin; PM peak hour traffic from Laughlin to Vasco

Existing Conditions

ROAD SEGMENT	TOTAL # VEHICLES	VEHICLE TYPE %			VEHICLE SPEED				NOISE LEVEL (dBA)			CALCULATED NOISE LEVEL 15 meters from roadway center	Receptor Dist. from Roadway Center (m.)	Adjusted Noise Level - Distance (dBA)	Adjusted Noise Level - Soundwall (dBA)					
		Auto	MT	HT	Auto k/h	MT k/h	HT k/h	Auto	MT	HT										
Calveno Peak																				
from: to:		%	Auto	%	MT	%	HT						roadway center	Center (m.)	(dBA)	(dBA)				
I-580 Hopyard Hacienda	13287	95	12623	1	132.9	4	531	65	##	65	104	65	##	83.1	69.5	80.5	85.1	113	76.3	60.4
I-580 Sta. Rita El Charro	14093	95	13388	1	140.9	4	564	65	##	65	104	65	##	83.3	69.7	80.7	85.3	62	79.2	60.5
I-580 Isabel N. Livermore	14471	95	13747	1	144.7	4	579	65	##	65	104	65	##	83.4	69.8	80.8	85.5	133	76.0	65.0

Assumptions: AM peak hour traffic data for Hopyard to Hacienda. Other 2 segments PM peak hour from ARUP

2025 Baseline Condition

ROAD SEGMENT	TOTAL # VEHICLES	VEHICLE TYPE %			VEHICLE SPEED				NOISE LEVEL (dBA)			CALCULATED NOISE LEVEL 15 meters from roadway center	Receptor Dist. from Roadway Center (m.)	Adjusted Noise Level	Adjusted Noise Level - Soundwall					
		Auto	MT	HT	Auto k/h	MT k/h	HT k/h	Auto	MT	HT										
Calveno Peak																				
from: to:		%	Auto	%	MT	%	HT							roadway center	Center (m.)	(dBA)				
I-580 Hopyard Hacienda	15190	95	14431	1	151.9	4	608	65	##	65	104	65	##	83.6	70.0	81.1	85.7	113	76.9	61.0
I-580 Sta. Rita El Charro	14514	95	13788	1	145.1	4	581	65	##	65	104	65	##	83.4	69.8	80.9	85.5	62	79.3	60.6
I-580 Isabel N. Livermore	15057	95	14304	1	150.6	4	602	65	##	65	104	65	##	83.6	70.0	81.0	85.6	133	76.2	65.2

Assumptions: AM peak hour traffic data for Hopyard to Hacienda. Other 2 segments PM peak hour from ARUP

2025 Baseline + Project

ROAD SEGMENT	TOTAL # VEHICLES	VEHICLE TYPE %			VEHICLE SPEED				NOISE LEVEL (dBA)			CALCULATED NOISE LEVEL 15 meters from roadway center	Receptor Dist. from Roadway Center (m.)	Adjusted Noise Level	Adjusted Noise Level - Soundwall					
		Auto	MT	HT	Auto k/h	MT k/h	HT k/h	Auto	MT	HT										
Calveno Peak																				
from: to:		%	Auto	%	MT	%	HT							roadway center	Center (m.)	(dBA)				
I-580 Hopyard Hacienda	14401	95	13681	1	144	4	576	65	##	65	104	65	##	83.4	69.8	80.8	85.4	106	76.9	61.0
I-580 Sta. Rita El Charro	14193	95	13483	1	141.9	4	568	65	##	65	104	65	##	83.3	69.7	80.8	85.4	55	79.7	61.0
I-580 Isabel N. Livermore	14696	95	13961	1	147	4	588	65	##	65	104	65	##	83.5	69.9	80.9	85.5	126	76.3	65.3

Assumptions: AM peak hour traffic data for Hopyard to Hacienda. Other 2 segments PM peak hour from ARUP

2025 Baseline + DMU Alternative

ROAD SEGMENT	TOTAL # VEHICLES	VEHICLE TYPE %			VEHICLE SPEED				NOISE LEVEL (dBA)			CALCULATED NOISE LEVEL 15 meters from roadway center	Receptor Dist. from Roadway Center (m.)	Adjusted Noise Level	Adjusted Noise Level - Soundwall					
		Auto	MT	HT	Auto k/h	MT k/h	HT k/h	Auto	MT	HT										
Calveno Peak																				
from: to:		%	Auto	%	MT	%	HT							roadway center	Center (m.)	(dBA)				
I-580 Hopyard Hacienda	14431	95	13709	1	144.3	4	577	65	##	65	104	65	##	83.4	69.8	80.8	85.4	91.7	77.6	61.7
I-580 Sta. Rita El Charro	14383	95	13664	1	143.8	4	575	65	##	65	104	65	##	83.4	69.8	80.8	85.4	55	79.8	61.1
I-580 Isabel N. Livermore	14917	95	14171	1	149.2	4	597	65	##	65	104	65	##	83.6	70.0	81.0	85.6	126	76.3	65.3

Assumptions: AM peak hour traffic data for Hopyard to Hacienda. Other 2 segments PM peak hour from ARUP

2025 Baseline + BRT Alternative

ROAD SEGMENT	TOTAL # VEHICLES	VEHICLE TYPE %			VEHICLE SPEED				NOISE LEVEL (dBA)			CALCULATED NOISE LEVEL 15 meters from roadway center)	Receptor Dist. from Roadway Center (m.)	Adjusted Noise Level (dBA)	Adjusted Noise Level - Soundwall						
		Auto	MT	HT	Auto	k/h	MT	k/h	HT	k/h	Auto					MT	HT				
Calveno Peak																					
from:	to:	%	Auto	%	MT	%	HT														
I-580	Hopyard Hacienda	14399	95	13679	1	144	4	576	65	##	65	104	65	##	83.4	69.8	80.8	85.4	90.1	77.7	61.8
I-580	Sta. Rita El Charro	14476	95	13752	1	144.8	4	579	65	##	65	104	65	##	83.4	69.8	80.8	85.5	62	79.3	60.6
I-580	Isabel N. Livermore	15023	95	14272	1	150.2	4	601	65	##	65	104	65	##	83.6	70.0	81.0	85.6	133	76.1	65.1

Assumptions: AM peak hour traffic data for Hopyard to Hacienda. Other 2 segments PM peak hour from ARUP

2025 Baseline + Enhanced Bus Alternative

ROAD SEGMENT	TOTAL # VEHICLES	VEHICLE TYPE %			VEHICLE SPEED				NOISE LEVEL (dBA)			CALCULATED NOISE LEVEL 15 meters from roadway center)	Receptor Dist. from Roadway Center (m.)	Adjusted Noise Level (dBA)	Adjusted Noise Level - Soundwall						
		Auto	MT	HT	Auto	k/h	MT	k/h	HT	k/h	Auto					MT	HT				
Calveno Peak																					
from:	to:	%	Auto	%	MT	%	HT														
I-580	Hopyard Hacienda	14446	95	13724	1	144.5	4	578	65	##	65	104	65	##	83.4	69.8	80.8	85.5	113	76.7	60.8
I-580	Sta. Rita El Charro	14482	95	13758	1	144.8	4	579	65	##	65	104	65	##	83.4	69.8	80.8	85.5	62	79.3	60.6
I-580	Isabel N. Livermore	15037	95	14285	1	150.4	4	601	65	##	65	104	65	##	83.6	70.0	81.0	85.6	133	76.1	65.1

Assumptions: AM peak hour traffic data for Hopyard to Hacienda. Other 2 segments PM peak hour from ARUP

2040 Baseline

ROAD SEGMENT	TOTAL # VEHICLES	VEHICLE TYPE %			VEHICLE SPEED				NOISE LEVEL (dBA)			CALCULATED NOISE LEVEL 15 meters from roadway center)	Dist. from Roadway Center (m.)	Noise Level (dBA)	Noise Level - Soundwall						
		Auto	MT	HT	Auto	k/h	MT	k/h	HT	k/h	Auto					MT	HT				
Calveno Peak																					
from:	to:	%	Auto	%	MT	%	HT														
I-580	Hopyard Hacienda	15403	95	14633	1	154	4	616	65	##	65	104	65	##	83.7	70.1	81.1	85.7	113	77.0	61.1
I-580	Sta. Rita El Charro	15798	95	15008	1	158	4	632	65	##	65	104	65	##	83.8	70.2	81.2	85.8	62	79.7	61.0
I-580	Isabel N. Livermore	16684	95	15850	1	166.8	4	667	65	##	65	104	65	##	84.1	70.4	81.5	86.1	133	76.6	65.6

Assumptions: AM peak hour traffic data for Hopyard to Hacienda. Other 2 segments PM peak hour from ARUP

2040 Baseline + Project

ROAD SEGMENT	TOTAL # VEHICLES	VEHICLE TYPE %			VEHICLE SPEED				NOISE LEVEL (dBA)			CALCULATED NOISE LEVEL 15 meters from roadway center)	Receptor Dist. from Roadway Center (m.)	Adjusted Noise Level (dBA)	Adjusted Noise Level - Soundwall						
		Auto	MT	HT	Auto	k/h	MT	k/h	HT	k/h	Auto					MT	HT				
Calveno Peak																					
from:	to:	%	Auto	%	MT	%	HT														
I-580	Hopyard Hacienda	15361	95	14593	1	153.6	4	614	65	##	65	104	65	##	83.7	70.1	81.1	85.7	106	77.2	61.3
I-580	Sta. Rita El Charro	15612	95	14831	1	156.1	4	624	65	##	65	104	65	##	83.8	70.2	81.2	85.8	55	80.1	61.4
I-580	Isabel N. Livermore	16483	95	15659	1	164.8	4	659	65	##	65	104	65	##	84.0	70.4	81.4	86.0	126	76.8	65.8

Assumptions: AM peak hour traffic data for Hopyard to Hacienda. Other 2 segments PM peak hour from ARUP

2040 Baseline + DMU Alternative

ROAD SEGMENT	TOTAL # VEHICLES	VEHICLE TYPE %			VEHICLE SPEED				NOISE LEVEL (dBA)			CALCULATED NOISE LEVEL 15 meters from roadway center)	Receptor Dist. from Roadway Center (m.)	Adjusted Noise Level (dBA)	Adjusted Noise Level - Soundwall					
		Auto	MT	HT	Auto k/h	MT k/h	HT k/h	Auto	MT	HT										
Calveno Peak																				
from: to:		%	Auto	%	MT	%	HT													
I-580 Hopyard Hacienda	15380	95	14611	1	153.8	4	615	65	##	65	104	65	##	83.7	70.1	81.1	85.7	91.7	77.9	62.0
I-580 Sta. Rita El Charro	15708	95	14923	1	157.1	4	628	65	##	65	104	65	##	83.8	70.2	81.2	85.8	55	80.2	61.5
I-580 Isabel N. Livermore	16541	95	15714	1	165.4	4	662	65	##	65	104	65	##	84.0	70.4	81.4	86.0	126	76.8	65.8

Assumptions: AM peak hour traffic data for Hopyard to Hacienda. Other 2 segments PM peak hour from ARUP

2040 Baseline + BRT Alternative

ROAD SEGMENT	TOTAL # VEHICLES	VEHICLE TYPE %			VEHICLE SPEED				NOISE LEVEL (dBA)			CALCULATED NOISE LEVEL 15 meters from roadway center)	Receptor Dist. from Roadway Center (m.)	Adjusted Noise Level (dBA)	Adjusted Noise Level - Soundwall					
		Auto	MT	HT	Auto k/h	MT k/h	HT k/h	Auto	MT	HT										
Calveno Peak																				
from: to:		%	Auto	%	MT	%	HT													
I-580 Hopyard Hacienda	15371	95	14602	1	153.7	4	615	65	##	65	104	65	##	83.7	70.1	81.1	85.7	90.1	77.0	62.0
I-580 Sta. Rita El Charro	15785	95	14996	1	157.9	4	631	65	##	65	104	65	##	83.8	70.2	81.2	85.8	62	79.7	61.0
I-580 Isabel N. Livermore	16681	95	15847	1	166.8	4	667	65	##	65	104	65	##	84.1	70.4	81.5	86.1	133	76.6	65.6

Assumptions: AM peak hour traffic data for Hopyard to Hacienda. Other 2 segments PM peak hour from ARUP

2040 Baseline + Enhanced Bus Alternative

ROAD SEGMENT	TOTAL # VEHICLES	VEHICLE TYPE %			VEHICLE SPEED				NOISE LEVEL (dBA)			CALCULATED NOISE LEVEL 15 meters from roadway center)	Receptor Dist. from Roadway Center (m.)	Adjusted Noise Level (dBA)	Adjusted Noise Level - Soundwall					
		Auto	MT	HT	Auto k/h	MT k/h	HT k/h	Auto	MT	HT										
Calveno Peak																				
from: to:		%	Auto	%	MT	%	HT													
I-580 Hopyard Hacienda	15426	95	14655	1	154.3	4	617	65	##	65	104	65	##	83.7	70.1	81.1	85.7	113	77.0	61.1
I-580 Sta. Rita El Charro	15834	95	15042	1	158.3	4	633	65	##	65	104	65	##	83.8	70.2	81.2	85.9	62	79.7	61.0
I-580 Isabel N. Livermore	16711	95	15875	1	167.1	4	668	65	##	65	104	65	##	84.1	70.5	81.5	86.1	133	76.6	65.6

Assumptions: AM peak hour traffic data for Hopyard to Hacienda. Other 2 segments PM peak hour from ARUP

2025 Baseline Conditions

ROAD SEGMENT	TOTAL # VEHICLES	VEHICLE TYPE %			VEHICLE SPEED				NOISE LEVEL (dBA)			CALCULATED NOISE LEVEL 15 meters from roadway center)	Receptor Dist. from Roadway Center (m.)	Adjusted Noise Level (dBA)	Adjusted Noise Level - Soundwall					
		Auto	MT	HT	Auto k/h	MT k/h	HT k/h	Auto	MT	HT										
Calveno Peak																				
from: to:		%	Auto	%	MT	%	HT													
I-580 Hopyard Hacienda	15190	95	14431	1	151.9	4	608	65	##	65	104	65	##	83.6	70.0	81.1	85.7	113	76.9	61.0
I-580 Sta. Rita El Charro	14514	95	13788	1	145.1	4	581	65	##	65	104	65	##	83.4	69.8	80.9	85.5	62	79.3	60.6
I-580 Isabel N. Livermore	15057	95	14304	1	150.6	4	602	65	##	65	104	65	##	83.6	70.0	81.0	85.6	133	76.2	65.2

Assumptions: AM peak hour traffic data for Hopyard to Hacienda. Other 2 segments PM peak hour from ARUP

2025 Baseline + Project + Cumulative

ROAD SEGMENT	TOTAL # VEHICLES	VEHICLE TYPE %			VEHICLE SPEED				NOISE LEVEL (dBA)			CALCULATED NOISE LEVEL 15 meters from roadway center)	Receptor Dist. from Roadway Center (m.)	Adjusted Noise Level (dBA)	Adjusted Noise Level - Soundwall					
		Auto	MT	HT	Auto k/h	MT k/h	HT k/h	Auto	MT	HT										
Calveno Peak																				
from: to:		%	Auto	%	MT	%	HT													
I-580 Hopyard Hacienda	14424	95	13703	1	144.2	4	577	65	##	65	104	65	##	83.4	69.8	80.8	85.4	106	77.0	61.1
I-580 Sta. Rita El Charro	14249	95	13537	1	142.5	4	570	65	##	65	104	65	##	83.4	69.8	80.8	85.4	55	79.7	61.0
I-580 Isabel N. Livermore	14836	95	14094	1	148.4	4	593	65	##	65	104	65	##	83.5	69.9	81.0	85.6	126	76.3	65.3

Assumptions: AM peak hour traffic data for Hopyard to Hacienda. Other 2 segments PM peak hour from ARUP

2025 Baseline + DMU Alternative + Cumulative

ROAD SEGMENT	TOTAL # VEHICLES	VEHICLE TYPE %			VEHICLE SPEED				NOISE LEVEL (dBA)			CALCULATED NOISE LEVEL 15 meters from roadway center)	Receptor Dist. from Roadway Center (m.)	Adjusted Noise Level (dBA)	Adjusted Noise Level - Soundwall					
		Auto	MT	HT	Auto k/h	MT k/h	HT k/h	Auto	MT	HT										
Calveno Peak																				
from: to:		%	Auto	%	MT	%	HT													
I-580 Hopyard Hacienda	14412	95	13691	1	144.1	4	576	65	##	65	104	65	##	83.4	69.8	80.8	85.4	91.7	77.6	61.7
I-580 Sta. Rita El Charro	14490	95	13766	1	144.9	4	580	65	##	65	104	65	##	83.4	69.8	80.8	85.5	55	79.8	61.1
I-580 Isabel N. Livermore	15006	95	14256	1	150.1	4	600	65	##	65	104	65	##	83.6	70.0	81.0	85.6	126	76.4	65.4

Assumptions: AM peak hour traffic data for Hopyard to Hacienda. Other 2 segments PM peak hour from ARUP

2025 Baseline + BRT Alternative + Cumulative

ROAD SEGMENT	TOTAL # VEHICLES	VEHICLE TYPE %			VEHICLE SPEED				NOISE LEVEL (dBA)			CALCULATED NOISE LEVEL 15 meters from roadway center)	Receptor Dist. from Roadway Center (m.)	Adjusted Noise Level (dBA)	Adjusted Noise Level - Soundwall					
		Auto	MT	HT	Auto k/h	MT k/h	HT k/h	Auto	MT	HT										
Calveno Peak																				
from: to:		%	Auto	%	MT	%	HT													
I-580 Hopyard Hacienda	14392	95	13672	1	143.9	4	576	65	##	65	104	65	##	83.4	69.8	80.8	85.4	90.1	77.6	61.7
I-580 Sta. Rita El Charro	14456	95	13733	1	144.6	4	578	65	##	65	104	65	##	83.4	69.8	80.8	85.5	39.1	81.3	62.6
I-580 Isabel N. Livermore	15087	95	14333	1	150.9	4	603	65	##	65	104	65	##	83.6	70.0	81.0	85.6	110.1	77.0	66.0

Assumptions: AM peak hour traffic data for Hopyard to Hacienda. Other 2 segments PM peak hour from ARUP

2025 Baseline + Enhanced Bus Alternative + Cumulative

ROAD SEGMENT	TOTAL # VEHICLES	VEHICLE TYPE %			VEHICLE SPEED				NOISE LEVEL (dBA)			CALCULATED NOISE LEVEL 15 meters from roadway center)	Receptor Dist. from Roadway Center (m.)	Adjusted Noise Level (dBA)	Adjusted Noise Level - Soundwall					
		Auto	MT	HT	Auto k/h	MT k/h	HT k/h	Auto	MT	HT										
Calveno Peak																				
from: to:		%	Auto	%	MT	%	HT						roadway center)	Center (m.)	(dBA)					
I-580 Hopyard Hacienda	14428	95	13707	1	144.3	4	577	65	##	65	104	65	##	83.4	69.8	80.8	85.4	113	76.7	60.8
I-580 Sta. Rita El Charro	14571	95	13842	1	145.7	4	583	65	##	65	104	65	##	83.5	69.9	80.9	85.5	62	79.3	60.6
I-580 Isabel N. Livermore	15037	95	14285	1	150.4	4	601	65	##	65	104	65	##	83.6	70.0	81.0	85.6	133	76.1	65.1

Assumptions: AM peak hour traffic data for Hopyard to Hacienda. Other 2 segments PM peak hour from ARUP

2040 Baseline Condition

ROAD SEGMENT	TOTAL # VEHICLES	VEHICLE TYPE %			VEHICLE SPEED				NOISE LEVEL (dBA)			CALCULATED NOISE LEVEL 15 meters from roadway center)	Receptor Dist. from Roadway Center (m.)	Adjusted Noise Level (dBA)	Adjusted Noise Level - Soundwall					
		Auto	MT	HT	Auto k/h	MT k/h	HT k/h	Auto	MT	HT										
Calveno Peak																				
from: to:		%	Auto	%	MT	%	HT						roadway center)	Center (m.)	(dBA)					
I-580 Hopyard Hacienda	15403	95	14633	1	154	4	616	65	##	65	104	65	##	83.7	70.1	81.1	85.7	113	77.0	61.1
I-580 Sta. Rita El Charro	15798	95	15008	1	158	4	632	65	##	65	104	65	##	83.8	70.2	81.2	85.8	62	79.7	61.0
I-580 Isabel N. Livermore	16684	95	15850	1	166.8	4	667	65	##	65	104	65	##	84.1	70.4	81.5	86.1	133	76.6	65.6

Assumptions: AM peak hour traffic data for Hopyard to Hacienda. Other 2 segments PM peak hour from ARUP

2040 Baseline + Project + Cumulative

ROAD SEGMENT	TOTAL # VEHICLES	VEHICLE TYPE %			VEHICLE SPEED				NOISE LEVEL (dBA)			CALCULATED NOISE LEVEL 15 meters from roadway center)	Receptor Dist. from Roadway Center (m.)	Adjusted Noise Level (dBA)	Adjusted Noise Level - Soundwall					
		Auto	MT	HT	Auto k/h	MT k/h	HT k/h	Auto	MT	HT										
Calveno Peak																				
from: to:		%	Auto	%	MT	%	HT						roadway center)	Center (m.)	(dBA)					
I-580 Hopyard Hacienda	15601	95	14821	1	156	4	624	65	##	65	104	65	##	83.8	70.2	81.2	85.8	106	77.3	61.4
I-580 Sta. Rita El Charro	15949	95	15152	1	159.5	4	638	65	##	65	104	65	##	83.9	70.3	81.3	85.9	55	80.2	61.5
I-580 Isabel N. Livermore	16857	95	16014	1	168.6	4	674	65	##	65	104	65	##	84.1	70.5	81.5	86.1	126	76.9	65.9

Assumptions: AM peak hour traffic data for Hopyard to Hacienda. Other 2 segments PM peak hour from ARUP

2040 Baseline + DMU Alternative+ Cumulative

ROAD SEGMENT	TOTAL # VEHICLES	VEHICLE TYPE %			VEHICLE SPEED				NOISE LEVEL (dBA)			CALCULATED NOISE LEVEL 15 meters from roadway center)	Receptor Dist. from Roadway Center (m.)	Adjusted Noise Level (dBA)	Adjusted Noise Level - Soundwall					
		Auto	MT	HT	Auto k/h	MT k/h	HT k/h	Auto	MT	HT										
Calveno Peak																				
from: to:		%	Auto	%	MT	%	HT						roadway center)	Center (m.)	(dBA)					
I-580 Hopyard Hacienda	15672	95	14888	1	156.7	4	627	65	##	65	104	65	##	83.8	70.2	81.2	85.8	91.7	77.9	62.0
I-580 Sta. Rita El Charro	15983	95	15184	1	159.8	4	639	65	##	65	104	65	##	83.9	70.3	81.3	85.9	55	80.2	61.5
I-580 Isabel N. Livermore	16852	95	16009	1	168.5	4	674	65	##	65	104	65	##	84.1	70.5	81.5	86.1	126	76.9	65.9

Assumptions: AM peak hour traffic data for Hopyard to Hacienda. Other 2 segments PM peak hour from ARUP

2040 Baseline + BRT Alternative + Cumulative

ROAD SEGMENT	TOTAL # VEHICLES	VEHICLE TYPE %			VEHICLE SPEED				NOISE LEVEL (dBA)			CALCULATED NOISE LEVEL 15 meters from roadway center)	Receptor Dist. from Roadway Center (m.)	Adjusted Noise Level (dBA)	Adjusted Noise Level - Soundwall					
		Auto	MT	HT	Auto k/h	MT k/h	HT k/h	Auto	MT	HT										
Calveno Peak																				
from: to:		%	Auto	%	MT	%	HT													
I-580 Hopyard Hacienda	15390	95	14621	1	153.9	4	616	65	##	65	104	65	##	83.7	70.1	81.1	85.7	90.1	77.9	62.0
I-580 Sta. Rita El Charro	15805	95	15015	1	158.1	4	632	65	##	65	104	65	##	83.8	70.2	81.2	85.8	39.1	81.7	63.0
I-580 Isabel N. Livermore	16686	95	15852	1	166.9	4	667	65	##	65	104	65	##	84.1	70.5	81.5	86.1	110.1	77.4	66.4

Assumptions: AM peak hour traffic data for Hopyard to Hacienda. Other 2 segments PM peak hour from ARUP

2040 Baseline + Enhanced Bus Alternative + Cumulative

ROAD SEGMENT	TOTAL # VEHICLES	VEHICLE TYPE %			VEHICLE SPEED				NOISE LEVEL (dBA)			CALCULATED NOISE LEVEL 15 meters from roadway center)	Receptor Dist. from Roadway Center (m.)	Adjusted Noise Level (dBA)	Adjusted Noise Level - Soundwall					
		Auto	MT	HT	Auto k/h	MT k/h	HT k/h	Auto	MT	HT										
Calveno Peak																				
from: to:		%	Auto	%	MT	%	HT													
I-580 Hopyard Hacienda	15387	95	14618	1	153.9	4	615	65	##	65	104	65	##	83.7	70.1	81.1	85.7	113	77.0	61.1
I-580 Sta. Rita El Charro	15838	95	15046	1	158.4	4	634	65	##	65	104	65	##	83.8	70.2	81.2	85.9	62	79.7	61.0
I-580 Isabel N. Livermore	16698	95	15863	1	167	4	668	65	##	65	104	65	##	84.1	70.5	81.5	86.1	133	76.6	65.6

Assumptions: AM peak hour traffic data for Hopyard to Hacienda. Other 2 segments PM peak hour from ARUP

G.3 Noise Model Data – Construction Noise Calculations

FTA General Noise Assessment Calculations for Construction Equipment

Underlying Equation from FTA Guidance Page 12-3

$$Leq(equip) = E.L. + 10 \log(U.F.) - 20 \log(D/50) - 10G \log(D/50)$$

where: Leq (equip) = the Leq at a receiver resulting from the operation of a single piece of equipment over a specified time period
 E.L. = the noise emission level of the particular piece of equipment at the reference distance of 50 feet, taken from Table 12-1
 G = a constant that accounts for topography and ground effects, taken from Figure 6-5 (Chapter 6)
 D = the distance from the receiver to the piece of equipment, and
 U.F. = a usage factor that accounts for the fraction of time that the equipment is in use over the specified time period.

For general assessment, FTA identifies the following assumptions:

1. Full power operation for a time period of one hour is assumed because most construction equipment operates continuously for periods of one hour or more at some point in the construction period.

Therefore, U.F. = 1, and $10 \log(U.F.) = 0$

Hence, the Equation simplifies to: $Leq(equip) = E.L. - 20 \log(D/50) - 10G \log(D/50)$

2. Free-field conditions are assumed and ground effects are ignored. Consequently, $G = 0$.

Hence, the Equation further simplifies to: $Leq(equip) = E.L. - 20 \log(D/50)$

Solving for distance (D) yields: $D = 50 * 10^{(Leq - E.L.) / -20}$

Equipment	E.L. (from Table 12-1)	Leq at Distance
		370 feet
Forklift	84 dBA. Leq	66.6
Crane	83 dBA. Leq	65.6
Excavator	85 dBA. Leq	67.6
Dozer	85 dBA. Leq	67.6
Compactor	82 dBA. Leq	64.6
Loader	85 dBA. Leq	67.6
Dump Truck	88 dBA. Leq	70.6
Scrapers	89 dBA. Leq	71.6
Grader	85 dBA. Leq	67.6
Paver	89 dBA. Leq	71.6
Vibrator Compactor	82 dBA. Leq	64.6
Two Noisiest (Scraper & Paver)	92.0 dBA. Leq	74.6

Proposed Project with Storage Facility

#	segments	nearest receptor to construction	
5	Dublin/Pleasanton Station to Hacienda Drive	Multi Family Housing at 5200 Iron Horse Parkway	370 feet north of Alt 1 construction
6	Hacienda to Tassajara		
7	Tassajara Interchange		
8	Tassajara to Fallon		
9	Fallon Interchange		
10	Fallon to Airway		
11	Airway Interchange		
12	Airway to Isabel Station		
13	Isabel Interchange		
14	Isabel Station BART		
16	Parking Garage / Surface South		
17	Isabel Station to yard		
19	Tail Track Yard		

FTA General Noise Assessment Calculations for Construction Equipment

Underlying Equation from FTA Guidance Page 12-3

$$Leq(equip) = E.L. + 10 \log(U.F.) - 20 \log(D/50) - 10G \log(D/50)$$

where: Leq (equip) = the Leq at a receiver resulting from the operation of a single piece of equipment over a specified time period
 E.L. = the noise emission level of the particular piece of equipment at the reference distance of 50 feet, taken from Table 12-1
 G = a constant that accounts for topography and ground effects, taken from Figure 6-5 (Chapter 6)
 D = the distance from the receiver to the piece of equipment, and
 U.F. = a usage factor that accounts for the fraction of time that the equipment is in use over the specified time period.

For general assessment, FTA identifies the following assumptions:

1. Full power operation for a time period of one hour is assumed because most construction equipment operates continuously for periods of one hour or more at some point in the construction period.

Therefore, U.F. = 1, and $10 \log(U.F.) = 0$

Hence, the Equation simplifies to: $Leq(equip) = E.L. - 20 \log(D/50) - 10G \log(D/50)$

2. Free-field conditions are assumed and ground effects are ignored. Consequently, $G = 0$.

Hence, the Equation further simplifies to: $Leq(equip) = E.L. - 20 \log(D/50)$

Solving for distance (D) yields: $D = 50 * 10^{(Leq-E.L.)/-20}$

Equipment	E.L. (from Table 12-1)	Leq at Distance
		442 feet
Forklift	84 dBA. Leq	65.1
Crane	83 dBA. Leq	64.1
Excavator	85 dBA. Leq	66.1
Dozer	85 dBA. Leq	66.1
Compactor	82 dBA. Leq	63.1
Loader	85 dBA. Leq	66.1
Dump Truck	88 dBA. Leq	69.1
Scrapers	89 dBA. Leq	70.1
Grader	85 dBA. Leq	66.1
Paver	89 dBA. Leq	70.1
Vibrator Compactor	82 dBA. Leq	63.1
Two Noisiest (Scraper & Paver)	92.0 dBA. Leq	73.1

Proposed Project with Storage Facility

#	segments	nearest receptor to construction
5	Dublin/Pleasanton Station to Hacienda Drive	
6	Hacienda to Tassajara	Single-Family Housing at 5200 Iron Horse Parkway
7	Tassajara Interchange	442 feet south of Alt 1 construction
8	Tassajara to Fallon	
9	Fallon Interchange	
10	Fallon to Airway	
11	Airway Interchange	
12	Airway to Isabel Station	
13	Isabel Interchange	
14	Isabel Station BART	
16	Parking Garage / Surface South	
17	Isabel Station to yard	
19	Tail Track Yard	

FTA General Noise Assessment Calculations for Construction Equipment

Underlying Equation from FTA Guidance Page 12-3

$$Leq(equip) = E.L. + 10 \log(U.F.) - 20 \log(D/50) - 10G \log(D/50)$$

where: Leq (equip) = the Leq at a receiver resulting from the operation of a single piece of equipment over a specified time period
 E.L. = the noise emission level of the particular piece of equipment at the reference distance of 50 feet, taken from Table 12-1
 G = a constant that accounts for topography and ground effects, taken from Figure 6-5 (Chapter 6)
 D = the distance from the receiver to the piece of equipment, and
 U.F. = a usage factor that accounts for the fraction of time that the equipment is in use over the specified time period.

For general assessment, FTA identifies the following assumptions:

1. Full power operation for a time period of one hour is assumed because most construction equipment operates continuously for periods of one hour or more at some point in the construction period.

Therefore, U.F. = 1, and $10 \log(U.F.) = 0$

Hence, the Equation simplifies to: $Leq(equip) = E.L. - 20 \log(D/50) - 10G \log(D/50)$

2. Free-field conditions are assumed and ground effects are ignored. Consequently, $G = 0$.

Hence, the Equation further simplifies to: $Leq(equip) = E.L. - 20 \log(D/50)$

Solving for distance (D) yields: $D = 50 * 10^{(Leq - E.L.) / -20}$

Equipment	E.L. (from Table 12-1)	Leq at Distance
		1100 feet
Forklift	84 dBA. Leq	57.2
Crane	83 dBA. Leq	56.2
Excavator	85 dBA. Leq	58.2
Dozer	85 dBA. Leq	58.2
Compactor	82 dBA. Leq	55.2
Loader	85 dBA. Leq	58.2
Dump Truck	88 dBA. Leq	61.2
Scrapers	89 dBA. Leq	62.2
Grader	85 dBA. Leq	58.2
Paver	89 dBA. Leq	62.2
Vibrator Compactor	82 dBA. Leq	55.2
Two Noisiest (Scraper & Paver)	92.0 dBA. Leq	65.2

Proposed Project with Storage Facility

#	segments	nearest receptor to construction
5	Dublin/Pleasanton Station to Hacienda Drive	
6	Hacienda Drive to Tassajara Road	
7	Tassajara Road/I-580 Interchange	Single-Family Housing
8	Tassajara Road to Fallon	855 feet southeast of Alt 1 construction
9	Fallon Interchange	
10	Fallon to Airway	
11	Airway Interchange	
12	Airway to Isabel Station	
13	Isabel Interchange	
14	Isabel Station BART	
16	Parking Garage / Surface South	
18	Maintenance Facility /Yard	
19	Tail Track Yard	

FTA General Noise Assessment Calculations for Construction Equipment

Underlying Equation from FTA Guidance Page 12-3

$$Leq(equip) = E.L. + 10 \log(U.F.) - 20 \log(D/50) - 10G \log(D/50)$$

where: Leq (equip) = the Leq at a receiver resulting from the operation of a single piece of equipment over a specified time period
 E.L. = the noise emission level of the particular piece of equipment at the reference distance of 50 feet, taken from Table 12-1
 G = a constant that accounts for topography and ground effects, taken from Figure 6-5 (Chapter 6)
 D = the distance from the receiver to the piece of equipment, and
 U.F. = a usage factor that accounts for the fraction of time that the equipment is in use over the specified time period.

For general assessment, FTA identifies the following assumptions:

1. Full power operation for a time period of one hour is assumed because most construction equipment operates continuously for periods of one hour or more at some point in the construction period.

Therefore, U.F. = 1, and $10 \log(U.F.) = 0$

Hence, the Equation simplifies to: $Leq(equip) = E.L. - 20 \log(D/50) - 10G \log(D/50)$

2. Free-field conditions are assumed and ground effects are ignored. Consequently, G = 0.

Hence, the Equation further simplifies to: $Leq(equip) = E.L. - 20 \log(D/50)$

Solving for distance (D) yields: $D = 50 * 10^{(Leq-E.L.)/-20}$

Equipment	E.L. (from Table 12-1)	Leq at Distance
		170 feet
Forklift	84 dBA. Leq	73.4
Crane	83 dBA. Leq	72.4
Excavator	85 dBA. Leq	74.4
Dozer	85 dBA. Leq	74.4
Compactor	82 dBA. Leq	71.4
Loader	85 dBA. Leq	74.4
Dump Truck	88 dBA. Leq	77.4
Scrapers	89 dBA. Leq	78.4
Grader	85 dBA. Leq	74.4
Paver	89 dBA. Leq	78.4
Vibrator Compactor	82 dBA. Leq	71.4
Two Noisiest (Scraper & Paver)	92.0 dBA. Leq	81.4

Proposed Project with Storage Facility

#	segments	nearest receptor to construction
5	Dublin/Pleasanton Station to Hacienda Drive	
6	Hacienda Drive to Tassajara Road	
7	Tassajara Road/I-580 Interchange	
8	Tassajara Road to Fallon	Single-Family Housing
9	Fallon Interchange	100 feet south of Alt 1 construction
10	Fallon to Airway	
11	Airway Interchange	
12	Airway to Isabel Station	
13	Isabel Interchange	
14	Isabel Station BART	
16	Parking Garage / Surface South	
17	Isabel Station to yard	
19	Tail Track Yard	

FTA General Noise Assessment Calculations for Construction Equipment

Underlying Equation from FTA Guidance Page 12-3

$$Leq(equip) = E.L. + 10 \log(U.F.) - 20 \log(D/50) - 10G \log(D/50)$$

where: Leq (equip) = the Leq at a receiver resulting from the operation of a single piece of equipment over a specified time period
 E.L. = the noise emission level of the particular piece of equipment at the reference distance of 50 feet, taken from Table 12-1
 G = a constant that accounts for topography and ground effects, taken from Figure 6-5 (Chapter 6)
 D = the distance from the receiver to the piece of equipment, and
 U.F. = a usage factor that accounts for the fraction of time that the equipment is in use over the specified time period.

For general assessment, FTA identifies the following assumptions:

1. Full power operation for a time period of one hour is assumed because most construction equipment operates continuously for periods of one hour or more at some point in the construction period.

Therefore, U.F. = 1, and $10 \log(U.F.) = 0$

Hence, the Equation simplifies to: $Leq(equip) = E.L. - 20 \log(D/50) - 10G \log(D/50)$

2. Free-field conditions are assumed and ground effects are ignored. Consequently, $G = 0$.

Hence, the Equation further simplifies to: $Leq(equip) = E.L. - 20 \log(D/50)$

Solving for distance (D) yields: $D = 50 * 10^{(Leq-E.L.)/-20}$

Equipment	E.L. (from Table 12-1)	Leq at Distance
		1400 feet
Forklift	84 dBA. Leq	55.1
Crane	83 dBA. Leq	54.1
Excavator	85 dBA. Leq	56.1
Dozer	85 dBA. Leq	56.1
Compactor	82 dBA. Leq	53.1
Loader	85 dBA. Leq	56.1
Dump Truck	88 dBA. Leq	59.1
Scrapers	89 dBA. Leq	60.1
Grader	85 dBA. Leq	56.1
Paver	89 dBA. Leq	60.1
Vibrator Compactor	82 dBA. Leq	53.1
Two Noisiest (Scraper & Paver)	92.0 dBA. Leq	63.1

Proposed Project with Storage Facility

#	segments	nearest receptor to construction
5	Dublin/Pleasanton Station to Hacienda Drive	
6	Hacienda Drive to Tassajara Road	
7	Tassajara Road/I-580 Interchange	
8	Tassajara Road to Fallon	
9	Fallon Road/I-580 Interchange	Single-Family Housing
10	Fallon Road to Airway Boulevard	1400 feet southwest of Alt 1 construction
11	Airway Boulevard/I-580 Interchange	
12	Airway Boulevard to Isabel BART Station	
13	Isabel Interchange	
14	Isabel Station BART	
16	Parking Garage / Surface South	
17	Isabel Station to yard	
19	Tail Track Yard	

FTA General Noise Assessment Calculations for Construction Equipment

Underlying Equation from FTA Guidance Page 12-3

$$Leq(equip) = E.L. + 10 \log(U.F.) - 20 \log(D/50) - 10G \log(D/50)$$

where: Leq (equip) = the Leq at a receiver resulting from the operation of a single piece of equipment over a specified time period
 E.L. = the noise emission level of the particular piece of equipment at the reference distance of 50 feet, taken from Table 12-1
 G = a constant that accounts for topography and ground effects, taken from Figure 6-5 (Chapter 6)
 D = the distance from the receiver to the piece of equipment, and
 U.F. = a usage factor that accounts for the fraction of time that the equipment is in use over the specified time period.

For general assessment, FTA identifies the following assumptions:

1. Full power operation for a time period of one hour is assumed because most construction equipment operates continuously for periods of one hour or more at some point in the construction period.

Therefore, U.F. = 1, and $10 \log(U.F.) = 0$

Hence, the Equation simplifies to: $Leq(equip) = E.L. - 20 \log(D/50) - 10G \log(D/50)$

2. Free-field conditions are assumed and ground effects are ignored. Consequently, G = 0.

Hence, the Equation further simplifies to: $Leq(equip) = E.L. - 20 \log(D/50)$

Solving for distance (D) yields: $D = 50 * 10^{(Leq - E.L.) / -20}$

Equipment	E.L. (from Table 12-1)	Leq at Distance
		1000 feet
Impact Pile Drivers	101 dBA. Leq	75.0
Forklift	84 dBA. Leq	58.0
Crane	83 dBA. Leq	57.0
Excavator	85 dBA. Leq	59.0
Dozer	85 dBA. Leq	59.0
Compactor	82 dBA. Leq	56.0
Loader	85 dBA. Leq	59.0
Dump Truck	88 dBA. Leq	62.0
Scrapers	89 dBA. Leq	63.0
Grader	85 dBA. Leq	59.0
Paver	89 dBA. Leq	63.0
Vibrator Compactor	82 dBA. Leq	56.0
Two Noisiest (Scraper & Pile driver)	101.3 dBA. Leq	75.3

Proposed Project with Storage Facility

#	segments	nearest receptor to construction
5	Dublin/Pleasanton Station to Hacienda Drive	
6	Hacienda Drive to Tassajara Road	
7	Tassajara Road/I-580 Interchange	
8	Tassajara Road to Fallon	
9	Fallon Road/I-580 Interchange	
10	Fallon Road to Airway Boulevard	
11	Airway Boulevard/I-580 Interchange	
12	Airway Boulevard to Isabel BART Station	1000 feet
13	Isabel Interchange	
14	Isabel Station BART	
16	Parking Garage / Surface South	
17	Isabel Station to yard	
19	Tail Track Yard	

FTA General Noise Assessment Calculations for Construction Equipment

Underlying Equation from FTA Guidance Page 12-3

$$Leq(equip) = E.L. + 10 \log(U.F.) - 20 \log(D/50) - 10G \log(D/50)$$

where: Leq (equip) = the Leq at a receiver resulting from the operation of a single piece of equipment over a specified time period
 E.L. = the noise emission level of the particular piece of equipment at the reference distance of 50 feet, taken from Table 12-1
 G = a constant that accounts for topography and ground effects, taken from Figure 6-5 (Chapter 6)
 D = the distance from the receiver to the piece of equipment, and
 U.F. = a usage factor that accounts for the fraction of time that the equipment is in use over the specified time period.

For general assessment, FTA identifies the following assumptions:

1. Full power operation for a time period of one hour is assumed because most construction equipment operates continuously for periods of one hour or more at some point in the construction period.

Therefore, U.F. = 1, and $10 \log(U.F.) = 0$

Hence, the Equation simplifies to: $Leq(equip) = E.L. - 20 \log(D/50) - 10G \log(D/50)$

2. Free-field conditions are assumed and ground effects are ignored. Consequently, $G = 0$.

Hence, the Equation further simplifies to: $Leq(equip) = E.L. - 20 \log(D/50)$

Solving for distance (D) yields: $D = 50 * 10^{(Leq-E.L.)/-20}$

Equipment	E.L. (from Table 12-1)	Leq at Distance
		1100 feet
Forklift	84 dBA. Leq	57.2
Crane	83 dBA. Leq	56.2
Excavator	85 dBA. Leq	58.2
Dozer	85 dBA. Leq	58.2
Compactor	82 dBA. Leq	55.2
Loader	85 dBA. Leq	58.2
Dump Truck	88 dBA. Leq	61.2
Scrapers	89 dBA. Leq	62.2
Grader	85 dBA. Leq	58.2
Paver	89 dBA. Leq	62.2
Vibrator Compactor	82 dBA. Leq	55.2
Two Noisiest (Scraper & Paver)	92.0 dBA. Leq	65.2

Proposed Project with Storage Facility

#	segments	nearest receptor to construction
5	Dublin/Pleasanton Station to Hacienda Drive	
6	Hacienda Drive to Tassajara Road	
7	Tassajara Road/I-580 Interchange	
8	Tassajara Road to Fallon	
9	Fallon Road/I-580 Interchange	
10	Fallon Road to Airway Boulevard	
11	Airway Boulevard/I-580 Interchange	
12	Airway Boulevard to Isabel BART Station	
13	Isabel Interchange	1100 feet
14	Isabel Station BART	
16	Parking Garage / Surface South	
17	Isabel Station to yard	
19	Tail Track Yard	

FTA General Noise Assessment Calculations for Construction Equipment

Underlying Equation from FTA Guidance Page 12-3

$$Leq(equip) = E.L. + 10 \log(U.F.) - 20 \log(D/50) - 10G \log(D/50)$$

where: Leq (equip) = the Leq at a receiver resulting from the operation of a single piece of equipment over a specified time period
 E.L. = the noise emission level of the particular piece of equipment at the reference distance of 50 feet, taken from Table 12-1
 G = a constant that accounts for topography and ground effects, taken from Figure 6-5 (Chapter 6)
 D = the distance from the receiver to the piece of equipment, and
 U.F. = a usage factor that accounts for the fraction of time that the equipment is in use over the specified time period.

For general assessment, FTA identifies the following assumptions:

1. Full power operation for a time period of one hour is assumed because most construction equipment operates continuously for periods of one hour or more at some point in the construction period.

Therefore, U.F. = 1, and $10 \log(U.F.) = 0$

Hence, the Equation simplifies to:

$$Leq(equip) = E.L. - 20 \log(D/50) - 10G \log(D/50)$$

2. Free-field conditions are assumed and ground effects are ignored. Consequently, G = 0.

Hence, the Equation further simplifies to:

$$Leq(equip) = E.L. - 20 \log(D/50)$$

Solving for distance (D) yields:

$$D = 50 * 10^{(Leq - E.L.) / -20}$$

Equipment	E.L. (from Table 12-1)	Leq at Distance
		1200 feet
Impact Pile Drivers	101 dBA. Leq	73.4
Forklift	84 dBA. Leq	56.4
Crane	83 dBA. Leq	55.4
Excavator	85 dBA. Leq	57.4
Dozer	85 dBA. Leq	57.4
Compactor	82 dBA. Leq	54.4
Loader	85 dBA. Leq	57.4
Dump Truck	88 dBA. Leq	60.4
Scrapers	89 dBA. Leq	61.4
Grader	85 dBA. Leq	57.4
Paver	89 dBA. Leq	61.4
Vibrator Compactor	82 dBA. Leq	54.4
Two Noisiest (Scraper & Pile Driver)	101.3 dBA. Leq	73.7

Proposed Project with Storage Facility

#	segments	nearest receptor to construction
5	Dublin/Pleasanton Station to Hacienda Drive	
6	Hacienda Drive to Tassajara Road	
7	Tassajara Road/I-580 Interchange	
8	Tassajara Road to Fallon	
9	Fallon Road/I-580 Interchange	
10	Fallon Road to Airway Boulevard	
11	Airway Boulevard/I-580 Interchange	
12	Airway Boulevard to Isabel BART Station	
13	Isabel Interchange	
14	Isabel Station BART	1200 feet
16	Parking Garage / Surface South	
17	Isabel Station to yard	
19	Tail Track Yard	

FTA General Noise Assessment Calculations for Construction Equipment

Underlying Equation from FTA Guidance Page 12-3

$$Leq(equip) = E.L. + 10 \log(U.F.) - 20 \log(D/50) - 10G \log(D/50)$$

where: $Leq(equip)$ = the Leq at a receiver resulting from the operation of a single piece of equipment over a specified time period
 $E.L.$ = the noise emission level of the particular piece of equipment at the reference distance of 50 feet, taken from Table 12-1
 G = a constant that accounts for topography and ground effects, taken from Figure 6-5 (Chapter 6)
 D = the distance from the receiver to the piece of equipment, and
 $U.F.$ = a usage factor that accounts for the fraction of time that the equipment is in use over the specified time period.

For general assessment, FTA identifies the following assumptions:

1. Full power operation for a time period of one hour is assumed because most construction equipment operates continuously for periods of one hour or more at some point in the construction period.

Therefore, $U.F. = 1$, and $10 \log(U.F.) = 0$

Hence, the Equation simplifies to:

$$Leq(equip) = E.L. - 20 \log(D/50) - 10G \log(D/50)$$

2. Free-field conditions are assumed and ground effects are ignored. Consequently, $G = 0$.

Hence, the Equation further simplifies to:

$$Leq(equip) = E.L. - 20 \log(D/50)$$

Solving for distance (D) yields:

$$D = 50 * 10^{(Leq - E.L.) / -20}$$

Equipment	E.L. (from Table 12-1)	Leq at Distance
		1400 feet
Impact Pile Drivers	101 dBA. Leq	72.1
Forklift	84 dBA. Leq	55.1
Crane	83 dBA. Leq	54.1
Excavator	85 dBA. Leq	56.1
Dozer	85 dBA. Leq	56.1
Compactor	82 dBA. Leq	53.1
Loader	85 dBA. Leq	56.1
Dump Truck	88 dBA. Leq	59.1
Scrapers	89 dBA. Leq	60.1
Grader	85 dBA. Leq	56.1
Paver	89 dBA. Leq	60.1
Vibrator Compactor	82 dBA. Leq	53.1
Two Noisiest (Scraper & Pile Driver)	101.3 dBA. Leq	72.4

Proposed Project with Storage Facility

#	segments	nearest receptor to construction
5	Dublin/Pleasanton Station to Hacienda Drive	
6	Hacienda Drive to Tassajara Road	
7	Tassajara Road/I-580 Interchange	
8	Tassajara Road to Fallon	
9	Fallon Road/I-580 Interchange	
10	Fallon Road to Airway Boulevard	
11	Airway Boulevard/I-580 Interchange	
12	Airway Boulevard to Isabel BART Station	
13	Isabel Interchange	
14	Isabel Station BART	
16	Parking Garage / Surface South	1400 feet
17	Isabel Station to yard	
19	Tail Track Yard	

FTA General Noise Assessment Calculations for Construction Equipment

Underlying Equation from FTA Guidance Page 12-3

$$Leq(equip) = E.L. + 10 \log(U.F.) - 20 \log(D/50) - 10G \log(D/50)$$

where: Leq (equip) = the Leq at a receiver resulting from the operation of a single piece of equipment over a specified time period
 E.L. = the noise emission level of the particular piece of equipment at the reference distance of 50 feet, taken from Table 12-1
 G = a constant that accounts for topography and ground effects, taken from Figure 6-5 (Chapter 6)
 D = the distance from the receiver to the piece of equipment, and
 U.F. = a usage factor that accounts for the fraction of time that the equipment is in use over the specified time period.

For general assessment, FTA identifies the following assumptions:

1. Full power operation for a time period of one hour is assumed because most construction equipment operates continuously for periods of one hour or more at some point in the construction period.

Therefore, U.F. = 1, and $10 \log(U.F.) = 0$

Hence, the Equation simplifies to: $Leq(equip) = E.L. - 20 \log(D/50) - 10G \log(D/50)$

2. Free-field conditions are assumed and ground effects are ignored. Consequently, G = 0.

Hence, the Equation further simplifies to: $Leq(equip) = E.L. - 20 \log(D/50)$

Solving for distance (D) yields: $D = 50 * 10^{(Leq - E.L.) / -20}$

Equipment	E.L. (from Table 12-1)	Leq at Distance
		370 feet
Impact Pile Drivers	101 dBA. Leq	83.6
Forklift	84 dBA. Leq	66.6
Crane	83 dBA. Leq	65.6
Excavator	85 dBA. Leq	67.6
Dozer	85 dBA. Leq	67.6
Compactor	82 dBA. Leq	64.6
Loader	85 dBA. Leq	67.6
Dump Truck	88 dBA. Leq	70.6
Scrapers	89 dBA. Leq	71.6
Grader	85 dBA. Leq	67.6
Paver	89 dBA. Leq	71.6
Vibrator Compactor	82 dBA. Leq	64.6
Two Noisiest (Scraper & Pile Driver)	101.3 dBA. Leq	83.9

DMU / EMU Alternative with Maintenance Facility

#	segments	nearest receptor to construction
3	Dublin/Pleasanton Station Cross Transfer Platform	370 feet
4	Hopyard to Hacienda Drive	
5	Hacienda Interchange	
6	Hacienda to Tassajara	
7	Tassajara Interchange	
8	Tassajara to Fallon	
9	Fallon Interchange	
10	Fallon to Airway	
11	Airway Interchange	
12	Airway to Isabel Station	
13	Isabel Interchange	
15	Isabel Station DMU EMU	
16	Parking Garage / Surface South	
17	Isabel Station to yard	
18	Maintenance Facility /yard	

FTA General Noise Assessment Calculations for Construction Equipment

Underlying Equation from FTA Guidance Page 12-3

$$Leq(equip) = E.L. + 10 \log(U.F.) - 20 \log(D/50) - 10G \log(D/50)$$

where: Leq (equip) = the Leq at a receiver resulting from the operation of a single piece of equipment over a specified time period
 E.L. = the noise emission level of the particular piece of equipment at the reference distance of 50 feet, taken from Table 12-1
 G = a constant that accounts for topography and ground effects, taken from Figure 6-5 (Chapter 6)
 D = the distance from the receiver to the piece of equipment, and
 U.F. = a usage factor that accounts for the fraction of time that the equipment is in use over the specified time period.

For general assessment, FTA identifies the following assumptions:

1. Full power operation for a time period of one hour is assumed because most construction equipment operates continuously for periods of one hour or more at some point in the construction period.

Therefore, U.F. = 1, and $10 \log(U.F.) = 0$
 Hence, the Equation simplifies to: $Leq(equip) = E.L. - 20 \log(D/50) - 10G \log(D/50)$

2. Free-field conditions are assumed and ground effects are ignored. Consequently, G = 0.

Hence, the Equation further simplifies to: $Leq(equip) = E.L. - 20 \log(D/50)$

Solving for distance (D) yields: $D = 50 * 10^{(Leq - E.L.) / -20}$

Equipment	E.L. (from Table 12-1)	Leq at Distance
		370 feet
Forklift	84 dBA. Leq	66.6
Crane	83 dBA. Leq	65.6
Excavator	85 dBA. Leq	67.6
Dozer	85 dBA. Leq	67.6
Compactor	82 dBA. Leq	64.6
Loader	85 dBA. Leq	67.6
Dump Truck	88 dBA. Leq	70.6
Scrapers	89 dBA. Leq	71.6
Grader	85 dBA. Leq	67.6
Paver	89 dBA. Leq	71.6
Vibrator Compactor	82 dBA. Leq	64.6
Two Noisiest (Scraper & Paver)	92.0 dBA. Leq	74.6

DMU / EMU Alternative with Maintenance Facility

#	segments	nearest receptor to construction
3	Dublin/Pleasanton Station Cross Transfer Platform	
4	Hopyard to Hacienda Drive	Multi Family Housing at 5200 Iron Horse Parkway
5	Hacienda Interchange	370 feet north of Alt 2 construction
6	Hacienda to Tassajara	
7	Tassajara Interchange	
8	Tassajara to Fallon	
9	Fallon Interchange	
10	Fallon to Airway	
11	Airway Interchange	
12	Airway to Isabel Station	
13	Isabel Interchange	
15	Isabel Station DMU EMU	
16	Parking Garage / Surface South	
17	Isabel Station to yard	
18	Maintenance Facility / yard	

FTA General Noise Assessment Calculations for Construction Equipment

Underlying Equation from FTA Guidance Page 12-3

$$Leq(equip) = E.L. + 10 \log(U.F.) - 20 \log(D/50) - 10G \log(D/50)$$

where: Leq (equip) = the Leq at a receiver resulting from the operation of a single piece of equipment over a specified time period
 E.L. = the noise emission level of the particular piece of equipment at the reference distance of 50 feet, taken from Table 12-1
 G = a constant that accounts for topography and ground effects, taken from Figure 6-5 (Chapter 6)
 D = the distance from the receiver to the piece of equipment, and
 U.F. = a usage factor that accounts for the fraction of time that the equipment is in use over the specified time period.

For general assessment, FTA identifies the following assumptions:

1. Full power operation for a time period of one hour is assumed because most construction equipment operates continuously for periods of one hour or more at some point in the construction period.

Therefore, U.F. = 1, and $10 \log(U.F.) = 0$

Hence, the Equation simplifies to: $Leq(equip) = E.L. - 20 \log(D/50) - 10G \log(D/50)$

2. Free-field conditions are assumed and ground effects are ignored. Consequently, G = 0.

Hence, the Equation further simplifies to: $Leq(equip) = E.L. - 20 \log(D/50)$

Solving for distance (D) yields: $D = 50 * 10^{(Leq - E.L.) / -20}$

Equipment	E.L. (from Table 12-1)	Leq at Distance
		442 feet
Forklift	84 dBA. Leq	65.1
Crane	83 dBA. Leq	64.1
Excavator	85 dBA. Leq	66.1
Dozer	85 dBA. Leq	66.1
Compactor	82 dBA. Leq	63.1
Loader	85 dBA. Leq	66.1
Dump Truck	88 dBA. Leq	69.1
Scrapers	89 dBA. Leq	70.1
Grader	85 dBA. Leq	66.1
Paver	89 dBA. Leq	70.1
Vibrator Compactor	82 dBA. Leq	63.1
Two Noisiest (Scraper & Paver)	92.0 dBA. Leq	73.1

DMU / EMU Alternative with Maintenance Facility

#	segments	nearest receptor to construction
3	Dublin/Pleasanton Station Cross Transfer Platform	
4	Hopyard to Hacienda Drive	
5	Hacienda Interchange	
6	Hacienda to Tassajara	Single-Family Housing at 5200 Iron Horse Parkway
7	Tassajara Interchange	442 feet south of Alt 2 construction
8	Tassajara to Fallon	
9	Fallon Interchange	
10	Fallon to Airway	
11	Airway Interchange	
12	Airway to Isabel Station	
13	Isabel Interchange	
15	Isabel Station DMU EMUT	
16	Parking Garage / Surface South	
17	Isabel Station to yard	
18	Maintenance Facility /Yard	

FTA General Noise Assessment Calculations for Construction Equipment

Underlying Equation from FTA Guidance Page 12-3

$$Leq(equip) = E.L. + 10 \log(U.F.) - 20 \log(D/50) - 10G \log(D/50)$$

where: Leq (equip) = the Leq at a receiver resulting from the operation of a single piece of equipment over a specified time period
 E.L. = the noise emission level of the particular piece of equipment at the reference distance of 50 feet, taken from Table 12-1
 G = a constant that accounts for topography and ground effects, taken from Figure 6-5 (Chapter 6)
 D = the distance from the receiver to the piece of equipment, and
 U.F. = a usage factor that accounts for the fraction of time that the equipment is in use over the specified time period.

For general assessment, FTA identifies the following assumptions:

1. Full power operation for a time period of one hour is assumed because most construction equipment operates continuously for periods of one hour or more at some point in the construction period.

Therefore, U.F. = 1, and $10 \log(U.F.) = 0$

Hence, the Equation simplifies to: $Leq(equip) = E.L. - 20 \log(D/50) - 10G \log(D/50)$

2. Free-field conditions are assumed and ground effects are ignored. Consequently, G = 0.

Hence, the Equation further simplifies to: $Leq(equip) = E.L. - 20 \log(D/50)$

Solving for distance (D) yields: $D = 50 * 10^{(Leq - E.L.) / -20}$

Equipment	E.L. (from Table 12-1)	Leq at Distance
		855 feet
Forklift	84 dBA. Leq	59.3
Crane	83 dBA. Leq	58.3
Excavator	85 dBA. Leq	60.3
Dozer	85 dBA. Leq	60.3
Compactor	82 dBA. Leq	57.3
Loader	85 dBA. Leq	60.3
Dump Truck	88 dBA. Leq	63.3
Scrapers	89 dBA. Leq	64.3
Grader	85 dBA. Leq	60.3
Paver	89 dBA. Leq	64.3
Vibrator Compactor	82 dBA. Leq	57.3
Two Noisiest (Scraper & Paver)	92.0 dBA. Leq	67.3

DMU / EMU Alternative with Maintenance Facility

#	segments	nearest receptor to construction
3	Dublin/Pleasanton Station Cross Transfer Platform	
4	Hopyard to Hacienda Drive	
5	Hacienda Interchange	
6	Hacienda Drive to Tassajara Road	
7	Tassajara Road/I-580 Interchange	Single-Family Housing
8	Tassajara Road to Fallon	855 feet southeast of Alt 2 construction
9	Fallon Interchange	
10	Fallon to Airway	
11	Airway Interchange	
12	Airway to Isabel Station	
13	Isabel Interchange	
15	Isabel Station DMU EMU	
16	Parking Garage / Surface South	
17	Isabel Station to yard	
18	Maintenance Facility /Yard	

FTA General Noise Assessment Calculations for Construction Equipment

Underlying Equation from FTA Guidance Page 12-3

$$Leq(equip) = E.L. + 10 \log(U.F.) - 20 \log(D/50) - 10G \log(D/50)$$

where: Leq (equip) = the Leq at a receiver resulting from the operation of a single piece of equipment over a specified time period
 E.L. = the noise emission level of the particular piece of equipment at the reference distance of 50 feet, taken from Table 12-1
 G = a constant that accounts for topography and ground effects, taken from Figure 6-5 (Chapter 6)
 D = the distance from the receiver to the piece of equipment, and
 U.F. = a usage factor that accounts for the fraction of time that the equipment is in use over the specified time period.

For general assessment, FTA identifies the following assumptions:

1. Full power operation for a time period of one hour is assumed because most construction equipment operates continuously for periods of one hour or more at some point in the construction period.

Therefore, U.F. = 1, and $10 \log(U.F.) = 0$

Hence, the Equation simplifies to: $Leq(equip) = E.L. - 20 \log(D/50) - 10G \log(D/50)$

2. Free-field conditions are assumed and ground effects are ignored. Consequently, $G = 0$.

Hence, the Equation further simplifies to: $Leq(equip) = E.L. - 20 \log(D/50)$

Solving for distance (D) yields: $D = 50 * 10^{(Leq - E.L.) / -20}$

Equipment	E.L. (from Table 12-1)	Leq at Distance
		170 feet
Forklift	84 dBA. Leq	73.4
Crane	83 dBA. Leq	72.4
Excavator	85 dBA. Leq	74.4
Dozer	85 dBA. Leq	74.4
Compactor	82 dBA. Leq	71.4
Loader	85 dBA. Leq	74.4
Dump Truck	88 dBA. Leq	77.4
Scrapers	89 dBA. Leq	78.4
Grader	85 dBA. Leq	74.4
Paver	89 dBA. Leq	78.4
Vibrator Compactor	82 dBA. Leq	71.4
Two Noisiest (Scraper & Paver)	92.0 dBA. Leq	81.4

DMU / EMU Alternative with Maintenance Facility

#	segments	nearest receptor to construction
3	Dublin/Pleasanton Station Cross Transfer Platform	
4	Hopyard to Hacienda Drive	
5	Hacienda Interchange	
6	Hacienda Drive to Tassajara Road	
7	Tassajara Road/I-580 Interchange	
8	Tassajara Road to Fallon	Single-Family Housing
9	Fallon Interchange	170 feet south of Alt 2 construction
10	Fallon to Airway	
11	Airway Interchange	
12	Airway to Isabel Station	
13	Isabel Interchange	
15	Isabel Station DMU EMU	
16	Parking Garage / Surface South	
17	Isabel Station to yard	
18	Maintenance Facility/yard	

FTA General Noise Assessment Calculations for Construction Equipment

Underlying Equation from FTA Guidance Page 12-3

$$Leq(equip) = E.L. + 10 \log(U.F.) - 20 \log(D/50) - 10G \log(D/50)$$

where: Leq (equip) = the Leq at a receiver resulting from the operation of a single piece of equipment over a specified time period
 E.L. = the noise emission level of the particular piece of equipment at the reference distance of 50 feet, taken from Table 12-1
 G = a constant that accounts for topography and ground effects, taken from Figure 6-5 (Chapter 6)
 D = the distance from the receiver to the piece of equipment, and
 U.F. = a usage factor that accounts for the fraction of time that the equipment is in use over the specified time period.

For general assessment, FTA identifies the following assumptions:

1. Full power operation for a time period of one hour is assumed because most construction equipment operates continuously for periods of one hour or more at some point in the construction period.

Therefore, U.F. = 1, and $10 \log(U.F.) = 0$

Hence, the Equation simplifies to: $Leq(equip) = E.L. - 20 \log(D/50) - 10G \log(D/50)$

2. Free-field conditions are assumed and ground effects are ignored. Consequently, G = 0.

Hence, the Equation further simplifies to: $Leq(equip) = E.L. - 20 \log(D/50)$

Solving for distance (D) yields: $D = 50 * 10^{(Leq - E.L.) / -20}$

Equipment	E.L. (from Table 12-1)	Leq at Distance
		1000 feet
Impact Pile Drivers	101 dBA. Leq	75.0
Forklift	84 dBA. Leq	58.0
Crane	83 dBA. Leq	57.0
Excavator	85 dBA. Leq	59.0
Dozer	85 dBA. Leq	59.0
Compactor	82 dBA. Leq	56.0
Loader	85 dBA. Leq	59.0
Dump Truck	88 dBA. Leq	62.0
Scrapers	89 dBA. Leq	63.0
Grader	85 dBA. Leq	59.0
Paver	89 dBA. Leq	63.0
Vibrator Compactor	82 dBA. Leq	56.0
Two Noisiest (Scraper & Pile driver)	101.3 dBA. Leq	75.3

DMU / EMU Alternative with Maintenance Facility

#	segments	nearest receptor to construction
3	Dublin/Pleasanton Station Cross Transfer Platform	
4	Hopyard to Hacienda Drive	
5	Hacienda Interchange	
6	Hacienda Drive to Tassajara Road	
7	Tassajara Road/I-580 Interchange	
8	Tassajara Road to Fallon	
9	Fallon Road/I-580 Interchange	
10	Fallon Road to Airway Boulevard	
11	Airway Boulevard/I-580 Interchange	
12	Airway Boulevard to Isabel Station	1000 feet
13	Isabel Interchange	
15	Isabel Station DMU EMU	
16	Parking Garage / Surface South	
17	Isabel Station to yard	
18	Maintennace Facility /Yard	

FTA General Noise Assessment Calculations for Construction Equipment

Underlying Equation from FTA Guidance Page 12-3

$$Leq(equip) = E.L. + 10 \log(U.F.) - 20 \log(D/50) - 10G \log(D/50)$$

where: Leq (equip) = the Leq at a receiver resulting from the operation of a single piece of equipment over a specified time period
 E.L. = the noise emission level of the particular piece of equipment at the reference distance of 50 feet, taken from Table 12-1
 G = a constant that accounts for topography and ground effects, taken from Figure 6-5 (Chapter 6)
 D = the distance from the receiver to the piece of equipment, and
 U.F. = a usage factor that accounts for the fraction of time that the equipment is in use over the specified time period.

For general assessment, FTA identifies the following assumptions:

1. Full power operation for a time period of one hour is assumed because most construction equipment operates continuously for periods of one hour or more at some point in the construction period.

Therefore, U.F. = 1, and $10 \log(U.F.) = 0$

Hence, the Equation simplifies to: $Leq(equip) = E.L. - 20 \log(D/50) - 10G \log(D/50)$

2. Free-field conditions are assumed and ground effects are ignored. Consequently, $G = 0$.

Hence, the Equation further simplifies to: $Leq(equip) = E.L. - 20 \log(D/50)$

Solving for distance (D) yields: $D = 50 * 10^{(Leq - E.L.) / -20}$

Equipment	E.L. (from Table 12-1)	Leq at Distance
		1100 feet
Forklift	84 dBA. Leq	57.2
Crane	83 dBA. Leq	56.2
Excavator	85 dBA. Leq	58.2
Dozer	85 dBA. Leq	58.2
Compactor	82 dBA. Leq	55.2
Loader	85 dBA. Leq	58.2
Dump Truck	88 dBA. Leq	61.2
Scrapers	89 dBA. Leq	62.2
Grader	85 dBA. Leq	58.2
Paver	89 dBA. Leq	62.2
Vibrator Compactor	82 dBA. Leq	55.2
Two Noisiest (Scraper & Paver)	92.0 dBA. Leq	65.2

DMU / EMU Alternative with Maintenance Facility

#	segments	nearest receptor to construction
3	Dublin/Pleasanton Station Cross Transfer Platform	
4	Hopyard to Hacienda Drive	
5	Dublin/Pleasanton Station to Hacienda Drive	
6	Hacienda Drive to Tassajara Road	
7	Tassajara Road/I-580 Interchange	
8	Tassajara Road to Fallon	
9	Fallon Road/I-580 Interchange	
10	Fallon Road to Airway Boulevard	
11	Airway Boulevard/I-580 Interchange	
12	Airway Boulevard to Isabel Station	
13	Isabel Interchange	1100 feet
15	Isabel Station DMU EMU	
16	Parking Garage / Surface South	
17	Isabel Station to yard	
18	Maintenance Facility /Yard	

FTA General Noise Assessment Calculations for Construction Equipment

Underlying Equation from FTA Guidance Page 12-3

$$Leq(equip) = E.L. + 10 \log(U.F.) - 20 \log(D/50) - 10G \log(D/50)$$

where: Leq (equip) = the Leq at a receiver resulting from the operation of a single piece of equipment over a specified time period
 E.L. = the noise emission level of the particular piece of equipment at the reference distance of 50 feet, taken from Table 12-1
 G = a constant that accounts for topography and ground effects, taken from Figure 6-5 (Chapter 6)
 D = the distance from the receiver to the piece of equipment, and
 U.F. = a usage factor that accounts for the fraction of time that the equipment is in use over the specified time period.

For general assessment, FTA identifies the following assumptions:

1. Full power operation for a time period of one hour is assumed because most construction equipment operates continuously for periods of one hour or more at some point in the construction period.

Therefore, U.F. = 1, and $10 \log(U.F.) = 0$

Hence, the Equation simplifies to: $Leq(equip) = E.L. - 20 \log(D/50) - 10G \log(D/50)$

2. Free-field conditions are assumed and ground effects are ignored. Consequently, G = 0.

Hence, the Equation further simplifies to: $Leq(equip) = E.L. - 20 \log(D/50)$

Solving for distance (D) yields: $D = 50 * 10^{(Leq - E.L.) / -20}$

Equipment	E.L. (from Table 12-1)	Leq at Distance	
			1100 feet
Impact Pile Drivers	101 dBA. Leq		74.2
Forklift	84 dBA. Leq		57.2
Crane	83 dBA. Leq		56.2
Excavator	85 dBA. Leq		58.2
Dozer	85 dBA. Leq		58.2
Compactor	82 dBA. Leq		55.2
Loader	85 dBA. Leq		58.2
Dump Truck	88 dBA. Leq		61.2
Scrapers	89 dBA. Leq		62.2
Grader	85 dBA. Leq		58.2
Paver	89 dBA. Leq		62.2
Vibrator Compactor	82 dBA. Leq		55.2
Two Noisiest (Scraper & Pile Drive)	101.3 dBA. Leq		74.5

DMU / EMU Alternative with Maintenance Facility

#	segments	nearest receptor to construction
3	Dublin/Pleasanton Station Cross Transfer Platform	
4	Hopyard to Hacienda Drive	
5	Hacienda Interchange	
6	Hacienda Drive to Tassajara Road	
7	Tassajara Road/I-580 Interchange	
8	Tassajara Road to Fallon	
9	Fallon Road/I-580 Interchange	
10	Fallon Road to Airway Boulevard	
11	Airway Boulevard/I-580 Interchange	
12	Airway Boulevard to Isabel Station	
13	Isabel Interchange	
15	Isabel Station DMU EMU	1200
16	Parking Garage / Surface South	
17	Isabel Station to yard	
18	Maintenance Facility /Yard	

FTA General Noise Assessment Calculations for Construction Equipment

Underlying Equation from FTA Guidance Page 12-3

$$Leq(equip) = E.L. + 10 \log(U.F.) - 20 \log(D/50) - 10G \log(D/50)$$

where: Leq (equip) = the Leq at a receiver resulting from the operation of a single piece of equipment over a specified time period
 E.L. = the noise emission level of the particular piece of equipment at the reference distance of 50 feet, taken from Table 12-1
 G = a constant that accounts for topography and ground effects, taken from Figure 6-5 (Chapter 6)
 D = the distance from the receiver to the piece of equipment, and
 U.F. = a usage factor that accounts for the fraction of time that the equipment is in use over the specified time period.

For general assessment, FTA identifies the following assumptions:

1. Full power operation for a time period of one hour is assumed because most construction equipment operates continuously for periods of one hour or more at some point in the construction period.

Therefore, U.F. = 1, and $10 \log(U.F.) = 0$

Hence, the Equation simplifies to: $Leq(equip) = E.L. - 20 \log(D/50) - 10G \log(D/50)$

2. Free-field conditions are assumed and ground effects are ignored. Consequently, G = 0.

Hence, the Equation further simplifies to: $Leq(equip) = E.L. - 20 \log(D/50)$

Solving for distance (D) yields: $D = 50 * 10^{(Leq - E.L.) / -20}$

Equipment	E.L. (from Table 12-1)	Leq at Distance
		1400 feet
Impact Pile Drivers	101 dBA. Leq	72.1
Forklift	84 dBA. Leq	55.1
Crane	83 dBA. Leq	54.1
Excavator	85 dBA. Leq	56.1
Dozer	85 dBA. Leq	56.1
Compactor	82 dBA. Leq	53.1
Loader	85 dBA. Leq	56.1
Dump Truck	88 dBA. Leq	59.1
Scrapers	89 dBA. Leq	60.1
Grader	85 dBA. Leq	56.1
Paver	89 dBA. Leq	60.1
Vibrator Compactor	82 dBA. Leq	53.1
Two Noisiest (Scraper & Pile Driver)	101.3 dBA. Leq	72.4

DMU / EMU Alternative with Maintenance Facility

#	segments	nearest receptor to construction
3	Dublin/Pleasanton Station Cross Transfer Platform	
4	Hopyard to Hacienda Drive	
5	Hacienda Interchange	
6	Hacienda Drive to Tassajara Road	
7	Tassajara Road/I-580 Interchange	
8	Tassajara Road to Fallon	
9	Fallon Road/I-580 Interchange	
10	Fallon Road to Airway Boulevard	
11	Airway Boulevard/I-580 Interchange	
12	Airway Boulevard to Isabel BART Station	
13	Isabel Interchange	
15	Isabel Station DMU EMU	
16	Parking Garage / Surface South	1400
17	Isabel Station to yard	
18	Maintenance Facility /Yard	
19	Tail Track Yard	

FTA General Noise Assessment Calculations for Construction Equipment

Underlying Equation from FTA Guidance Page 12-3

$$Leq(equip) = E.L. + 10 \log(U.F.) - 20 \log(D/50) - 10G \log(D/50)$$

where: Leq (equip) = the Leq at a receiver resulting from the operation of a single piece of equipment over a specified time period
 E.L. = the noise emission level of the particular piece of equipment at the reference distance of 50 feet, taken from Table 12-1
 G = a constant that accounts for topography and ground effects, taken from Figure 6-5 (Chapter 6)
 D = the distance from the receiver to the piece of equipment, and
 U.F. = a usage factor that accounts for the fraction of time that the equipment is in use over the specified time period.

For general assessment, FTA identifies the following assumptions:

1. Full power operation for a time period of one hour is assumed because most construction equipment operates continuously for periods of one hour or more at some point in the construction period.

Therefore, U.F. = 1, and $10 \log(U.F.) = 0$

Hence, the Equation simplifies to: $Leq(equip) = E.L. - 20 \log(D/50) - 10G \log(D/50)$

2. Free-field conditions are assumed and ground effects are ignored. Consequently, G = 0.

Hence, the Equation further simplifies to: $Leq(equip) = E.L. - 20 \log(D/50)$

Solving for distance (D) yields: $D = 50 * 10^{(Leq - E.L.) / -20}$

Equipment	E.L. (from Table 12-1)	Leq at Distance
		430 feet
Forklift	84 dBA. Leq	65.3
Crane	83 dBA. Leq	64.3
Excavator	85 dBA. Leq	66.3
Dozer	85 dBA. Leq	66.3
Compactor	82 dBA. Leq	63.3
Loader	85 dBA. Leq	66.3
Dump Truck	88 dBA. Leq	69.3
Scrapers	89 dBA. Leq	70.3
Grader	85 dBA. Leq	66.3
Paver	89 dBA. Leq	70.3
Vibrator Compactor	82 dBA. Leq	63.3
Two Noisiest (Scraper & Paver)	92.0 dBA. Leq	73.3

DMU / EMU Alternative with Maintenance Facility

#	segments	nearest receptor to construction
3	Dublin/Pleasanton Station Cross Transfer Platform	
4	Hopyard to Hacienda Drive	
5	Hacienda Interchange	
6	Hacienda Drive to Tassajara Road	
7	Tassajara Road/I-580 Interchange	
8	Tassajara Road to Fallon	
9	Fallon Road/I-580 Interchange	
10	Fallon Road to Airway Boulevard	
11	Airway Boulevard/I-580 Interchange	
12	Airway Boulevard to Isabel Station	
13	Isabel Interchange	
15	Isabel Station DMU EMU	
16	Parking Garage / Surface South	
17	Isabel Station to yard	430 feet
18	Maintenance Facility/Yard	

FTA General Noise Assessment Calculations for Construction Equipment

Underlying Equation from FTA Guidance Page 12-3

$$Leq(equip) = E.L. + 10 \log(U.F.) - 20 \log(D/50) - 10G \log(D/50)$$

where: Leq (equip) = the Leq at a receiver resulting from the operation of a single piece of equipment over a specified time period
 E.L. = the noise emission level of the particular piece of equipment at the reference distance of 50 feet, taken from Table 12-1
 G = a constant that accounts for topography and ground effects, taken from Figure 6-5 (Chapter 6)
 D = the distance from the receiver to the piece of equipment, and
 U.F. = a usage factor that accounts for the fraction of time that the equipment is in use over the specified time period.

For general assessment, FTA identifies the following assumptions:

1. Full power operation for a time period of one hour is assumed because most construction equipment operates continuously for periods of one hour or more at some point in the construction period.

Therefore, U.F. = 1, and $10 \log(U.F.) = 0$

Hence, the Equation simplifies to: $Leq(equip) = E.L. - 20 \log(D/50) - 10G \log(D/50)$

2. Free-field conditions are assumed and ground effects are ignored. Consequently, G = 0.

Hence, the Equation further simplifies to: $Leq(equip) = E.L. - 20 \log(D/50)$

Solving for distance (D) yields: $D = 50 * 10^{(Leq - E.L.) / -20}$

Equipment	E.L. (from Table 12-1)	Leq at Distance
		1900 feet
Forklift	84 dBA. Leq	52.4
Crane	83 dBA. Leq	51.4
Excavator	85 dBA. Leq	53.4
Dozer	85 dBA. Leq	53.4
Compactor	82 dBA. Leq	50.4
Loader	85 dBA. Leq	53.4
Dump Truck	88 dBA. Leq	56.4
Scrapers	89 dBA. Leq	57.4
Grader	85 dBA. Leq	53.4
Paver	89 dBA. Leq	57.4
Vibrator Compactor	82 dBA. Leq	50.4
Two Noisiest (Scraper & Paver)	92.0 dBA. Leq	60.4

DMU / EMU Alternative with Maintenance Facility

#	segments	nearest receptor to construction
3	Dublin/Pleasanton Station Cross Transfer Platform	
4	Hopyard to Hacienda Drive	
5	Hacienda Interchange	
6	Hacienda Drive to Tassajara Road	
7	Tassajara Road/I-580 Interchange	
8	Tassajara Road to Fallon	
9	Fallon Road/I-580 Interchange	
10	Fallon Road to Airway Boulevard	
11	Airway Boulevard/I-580 Interchange	
12	Airway Boulevard to Isabel Station	
13	Isabel Interchange	
15	Isabel Station DMU EMU	s
16	Parking Garage / Surface South	
17	Isabel Station to yard	
18	Maintenance Facility/Yard	1900 feet

FTA General Noise Assessment Calculations for Construction Equipment

Underlying Equation from FTA Guidance Page 12-3

$$Leq(equip) = E.L. + 10 \log(U.F.) - 20 \log(D/50) - 10G \log(D/50)$$

where: Leq (equip) = the Leq at a receiver resulting from the operation of a single piece of equipment over a specified time period
 E.L. = the noise emission level of the particular piece of equipment at the reference distance of 50 feet, taken from Table 12-1
 G = a constant that accounts for topography and ground effects, taken from Figure 6-5 (Chapter 6)
 D = the distance from the receiver to the piece of equipment, and
 U.F. = a usage factor that accounts for the fraction of time that the equipment is in use over the specified time period.

For general assessment, FTA identifies the following assumptions:

1. Full power operation for a time period of one hour is assumed because most construction equipment operates continuously for periods of one hour or more at some point in the construction period.

Therefore, U.F. = 1, and $10 \log(U.F.) = 0$

Hence, the Equation simplifies to: $Leq(equip) = E.L. - 20 \log(D/50) - 10G \log(D/50)$

2. Free-field conditions are assumed and ground effects are ignored. Consequently, G = 0.

Hence, the Equation further simplifies to: $Leq(equip) = E.L. - 20 \log(D/50)$

Solving for distance (D) yields: $D = 50 * 10^{(Leq - E.L.) / -20}$

Equipment	E.L. (from Table 12-1)	Leq at Distance
		1,100 feet
Forklift	84 dBA. Leq	57.2
Crane	83 dBA. Leq	56.2
Excavator	85 dBA. Leq	58.2
Dozer	85 dBA. Leq	58.2
Compactor	82 dBA. Leq	55.2
Loader	85 dBA. Leq	58.2
Dump Truck	88 dBA. Leq	61.2
Scrapers	89 dBA. Leq	62.2
Grader	85 dBA. Leq	58.2
Paver	89 dBA. Leq	62.2
Vibrator Compactor	82 dBA. Leq	55.2
Two Noisiest (Scraper & Paver)	92.0 dBA. Leq	65.2

Alternative 3 - Express Bus

#	segments	nearest receptor to construction
2	Hopyard Interchange	1,100 feet
3	Dublin/Pleasanton Station Cross Transfer Platform	
4	Hopyard to Hacienda Drive	
5	Hacienda Interchange	

FTA General Noise Assessment Calculations for Construction Equipment

Underlying Equation from FTA Guidance Page 12-3

$$Leq(equip) = E.L. + 10 \log(U.F.) - 20 \log(D/50) - 10G \log(D/50)$$

where: Leq (equip) = the Leq at a receiver resulting from the operation of a single piece of equipment over a specified time period
 E.L. = the noise emission level of the particular piece of equipment at the reference distance of 50 feet, taken from Table 12-1
 G = a constant that accounts for topography and ground effects, taken from Figure 6-5 (Chapter 6)
 D = the distance from the receiver to the piece of equipment, and
 U.F. = a usage factor that accounts for the fraction of time that the equipment is in use over the specified time period.

For general assessment, FTA identifies the following assumptions:

1. Full power operation for a time period of one hour is assumed because most construction equipment operates continuously for periods of one hour or more at some point in the construction period.

Therefore, U.F. = 1, and $10 \log(U.F.) = 0$

Hence, the Equation simplifies to: $Leq(equip) = E.L. - 20 \log(D/50) - 10G \log(D/50)$

2. Free-field conditions are assumed and ground effects are ignored. Consequently, G = 0.

Hence, the Equation further simplifies to: $Leq(equip) = E.L. - 20 \log(D/50)$

Solving for distance (D) yields: $D = 50 * 10^{(Leq - E.L.) / -20}$

Equipment	E.L. (from Table 12-1)	Leq at Distance
		370 feet
Impact Pile Drivers	101 dBA. Leq	83.6
Forklift	84 dBA. Leq	66.6
Crane	83 dBA. Leq	65.6
Excavator	85 dBA. Leq	67.6
Dozer	85 dBA. Leq	67.6
Compactor	82 dBA. Leq	64.6
Loader	85 dBA. Leq	67.6
Dump Truck	88 dBA. Leq	70.6
Scrapers	89 dBA. Leq	71.6
Grader	85 dBA. Leq	67.6
Paver	89 dBA. Leq	71.6
Vibrator Compactor	82 dBA. Leq	64.6
Two Noisiest (Scraper & Pile Driver)	101.3 dBA. Leq	83.9

Alternative 3 - Express Bus

#	segments	nearest receptor to construction
2	Hopyard Interchange	
3	Dublin/Pleasanton Station Cross Transfer Platform	370 feet
4	Hopyard to Hacienda Drive	
5	Hacienda Interchange	

FTA General Noise Assessment Calculations for Construction Equipment

Underlying Equation from FTA Guidance Page 12-3

$$Leq(equip) = E.L. + 10 \log(U.F.) - 20 \log(D/50) - 10G \log(D/50)$$

where: Leq (equip) = the Leq at a receiver resulting from the operation of a single piece of equipment over a specified time period
 E.L. = the noise emission level of the particular piece of equipment at the reference distance of 50 feet, taken from Table 12-1
 G = a constant that accounts for topography and ground effects, taken from Figure 6-5 (Chapter 6)
 D = the distance from the receiver to the piece of equipment, and
 U.F. = a usage factor that accounts for the fraction of time that the equipment is in use over the specified time period.

For general assessment, FTA identifies the following assumptions:

1. Full power operation for a time period of one hour is assumed because most construction equipment operates continuously for periods of one hour or more at some point in the construction period.

Therefore, U.F. = 1, and $10 \log(U.F.) = 0$

Hence, the Equation simplifies to: $Leq(equip) = E.L. - 20 \log(D/50) - 10G \log(D/50)$

2. Free-field conditions are assumed and ground effects are ignored. Consequently, G = 0.

Hence, the Equation further simplifies to: $Leq(equip) = E.L. - 20 \log(D/50)$

Solving for distance (D) yields: $D = 50 * 10^{(Leq - E.L.) / -20}$

Equipment	E.L. (from Table 12-1)	Leq at Distance
		370 feet
Forklift	84 dBA. Leq	66.6
Crane	83 dBA. Leq	65.6
Excavator	85 dBA. Leq	67.6
Dozer	85 dBA. Leq	67.6
Compactor	82 dBA. Leq	64.6
Loader	85 dBA. Leq	67.6
Dump Truck	88 dBA. Leq	70.6
Scrapers	89 dBA. Leq	71.6
Grader	85 dBA. Leq	67.6
Paver	89 dBA. Leq	71.6
Vibrator Compactor	82 dBA. Leq	64.6
Two Noisiest (Scraper & Paver)	92.0 dBA. Leq	74.6

Alternative 3 - Express Bus

#	segments	nearest receptor to construction
2	Hopyard Interchange	
3	Dublin/Pleasanton Station Cross Transfer Platform	
4	Hopyard to Hacienda Drive	Multi Family Housing at 5200 Iron Horse Parkway
5	Hacienda Interchange	370 feet north of Alt 2 construction
6	Hacienda to Tassajara	
7	Tassajara Interchange	
8	Tassajara to Fallon	
9	Fallon Interchange	
10	Fallon to Airway	
11	Airway Interchange	
12	Airway to Isabel Station	
13	Isabel Interchange	
15	Isabel Station DMU EMU	
16	Parking Garage / Surface South	
17	Isabel Station to yard	
18	Maintenance Facility /yard	

FTA General Noise Assessment Calculations for Construction Equipment

Underlying Equation from FTA Guidance Page 12-3

$$Leq(equip) = E.L. + 10 \log(U.F.) - 20 \log(D/50) - 10G \log(D/50)$$

where: Leq (equip) = the Leq at a receiver resulting from the operation of a single piece of equipment over a specified time period
 E.L. = the noise emission level of the particular piece of equipment at the reference distance of 50 feet, taken from Table 12-1
 G = a constant that accounts for topography and ground effects, taken from Figure 6-5 (Chapter 6)
 D = the distance from the receiver to the piece of equipment, and
 U.F. = a usage factor that accounts for the fraction of time that the equipment is in use over the specified time period.

For general assessment, FTA identifies the following assumptions:

1. Full power operation for a time period of one hour is assumed because most construction equipment operates continuously for periods of one hour or more at some point in the construction period.

Therefore, U.F. = 1, and $10 \log(U.F.) = 0$

Hence, the Equation simplifies to: $Leq(equip) = E.L. - 20 \log(D/50) - 10G \log(D/50)$

2. Free-field conditions are assumed and ground effects are ignored. Consequently, G = 0.

Hence, the Equation further simplifies to: $Leq(equip) = E.L. - 20 \log(D/50)$

Solving for distance (D) yields: $D = 50 * 10^{(Leq-E.L.)/-20}$

Equipment	E.L. (from Table 12-1)	Leq at Distance
		1150 feet
Forklift	84 dBA. Leq	56.8
Crane	83 dBA. Leq	55.8
Excavator	85 dBA. Leq	57.8
Dozer	85 dBA. Leq	57.8
Compactor	82 dBA. Leq	54.8
Loader	85 dBA. Leq	57.8
Dump Truck	88 dBA. Leq	60.8
Scrapers	89 dBA. Leq	61.8
Grader	85 dBA. Leq	57.8
Paver	89 dBA. Leq	61.8
Vibrator Compactor	82 dBA. Leq	54.8
Two Noisiest (Scraper & Paver)	92.0 dBA. Leq	64.8

Alternative 3 - Express Bus

#	segments	nearest receptor to construction
2	Hopyard Interchange	
3	Dublin/Pleasanton Station Cross Transfer Platform	
4	Hopyard to Hacienda Drive	
5	Hacienda Interchange	1,150 feet

FTA General Noise Assessment Calculations for Construction Equipment

Underlying Equation from FTA Guidance Page 12-3

$$Leq(equip) = E.L. + 10 \log(U.F.) - 20 \log(D/50) - 10G \log(D/50)$$

where: Leq (equip) = the Leq at a receiver resulting from the operation of a single piece of equipment over a specified time period
 E.L. = the noise emission level of the particular piece of equipment at the reference distance of 50 feet, taken from Table 12-1
 G = a constant that accounts for topography and ground effects, taken from Figure 6-5 (Chapter 6)
 D = the distance from the receiver to the piece of equipment, and
 U.F. = a usage factor that accounts for the fraction of time that the equipment is in use over the specified time period.

For general assessment, FTA identifies the following assumptions:

1. Full power operation for a time period of one hour is assumed because most construction equipment operates continuously for periods of one hour or more at some point in the construction period.

Therefore, U.F. = 1, and $10 \log(U.F.) = 0$

Hence, the Equation simplifies to: $Leq(equip) = E.L. - 20 \log(D/50) - 10G \log(D/50)$

2. Free-field conditions are assumed and ground effects are ignored. Consequently, G = 0.

Hence, the Equation further simplifies to: $Leq(equip) = E.L. - 20 \log(D/50)$

Solving for distance (D) yields: $D = 50 * 10^{(Leq - E.L.) / -20}$

Equipment	E.L. (from Table 12-1)	Leq at Distance
		370 feet
Forklift	84 dBA. Leq	66.6
Crane	83 dBA. Leq	65.6
Excavator	85 dBA. Leq	67.6
Dozer	85 dBA. Leq	67.6
Compactor	82 dBA. Leq	64.6
Loader	85 dBA. Leq	67.6
Dump Truck	88 dBA. Leq	70.6
Scrapers	89 dBA. Leq	71.6
Grader	85 dBA. Leq	67.6
Paver	89 dBA. Leq	71.6
Vibrator Compactor	82 dBA. Leq	64.6
Two Noisiest (Scraper & Paver)	92.0 dBA. Leq	74.6

BART and DMU Alts

segments nearest receptor to construction
0.5 Dougherty to Hacienda 370 feet

FTA General Noise Assessment Calculations for Construction Equipment

Underlying Equation from FTA Guidance Page 12-3

$$Leq(equip) = E.L. + 10 \log(U.F.) - 20 \log(D/50) - 10G \log(D/50)$$

where: Leq (equip) = the Leq at a receiver resulting from the operation of a single piece of equipment over a specified time period
 E.L. = the noise emission level of the particular piece of equipment at the reference distance of 50 feet, taken from Table 12-1
 G = a constant that accounts for topography and ground effects, taken from Figure 6-5 (Chapter 6)
 D = the distance from the receiver to the piece of equipment, and
 U.F. = a usage factor that accounts for the fraction of time that the equipment is in use over the specified time period.

For general assessment, FTA identifies the following assumptions:

1. Full power operation for a time period of one hour is assumed because most construction equipment operates continuously for periods of one hour or more at some point in the construction period.

Therefore, U.F. = 1, and $10 \log(U.F.) = 0$

Hence, the Equation simplifies to: $Leq(equip) = E.L. - 20 \log(D/50) - 10G \log(D/50)$

2. Free-field conditions are assumed and ground effects are ignored. Consequently, G = 0.

Hence, the Equation further simplifies to: $Leq(equip) = E.L. - 20 \log(D/50)$

Solving for distance (D) yields: $D = 50 * 10^{(Leq - E.L.) / -20}$

Equipment	E.L. (from Table 12-1)	Leq at Distance
		460 feet
Forklift	84 dBA. Leq	64.7
Crane	83 dBA. Leq	63.7
Excavator	85 dBA. Leq	65.7
Dozer	85 dBA. Leq	65.7
Compactor	82 dBA. Leq	62.7
Loader	85 dBA. Leq	65.7
Dump Truck	88 dBA. Leq	68.7
Scrapers	89 dBA. Leq	69.7
Grader	85 dBA. Leq	65.7
Paver	89 dBA. Leq	69.7
Vibrator Compactor	82 dBA. Leq	62.7
Two Noisiest (Scraper & Paver)	92.0 dBA. Leq	72.7

BRT Alternative

#	segments	nearest receptor to construction
21	Laughlin Parking Lot	460 feet

G.4 Noise Model Data – Construction Vibration Calculations

Vibration propagation from Construction Equipment
Proposed Project - BART Extension with Storage Facility
Tail Track to Main Line

Formula from FTA, 2006 = $PPV_{equip} = PPV_{ref} \times (25/D)^{1.5}$
 where

Segment 0.5

Tail Track conversion		PPV@25ft
PPV refs @ 25 ft =	pile driver (impact)	0.644
	Vibratory Roller	0.21
	Bulldozer (large)	0.089
	Truck (loaded)	0.076
	Jackhammer	0.035

Enter distance = Adjacent Buildings

Resultant PPV =	pile driver (impact)	0.011311
	Vibratory Roller	0.003688
	Bulldozer (large)	0.001563
	Truck (loaded)	0.001335
	Jackhammer	0.000615

	Lv@25 ft	
pile driver (impact)		104
Vibratory Roller		94
Bulldozer (large)		87
Truck (loaded)		86
Jackhammer		79

Formula from FTA 2006 = $Lv(D) = Lv(25 \text{ ft}) - 30 \log(D/25)$

Resultant Lv =	pile driver (impact)	68.89215
	Vibratory Roller	58.89215
	Bulldozer (large)	51.89215
	Truck (loaded)	50.89215
	Jackhammer	43.89215

Vibration propagation from Construction Equipment

Proposed Project - BART Extension with Storage Facility

Formula from FTA, 2006 = $PPV_{equip} = PPV_{ref} \times (25/D)^{1.5}$
 where

Segment 5-Dublin/Pleasanton Station to Hacienda Drive

PPV refs @ 25 ft =		PPV@25ft
	pile driver (impact)	0.644
	Vibratory Roller	0.21
	Bulldozer (large)	0.089
	Truck(loaded)	0.076
	Jackhammer	0.035

Enter distance = Adjacent Buildings

Resultant PPV =	pile driver (impact)	0.011311
	Vibratory Roller	0.003688
	Bulldozer (large)	0.001563
	Truck(loaded)	0.001335
	Jackhammer	0.000615

	Lv@25 ft
pile driver (impact)	104
Vibratory Roller	94
Bulldozer (large)	87
Truck(loaded)	86
Jackhammer	79

Formula from FTA 2006 = $Lv(D) = Lv(25 \text{ ft}) - 30\log(D/25)$

Resultant Lv =	pile driver (impact)	68.89215
	Vibratory Roller	58.89215
	Bulldozer (large)	51.89215
	Truck(loaded)	50.89215
	Jackhammer	43.89215

Vibration propagation from Construction Equipment

Proposed Project - BART Extension with Storage Facility

Formula from FTA, 2006 = $PPV_{equip} = PPV_{ref} \times (25/D)^{1.5}$
 where

Segment 6- Hacienda Drive to Tassajara Road

PPV refs @ 25 ft =		PPV@25ft
	pile driver (impact)	0.644
	Vibratory Roller	0.21
	Bulldozer (large)	0.089
	Truck(loaded)	0.076
	Jackhammer	0.035

Enter distance = Adjacent Buildings

Resultant PPV =	pile driver (impact)	0.008663
	Vibratory Roller	0.002825
	Bulldozer (large)	0.001197
	Truck(loaded)	0.001022
	Jackhammer	0.000471

	Lv@25 ft
pile driver (impact)	104
Vibratory Roller	94
Bulldozer (large)	87
Truck(loaded)	86
Jackhammer	79

Formula from FTA 2006 = $Lv(D) = Lv(25 \text{ ft}) - 30\log(D/25)$

Resultant Lv =	pile driver (impact)	66.57553
	Vibratory Roller	56.57553
	Bulldozer (large)	49.57553
	Truck(loaded)	48.57553
	Jackhammer	41.57553

Vibration propagation from Construction Equipment

Proposed Project - BART Extension with Storage Facility

Formula from FTA, 2006 = $PPV_{equip} = PPV_{ref} \times (25/D)^{1.5}$
 where

Segment7 -Tassajara Road/I-580 Interchange

PPV refs @ 25 ft =		PPV@25ft
	pile driver (impact)	0.644
	Vibratory Roller	0.21
	Bulldozer (large)	0.089
	Truck(loaded)	0.076
	Jackhammer	0.035

Enter distance = Adjacent Buildings

Resultant PPV =	pile driver (impact)	0.002207
	Vibratory Roller	0.00072
	Bulldozer (large)	0.000305
	Truck(loaded)	0.00026
	Jackhammer	0.00012

	Lv@25 ft
pile driver (impact)	104
Vibratory Roller	94
Bulldozer (large)	87
Truck(loaded)	86
Jackhammer	79

Formula from FTA 2006 = $Lv(D) = Lv(25 \text{ ft}) - 30\log(D/25)$

Resultant Lv =	pile driver (impact)	54.69642
	Vibratory Roller	44.69642
	Bulldozer (large)	37.69642
	Truck(loaded)	36.69642
	Jackhammer	29.69642

Vibration propagation from Construction Equipment

Proposed Project - BART Extension with Storage Facility

Formula from FTA, 2006 = $PPV_{equip} = PPV_{ref} \times (25/D)^{1.5}$
 where

Segment 8-Tassajara Road to Fallon Road

PPV refs @ 25 ft =		PPV@25ft
	pile driver (impact)	0.644
	Vibratory Roller	0.21
	Bulldozer (large)	0.089
	Truck(loaded)	0.076
	Jackhammer	0.035

Enter distance = Adjacent Buildings

Resultant PPV =	pile driver (impact)	0.036318
	Vibratory Roller	0.011843
	Bulldozer (large)	0.005019
	Truck(loaded)	0.004286
	Jackhammer	0.001974

	Lv@25 ft
pile driver (impact)	104
Vibratory Roller	94
Bulldozer (large)	87
Truck(loaded)	86
Jackhammer	79

Formula from FTA 2006 = $Lv(D) = Lv(25 \text{ ft}) - 30\log(D/25)$

Resultant Lv =	pile driver (impact)	79.02473
	Vibratory Roller	69.02473
	Bulldozer (large)	62.02473
	Truck(loaded)	61.02473
	Jackhammer	54.02473

0

Vibration propagation from Construction Equipment

Proposed Project - BART Extension with Storage Facility

Formula from FTA, 2006 = $PPV_{equip} = PPV_{ref} \times (25/D)^{1.5}$
 where

Segment 12 - Airway Boulevard to Isabel BART Station

PPV refs @ 25 ft =		PPV@25ft
	pile driver (impact)	0.644
	Vibratory Roller	0.21
	Bulldozer (large)	0.089
	Truck(loaded)	0.076
	Jackhammer	0.035

Enter distance = Adjacent Buildings

Resultant PPV =	pile driver (impact)	0.002546
	Vibratory Roller	0.00083
	Bulldozer (large)	0.000352
	Truck(loaded)	0.0003
	Jackhammer	0.000138

	Lv@25 ft
pile driver (impact)	104
Vibratory Roller	94
Bulldozer (large)	87
Truck(loaded)	86
Jackhammer	79

Formula from FTA 2006 = $Lv(D) = Lv(25 \text{ ft}) - 30 \log(D/25)$

Resultant Lv =	pile driver (impact)	55.9382
	Vibratory Roller	45.9382
	Bulldozer (large)	38.9382
	Truck(loaded)	37.9382
	Jackhammer	30.9382

Vibration propagation from Construction Equipment

Proposed Project - BART Extension with Storage Facility

Formula from FTA, 2006 = $PPV_{equip} = PPV_{ref} \times (25/D)^{1.5}$
 where

Segment 13 - Isabel Interchange

PPV refs @ 25 ft =		PPV@25ft
	pile driver (impact)	0.644
	Vibratory Roller	0.21
	Bulldozer (large)	0.089
	Truck(loaded)	0.076
	Jackhammer	0.035

Enter distance = Adjacent Buildings

Resultant PPV =	pile driver (impact)	0.002207
	Vibratory Roller	0.00072
	Bulldozer (large)	0.000305
	Truck(loaded)	0.00026
	Jackhammer	0.00012

	Lv@25 ft
pile driver (impact)	104
Vibratory Roller	94
Bulldozer (large)	87
Truck(loaded)	86
Jackhammer	79

Formula from FTA 2006 = $Lv(D) = Lv(25 \text{ ft}) - 30\log(D/25)$

Resultant Lv =	pile driver (impact)	54.69642
	Vibratory Roller	44.69642
	Bulldozer (large)	37.69642
	Truck(loaded)	36.69642
	Jackhammer	29.69642

Vibration propagation from Construction Equipment

Proposed Project - BART Extension with Storage Facility

Formula from FTA, 2006 = $PPV_{equip} = PPV_{ref} \times (25/D)^{1.5}$
 where

Segment 14 - Isabel Station BART

		PPV@25ft
PPV refs @ 25 ft =	pile driver (impact)	0.644
	Vibratory Roller	0.21
	Bulldozer (large)	0.089
	Truck(loaded)	0.076
	Jackhammer	0.035

Enter distance = Adjacent Buildings

Resultant PPV =	pile driver (impact)	0.001937
	Vibratory Roller	0.000631
	Bulldozer (large)	0.000268
	Truck(loaded)	0.000229
	Jackhammer	0.000105

	Lv@25 ft
pile driver (impact)	104
Vibratory Roller	94
Bulldozer (large)	87
Truck(loaded)	86
Jackhammer	79

Formula from FTA 2006 = $Lv(D) = Lv(25 \text{ ft}) - 30 \log(D/25)$

Resultant Lv =	pile driver (impact)	53.56276
	Vibratory Roller	43.56276
	Bulldozer (large)	36.56276
	Truck(loaded)	35.56276
	Jackhammer	28.56276

Vibration propagation from Construction Equipment

Proposed Project - BART Extension with Storage Facility

Formula from FTA, 2006 = $PPV_{equip} = PPV_{ref} \times (25/D)^{1.5}$
 where

Segment 16 - Parking Garage / Surface South

PPV refs @ 25 ft =		PPV@25ft
	pile driver (impact)	0.644
	Vibratory Roller	0.21
	Bulldozer (large)	0.089
	Truck(loaded)	0.076
	Jackhammer	0.035

Enter distance = Adjacent Buildings

Resultant PPV =	pile driver (impact)	0.001537
	Vibratory Roller	0.000501
	Bulldozer (large)	0.000212
	Truck(loaded)	0.000181
	Jackhammer	8.35E-05

	Lv@25 ft
pile driver (impact)	104
Vibratory Roller	94
Bulldozer (large)	87
Truck(loaded)	86
Jackhammer	79

Formula from FTA 2006 = $Lv(D) = Lv(25 \text{ ft}) - 30 \log(D/25)$

Resultant Lv =	pile driver (impact)	51.55436
	Vibratory Roller	41.55436
	Bulldozer (large)	34.55436
	Truck(loaded)	33.55436
	Jackhammer	26.55436

Vibration propagation from Construction Equipment

Proposed Project - BART Extension with Storage Facility

Formula from FTA, 2006 = $PPV_{equip} = PPV_{ref} \times (25/D)^{1.5}$
 where

Segment 17 - Isabel Station to yard

		PPV@25ft
PPV refs @ 25 ft =	pile driver (impact)	0.644
	Vibratory Roller	0.21
	Bulldozer (large)	0.089
	Truck(loaded)	0.076
	Jackhammer	0.035

Enter distance = Adjacent Buildings

Resultant PPV =	pile driver (impact)	0.009028
	Vibratory Roller	0.002944
	Bulldozer (large)	0.001248
	Truck(loaded)	0.001065
	Jackhammer	0.000491

	Lv@25 ft
pile driver (impact)	104
Vibratory Roller	94
Bulldozer (large)	87
Truck(loaded)	86
Jackhammer	79

Formula from FTA 2006 = $Lv(D) = Lv(25 \text{ ft}) - 30\log(D/25)$

Resultant Lv =	pile driver (impact)	66.93415
	Vibratory Roller	56.93415
	Bulldozer (large)	49.93415
	Truck(loaded)	48.93415
	Jackhammer	41.93415

Vibration propagation from Construction Equipment

Proposed Project - BART Extension with Storage Facility

Formula from FTA, 2006 = $PPV_{equip} = PPV_{ref} \times (25/D)^{1.5}$
 where

Segment 18 - Tail Track Yard

PPV refs @ 25 ft =		PPV@25ft
	pile driver (impact)	0.644
	Vibratory Roller	0.21
	Bulldozer (large)	0.089
	Truck(loaded)	0.076
	Jackhammer	0.035

Enter distance = Adjacent Buildings

Resultant PPV =	pile driver (impact)	0.000972
	Vibratory Roller	0.000317
	Bulldozer (large)	0.000134
	Truck(loaded)	0.000115
	Jackhammer	5.28E-05

	Lv@25 ft
pile driver (impact)	104
Vibratory Roller	94
Bulldozer (large)	87
Truck(loaded)	86
Jackhammer	79

Formula from FTA 2006 = $Lv(D) = Lv(25 \text{ ft}) - 30\log(D/25)$

Resultant Lv =	pile driver (impact)	47.57559
	Vibratory Roller	37.57559
	Bulldozer (large)	30.57559
	Truck(loaded)	29.57559
	Jackhammer	22.57559

Vibration propagation from Construction Equipment

DMU Alternative with Storage Facility

Formula from FTA, 2006 = $PPV_{equip} = PPV_{ref} \times (25/D)^{1.5}$
 where

Segment 3

PPV refs @ 25 ft =		PPV@25ft
	pile driver (impact)	0.644
	Vibratory Roller	0.21
	Bulldozer (large)	0.089
	Truck(loaded)	0.076
	Jackhammer	0.035

Enter distance = Adjacent Buildings

Resultant PPV =	pile driver (impact)	0.011311
	Vibratory Roller	0.003688
	Bulldozer (large)	0.001563
	Truck(loaded)	0.001335
	Jackhammer	0.000615

	Lv@25 ft
pile driver (impact)	104
Vibratory Roller	94
Bulldozer (large)	87
Truck(loaded)	86
Jackhammer	79

Formula from FTA 2006 = $Lv(D) = Lv(25 \text{ ft}) - 30\log(D/25)$

Resultant Lv =	pile driver (impact)	68.89215
	Vibratory Roller	58.89215
	Bulldozer (large)	51.89215
	Truck(loaded)	50.89215
	Jackhammer	43.89215

Vibration propagation from Construction Equipment

DMU Alternative with Storage Facility

Formula from FTA, 2006 = $PPV_{equip} = PPV_{ref} \times (25/D)^{1.5}$
 where

Segment 4

PPV refs @ 25 ft =		PPV@25ft
	pile driver (impact)	0.644
	Vibratory Roller	0.21
	Bulldozer (large)	0.089
	Truck(loaded)	0.076
	Jackhammer	0.035

Enter distance = Adjacent Buildings

Resultant PPV =	pile driver (impact)	0.011311
	Vibratory Roller	0.003688
	Bulldozer (large)	0.001563
	Truck(loaded)	0.001335
	Jackhammer	0.000615

	Lv@25 ft
pile driver (impact)	104
Vibratory Roller	94
Bulldozer (large)	87
Truck(loaded)	86
Jackhammer	79

Formula from FTA 2006 = $Lv(D) = Lv(25 \text{ ft}) - 30\log(D/25)$

Resultant Lv =	pile driver (impact)	68.89215
	Vibratory Roller	58.89215
	Bulldozer (large)	51.89215
	Truck(loaded)	50.89215
	Jackhammer	43.89215

Vibration propagation from Construction Equipment

DMU Alternative with Storage Facility

Formula from FTA, 2006 = $PPV_{equip} = PPV_{ref} \times (25/D)^{1.5}$
 where

Segment 6

PPV refs @ 25 ft =		PPV@25ft
	pile driver (impact)	0.644
	Vibratory Roller	0.21
	Bulldozer (large)	0.089
	Truck(loaded)	0.076
	Jackhammer	0.035

Enter distance = Adjacent Buildings

Resultant PPV =	pile driver (impact)	0.008663
	Vibratory Roller	0.002825
	Bulldozer (large)	0.001197
	Truck(loaded)	0.001022
	Jackhammer	0.000471

	Lv@25 ft
pile driver (impact)	104
Vibratory Roller	94
Bulldozer (large)	87
Truck(loaded)	86
Jackhammer	79

Formula from FTA 2006 = $Lv(D) = Lv(25 \text{ ft}) - 30\log(D/25)$

Resultant Lv =	pile driver (impact)	66.57553
	Vibratory Roller	56.57553
	Bulldozer (large)	49.57553
	Truck(loaded)	48.57553
	Jackhammer	41.57553

Vibration propagation from Construction Equipment

DMU Alternative with Storage Facility

Formula from FTA, 2006 = $PPV_{equip} = PPV_{ref} \times (25/D)^{1.5}$
 where

Segment7

PPV refs @ 25 ft =		PPV@25ft
	pile driver (impact)	0.644
	Vibratory Roller	0.21
	Bulldozer (large)	0.089
	Truck(loaded)	0.076
	Jackhammer	0.035

Enter distance = Adjacent Buildings

Resultant PPV =	pile driver (impact)	0.00322
	Vibratory Roller	0.00105
	Bulldozer (large)	0.000445
	Truck(loaded)	0.00038
	Jackhammer	0.000175

	Lv@25 ft
pile driver (impact)	104
Vibratory Roller	94
Bulldozer (large)	87
Truck(loaded)	86
Jackhammer	79

Formula from FTA 2006 = $Lv(D) = Lv(25 \text{ ft}) - 30\log(D/25)$

Resultant Lv =	pile driver (impact)	57.97922
	Vibratory Roller	47.97922
	Bulldozer (large)	40.97922
	Truck(loaded)	39.97922
	Jackhammer	32.97922

Vibration propagation from Construction Equipment

DMU Alternative with Storage Facility

Formula from FTA, 2006 = $PPV_{equip} = PPV_{ref} \times (25/D)^{1.5}$
 where

Segment 8

PPV refs @ 25 ft =		PPV@25ft
	pile driver (impact)	0.644
	Vibratory Roller	0.21
	Bulldozer (large)	0.089
	Truck(loaded)	0.076
	Jackhammer	0.035

Enter distance = Adjacent Buildings

Resultant PPV =	pile driver (impact)	0.0805
	Vibratory Roller	0.02625
	Bulldozer (large)	0.011125
	Truck(loaded)	0.0095
	Jackhammer	0.004375

	Lv@25 ft
pile driver (impact)	104
Vibratory Roller	94
Bulldozer (large)	87
Truck(loaded)	86
Jackhammer	79

Formula from FTA 2006 = $Lv(D) = Lv(25 \text{ ft}) - 30\log(D/25)$

Resultant Lv =	pile driver (impact)	85.9382
	Vibratory Roller	75.9382
	Bulldozer (large)	68.9382
	Truck(loaded)	67.9382
	Jackhammer	60.9382

Vibration propagation from Construction Equipment

DMU Alternative with Storage Facility

Formula from FTA, 2006 = $PPV_{equip} = PPV_{ref} \times (25/D)^{1.5}$
 where

Segment 9

PPV refs @ 25 ft =		PPV@25ft
	pile driver (impact)	0.644
	Vibratory Roller	0.21
	Bulldozer (large)	0.089
	Truck(loaded)	0.076
	Jackhammer	0.035

Enter distance = Adjacent Buildings

Resultant PPV =	pile driver (impact)	0.001537
	Vibratory Roller	0.000501
	Bulldozer (large)	0.000212
	Truck(loaded)	0.000181
	Jackhammer	8.35E-05

	Lv@25 ft
pile driver (impact)	104
Vibratory Roller	94
Bulldozer (large)	87
Truck(loaded)	86
Jackhammer	79

Formula from FTA 2006 = $Lv(D) = Lv(25 \text{ ft}) - 30\log(D/25)$

Resultant Lv =	pile driver (impact)	51.55436
	Vibratory Roller	41.55436
	Bulldozer (large)	34.55436
	Truck(loaded)	33.55436
	Jackhammer	26.55436

Vibration propagation from Construction Equipment

DMU Alternative with Storage Facility

Formula from FTA, 2006 = $PPV_{equip} = PPV_{ref} \times (25/D)^{1.5}$
 where

Segment 10

PPV refs @ 25 ft =		PPV@25ft
	pile driver (impact)	0.644
	Vibratory Roller	0.21
	Bulldozer (large)	0.089
	Truck(loaded)	0.076
	Jackhammer	0.035

Enter distance = Adjacent Buildings

Resultant PPV =	pile driver (impact)	0.003277
	Vibratory Roller	0.001069
	Bulldozer (large)	0.000453
	Truck(loaded)	0.000387
	Jackhammer	0.000178

	Lv@25 ft
pile driver (impact)	104
Vibratory Roller	94
Bulldozer (large)	87
Truck(loaded)	86
Jackhammer	79

Formula from FTA 2006 = $Lv(D) = Lv(25 \text{ ft}) - 30\log(D/25)$

Resultant Lv =	pile driver (impact)	58.1325
	Vibratory Roller	48.1325
	Bulldozer (large)	41.1325
	Truck(loaded)	40.1325
	Jackhammer	33.1325

Vibration propagation from Construction Equipment

DMU Alternative with Storage Facility

Formula from FTA, 2006 = $PPV_{equip} = PPV_{ref} \times (25/D)^{1.5}$
 where

Segment 12

PPV refs @ 25 ft =		PPV@25ft
	pile driver (impact)	0.644
	Vibratory Roller	0.21
	Bulldozer (large)	0.089
	Truck(loaded)	0.076
	Jackhammer	0.035

Enter distance = Adjacent Buildings

Resultant PPV =	pile driver (impact)	0.002546
	Vibratory Roller	0.00083
	Bulldozer (large)	0.000352
	Truck(loaded)	0.0003
	Jackhammer	0.000138

	Lv@25 ft
pile driver (impact)	104
Vibratory Roller	94
Bulldozer (large)	87
Truck(loaded)	86
Jackhammer	79

Formula from FTA 2006 = $Lv(D) = Lv(25 \text{ ft}) - 30\log(D/25)$

Resultant Lv =	pile driver (impact)	55.9382
	Vibratory Roller	45.9382
	Bulldozer (large)	38.9382
	Truck(loaded)	37.9382
	Jackhammer	30.9382

Vibration propagation from Construction Equipment

DMU Alternative with Storage Facility

Formula from FTA, 2006 = $PPV_{equip} = PPV_{ref} \times (25/D)^{1.5}$
 where

Segment 13

PPV refs @ 25 ft =		PPV@25ft
	pile driver (impact)	0.644
	Vibratory Roller	0.21
	Bulldozer (large)	0.089
	Truck(loaded)	0.076
	Jackhammer	0.035

Enter distance = Adjacent Buildings

Resultant PPV =	pile driver (impact)	0.002207
	Vibratory Roller	0.00072
	Bulldozer (large)	0.000305
	Truck(loaded)	0.00026
	Jackhammer	0.00012

	Lv@25 ft
pile driver (impact)	104
Vibratory Roller	94
Bulldozer (large)	87
Truck(loaded)	86
Jackhammer	79

Formula from FTA 2006 = $Lv(D) = Lv(25 \text{ ft}) - 30\log(D/25)$

Resultant Lv =	pile driver (impact)	54.69642
	Vibratory Roller	44.69642
	Bulldozer (large)	37.69642
	Truck(loaded)	36.69642
	Jackhammer	29.69642

Vibration propagation from Construction Equipment

DMU Alternative with Storage Facility

Formula from FTA, 2006 = $PPV_{equip} = PPV_{ref} \times (25/D)^{1.5}$
 where

Segment 15

PPV refs @ 25 ft =		PPV@25ft
	pile driver (impact)	0.644
	Vibratory Roller	0.21
	Bulldozer (large)	0.089
	Truck(loaded)	0.076
	Jackhammer	0.035

Enter distance = Adjacent Buildings

Resultant PPV =	pile driver (impact)	0.001937
	Vibratory Roller	0.000631
	Bulldozer (large)	0.000268
	Truck(loaded)	0.000229
	Jackhammer	0.000105

	Lv@25 ft
pile driver (impact)	104
Vibratory Roller	94
Bulldozer (large)	87
Truck(loaded)	86
Jackhammer	79

Formula from FTA 2006 = $Lv(D) = Lv(25 \text{ ft}) - 30\log(D/25)$

Resultant Lv =	pile driver (impact)	53.56276
	Vibratory Roller	43.56276
	Bulldozer (large)	36.56276
	Truck(loaded)	35.56276
	Jackhammer	28.56276

Vibration propagation from Construction Equipment

DMU Alternative with Storage Facility

Formula from FTA, 2006 = $PPV_{equip} = PPV_{ref} \times (25/D)^{1.5}$
 where

Segment 16

PPV refs @ 25 ft =		PPV@25ft
	pile driver (impact)	0.644
	Vibratory Roller	0.21
	Bulldozer (large)	0.089
	Truck(loaded)	0.076
	Jackhammer	0.035

Enter distance = Adjacent Buildings

Resultant PPV =	pile driver (impact)	0.001537
	Vibratory Roller	0.000501
	Bulldozer (large)	0.000212
	Truck(loaded)	0.000181
	Jackhammer	8.35E-05

	Lv@25 ft
pile driver (impact)	104
Vibratory Roller	94
Bulldozer (large)	87
Truck(loaded)	86
Jackhammer	79

Formula from FTA 2006 = $Lv(D) = Lv(25 \text{ ft}) - 30\log(D/25)$

Resultant Lv =	pile driver (impact)	51.55436
	Vibratory Roller	41.55436
	Bulldozer (large)	34.55436
	Truck(loaded)	33.55436
	Jackhammer	26.55436

Vibration propagation from Construction Equipment

DMU Alternative with Storage Facility

Formula from FTA, 2006 = $PPV_{equip} = PPV_{ref} \times (25/D)^{1.5}$
 where

Segment 17

PPV refs @ 25 ft =		PPV@25ft
	pile driver (impact)	0.644
	Vibratory Roller	0.21
	Bulldozer (large)	0.089
	Truck(loaded)	0.076
	Jackhammer	0.035

Enter distance = Adjacent Buildings

Resultant PPV =	pile driver (impact)	0.009028
	Vibratory Roller	0.002944
	Bulldozer (large)	0.001248
	Truck(loaded)	0.001065
	Jackhammer	0.000491

	Lv@25 ft
pile driver (impact)	104
Vibratory Roller	94
Bulldozer (large)	87
Truck(loaded)	86
Jackhammer	79

Formula from FTA 2006 = $Lv(D) = Lv(25 \text{ ft}) - 30\log(D/25)$

Resultant Lv =	pile driver (impact)	66.93415
	Vibratory Roller	56.93415
	Bulldozer (large)	49.93415
	Truck(loaded)	48.93415
	Jackhammer	41.93415

Vibration propagation from Construction Equipment

DMU Alternative with Storage Facility

Formula from FTA, 2006 = $PPV_{equip} = PPV_{ref} \times (25/D)^{1.5}$
 where

Segment 18

PPV refs @ 25 ft =		PPV@25ft
	pile driver (impact)	0.644
	Vibratory Roller	0.21
	Bulldozer (large)	0.089
	Truck(loaded)	0.076
	Jackhammer	0.035

Enter distance = Adjacent Buildings

Resultant PPV =	pile driver (impact)	0.000972
	Vibratory Roller	0.000317
	Bulldozer (large)	0.000134
	Truck(loaded)	0.000115
	Jackhammer	5.28E-05

	Lv@25 ft
pile driver (impact)	104
Vibratory Roller	94
Bulldozer (large)	87
Truck(loaded)	86
Jackhammer	79

Formula from FTA 2006 = $Lv(D) = Lv(25 \text{ ft}) - 30\log(D/25)$

Resultant Lv =	pile driver (impact)	47.57559
	Vibratory Roller	37.57559
	Bulldozer (large)	30.57559
	Truck(loaded)	29.57559
	Jackhammer	22.57559

Vibration propagation from Construction Equipment

Express Bus/BRT Alternative

Formula from FTA, 2006 = $PPV_{equip} = PPV_{ref} \times (25/D)^{1.5}$
 where

Segment 2 - Hopyard Interchange

PPV refs @ 25 ft =		PPV@25ft
	pile driver (impact)	0.644
	Vibratory Roller	0.21
	Bulldozer (large)	0.089
	Truck(loaded)	0.076
	Jackhammer	0.035

Enter distance = Adjacent Buildings

Resultant PPV =	pile driver (impact)	0.002207
	Vibratory Roller	0.00072
	Bulldozer (large)	0.000305
	Truck(loaded)	0.00026
	Jackhammer	0.00012

	Lv@25 ft
pile driver (impact)	104
Vibratory Roller	94
Bulldozer (large)	87
Truck(loaded)	86
Jackhammer	79

Formula from FTA 2006 = $Lv(D) = Lv(25 \text{ ft}) - 30\log(D/25)$

Resultant Lv =	pile driver (impact)	54.69642
	Vibratory Roller	44.69642
	Bulldozer (large)	37.69642
	Truck(loaded)	36.69642
	Jackhammer	29.69642

Vibration propagation from Construction Equipment

Express Bus/BRT Alternative

Formula from FTA, 2006 = $PPV_{equip} = PPV_{ref} \times (25/D)^{1.5}$
 where

Segment 3 - Dublin/Pleasanton Station Cross Transfer Platform

[PPV@25ft](#)

PPV refs @ 25 ft =	pile driver (impact)	0.644
	Vibratory Roller	0.21
	Bulldozer (large)	0.089
	Truck(loaded)	0.076
	Jackhammer	0.035

Enter distance = Adjacent Buildings

Resultant PPV =	pile driver (impact)	0.011311
	Vibratory Roller	0.003688
	Bulldozer (large)	0.001563
	Truck(loaded)	0.001335
	Jackhammer	0.000615

[Lv@25 ft](#)

pile driver (impact)	104
Vibratory Roller	94
Bulldozer (large)	87
Truck(loaded)	86
Jackhammer	79

Formula from FTA 2006 = $Lv(D) = Lv(25 \text{ ft}) - 30\log(D/25)$

Resultant Lv =	pile driver (impact)	68.89215
	Vibratory Roller	58.89215
	Bulldozer (large)	51.89215
	Truck(loaded)	50.89215
	Jackhammer	43.89215

Vibration propagation from Construction Equipment

Express Bus/BRT Alternative

Formula from FTA, 2006 = $PPV_{equip} = PPV_{ref} \times (25/D)^{1.5}$
 where

Segment 4 - Hopyard to Hacienda Drive

PPV refs @ 25 ft =		PPV@25ft
	pile driver (impact)	0.644
	Vibratory Roller	0.21
	Bulldozer (large)	0.089
	Truck(loaded)	0.076
	Jackhammer	0.035

Enter distance = Adjacent Buildings

Resultant PPV =	pile driver (impact)	0.011311
	Vibratory Roller	0.003688
	Bulldozer (large)	0.001563
	Truck(loaded)	0.001335
	Jackhammer	0.000615

	Lv@25 ft
pile driver (impact)	104
Vibratory Roller	94
Bulldozer (large)	87
Truck(loaded)	86
Jackhammer	79

Formula from FTA 2006 = $Lv(D) = Lv(25 \text{ ft}) - 30\log(D/25)$

Resultant Lv =	pile driver (impact)	68.89215
	Vibratory Roller	58.89215
	Bulldozer (large)	51.89215
	Truck(loaded)	50.89215
	Jackhammer	43.89215

Vibration propagation from Construction Equipment

Express Bus/BRT Alternative

Formula from FTA, 2006 = $PPV_{equip} = PPV_{ref} \times (25/D)^{1.5}$
 where

Segment 5 - Hacienda Interchange

PPV refs @ 25 ft =		PPV@25ft
	pile driver (impact)	0.644
	Vibratory Roller	0.21
	Bulldozer (large)	0.089
	Truck(loaded)	0.076
	Jackhammer	0.035

Enter distance = Adjacent Buildings

Resultant PPV =	pile driver (impact)	0.002064
	Vibratory Roller	0.000673
	Bulldozer (large)	0.000285
	Truck(loaded)	0.000244
	Jackhammer	0.000112

	Lv@25 ft
pile driver (impact)	104
Vibratory Roller	94
Bulldozer (large)	87
Truck(loaded)	86
Jackhammer	79

Formula from FTA 2006 = $Lv(D) = Lv(25 \text{ ft}) - 30\log(D/25)$

Resultant Lv =	pile driver (impact)	54.11727
	Vibratory Roller	44.11727
	Bulldozer (large)	37.11727
	Truck(loaded)	36.11727
	Jackhammer	29.11727

Vibration propagation from Construction Equipment

Express Bus/BRT Alternative

Formula from FTA, 2006 = $PPV_{equip} = PPV_{ref} \times (25/D)^{1.5}$
 where

Laughlin Lot

PPV refs @ 25 ft =		PPV@25ft
	pile driver (impact)	0.644
	Vibratory Roller	0.21
	Bulldozer (large)	0.089
	Truck (loaded)	0.076
	Jackhammer	0.035

Enter distance = Adjacent Buildings

Resultant PPV =	pile driver (impact)	0.008159
	Vibratory Roller	0.002661
	Bulldozer (large)	0.001128
	Truck (loaded)	0.000963
	Jackhammer	0.000443

	Lv@25 ft
pile driver (impact)	104
Vibratory Roller	94
Bulldozer (large)	87
Truck (loaded)	86
Jackhammer	79

Formula from FTA 2006 = $Lv(D) = Lv(25 \text{ ft}) - 30 \log(D/25)$

Resultant Lv =	pile driver (impact)	66.05547
	Vibratory Roller	56.05547
	Bulldozer (large)	49.05547
	Truck (loaded)	48.05547
	Jackhammer	41.05547

G.5 Noise Model Data – Noise Monitoring Summary Sheets

Calculated Ldn from long-term noise monitoring data - LT-1 DP Station Unadjusted

	TIME	dBA	Remove LOG	10 dBA Penalized Values	5 dBA Penalized Values
9/12/2016	Midnight 0 / 24	54.2	263027	2630268	831764
	am 1:00	100 52.4	173780	1737801	549541
	2:00	200 53.3	213796	2137962	676083
	3:00	300 55.5	354813	3548134	1122018
	4:00	400 58.3	676083	6760830	2137962
	5:00	500 58.1	645654	6456542	2041738
	6:00	600 58.3	676083	6760830	2137962
	7:00	700 57.7	588844	5888437	1862087
	8:00	800 56.9	489779	4897788	1548817
	9:00	900 58.1	645654	6456542	2041738
	10:00	1000 59.6	912011	9120108	2884032
	11:00	1100 59.8	954993	9549926	3019952
	12:00	1200 62.3	1698244	16982437	5370318
	pm 1:00	1300 61.2	1318257	13182567	4168694
	2:00	1400 62.7	1862087	18620871	5888437
	3:00	1500 64.6	2884032	28840315	9120108
	4:00	1600 63.6	2290868	22908677	7244360
	5:00	1700 65.4	3467369	34673685	10964782
	6:00	1800 64.2	2630268	26302680	8317638
	7:00	1900 60.7	1174898	11748976	3715352
	8:00	2000 59.6	912011	9120108	2884032
	9:00	2100 57.1	512861	5128614	1621810
	10:00	2200 56.6	457088	4570882	1445440
	pm 11:00	2300 54.6	288403	2884032	912011

Leq Morning Peak Hour 7:00-10:00 a.m.

58 dBA

Leq Evening Peak Hour 4:00-8:00 p.m.

64 dBA

Leq Nighttime 10:00 pm-7:00 a.m. (not penalized)

56 dBA

Leq Daytime 7:00 am-10:00 p.m.

62 dBA

Leq 24-Hour

60 dBA

Ldn: 10 dBA penalty for noise between 10:00 p.m. and 7:00 a.m.

64 dBA

CNEL: 5 dBA penalty for noise between 7:00p.m. and 10:00 p.m., and 10 dBA penalty for noise between 10:00 p.m. and 7:00 a.m.

64 dBA

CNEL - Ldn 0.39000439

Calculated Ldn from long-term noise monitoring data - LT-1 DP Station - Adjusted to reflect front of structure at 5200 Iron Horse Pkwy

	TIME	dBA	Remove LOG	10 dBA Penalized Values	5 dBA Penalized Values
9/12/2016	Midnight 0 / 24	56.5	446684	4466836	1412538
	am 1:00	100 54.7	295121	2951209	933254
		2:00 200	363078	3630781	1148154
		3:00 300	602560	6025596	1905461
		4:00 400	1148154	11481536	3630781
		5:00 500	1096478	10964782	3467369
		6:00 600	1148154	11481536	3630781
		7:00 700	1000000	10000000	3162278
		8:00 800	831764	8317638	2630268
		9:00 900	1096478	10964782	3467369
		10:00 1000	1548817	15488166	4897788
		11:00 1100	1621810	16218101	5128614
		12:00 1200	2884032	28840315	9120108
	pm 1:00	1300 63.5	2238721	22387211	7079458
		2:00 1400	3162278	31622777	10000000
		3:00 1500	4897788	48977882	15488166
		4:00 1600	3890451	38904514	12302688
		5:00 1700	5888437	58884366	18620871
		6:00 1800	4466836	44668359	14125375
		7:00 1900	1995262	19952623	6309573
		8:00 2000	1548817	15488166	4897788
		9:00 2100	870964	8709636	2754229
		10:00 2200	776247	7762471	2454709
	pm 11:00	2300 56.9	489779	4897788	1548817

Leq Morning Peak Hour 7:00-10:00 a.m.

59.9 dBA

Leq Evening Peak Hour 4:00-8:00 p.m.

66 dBA

Leq Nighttime 10:00 pm-7:00 a.m. (not penalized)

58 dBA

Leq Daytime 7:00 am-10:00 p.m.

64 dBA

Leq 24-Hour

63 dBA

Ldn: 10 dBA penalty for noise between 10:00 p.m. and 7:00 a.m.

66.3 dBA

CNEL: 5 dBA penalty for noise between 7:00p.m. and 10:00 p.m., and 10 dBA penalty for noise between 10:00 p.m. and 7:00 a.m.

67 dBA

CNEL - Ldn 0.39000439

Adjustment based on Monitoring at 5200 Iron Horse Parkway

monitored Leq at long term location	Leq at receptor	Adjustment increase
64.6	66.9	2.3

dp station.TXT

METROSONICS db-308 SN 2458 V2.3 3/87

CURRENT DATE: 9/13/16
CURRENT TIME: 12:52:50

Long-term monitoring Dublin Pleasanton Station area LT-1

CALIBRATED: 9/11/16 @ 9:26:23

DISPLAY RANGE: 42.5dB TO 138.5dB

DOUBLING RATE: 3 dB

FILTER: A WGHT

RESPONSE: SLOW

SCHEDULED RUN: OFF

START DATE: 9/12/16
START TIME: 0:00:00
LENGTH: 26:00:00

** OVERALL REPORT **

TEST STARTING DATE: 9/12/16
TEST STARTING TIME: 0:00:19
TEST LENGTH: 1DAYS 2:00:00

Lav = 60.1dB
Lav 80= 52.1dB
Lav 90= 43.2dB
SEL =109.6dB

Lmax = 90.5dB ON 9/12/16 @ 17:54:49
Lpk = 125dB ON 9/12/16 @ 17:53:25

TIME OVER 115dB 0D 0:00:00.00

DOSE CRITERION: 90dB

8 HR DOSE (80dB CUTOFF)= 0.05%
8 HR DOSE (90dB CUTOFF)= 0.00%

** TIME HISTORY REPORT **

MODE: CONTINUOUS
PERIOD LENGTH: 1:00:00
TIME HISTORY CUTOFF: NONE
Ln(1): 10.0% Ln(2): 90.0%

INT#	START	Lav	Lmax	Lpk
TAG#	TIME	ET	L1	L2

dp station.TXT

INT# TAG#	START TIME	Lav ET	Lmax L1	Lpk L2					
1 0	9/12/16 0 0:00:19	54.2 1:00:00	63.4 56	<117 51	*	+			
2 0	9/12/16 0 1:00:19	52.4 1:00:00	65.5 54	<117 48	*	+			
3 0	9/12/16 0 2:00:19	53.3 1:00:00	62.2 56	<117 48	*	+			
4 0	9/12/16 0 3:00:19	55.5 1:00:00	61.9 57	<117 51	*	+			
5 0	9/12/16 0 4:00:19	58.3 1:00:00	65.5 59	<117 56	*	+			
6 0	9/12/16 0 5:00:19	58.1 1:00:00	64.9 60	<117 55	*	+			
7 0	9/12/16 0 6:00:19	58.3 1:00:00	63.9 59	<117 56	*	+			
8 0	9/12/16 0 7:00:19	57.7 1:00:00	70.9 59	<117 54	*		+		
9 0	9/12/16 0 8:00:19	56.9 1:00:00	75.1 58	<117 53	*			+	
10 0	9/12/16 0 9:00:19	58.1 1:00:00	80.2 58	119 53	*				+
11 0	9/12/16 0 10:00:19	59.6 1:00:00	77.7 61	119 54	*				+
12 0	9/12/16 0 11:00:19	59.8 1:00:00	77.9 60	118 56	*				+
13 0	9/12/16 0 12:00:19	62.3 1:00:00	82.8 62	120 57	*				+
14 0	9/12/16 0 13:00:19	61.2 1:00:00	81.3 62	118 56	*				+
15 0	9/12/16 0 14:00:19	62.7 1:00:00	84.5 63	123 57	*				+
16 0	9/12/16 0 15:00:19	64.6 1:00:00	89.7 64	124 54	*				+
17 0	9/12/16 0 16:00:19	63.6 1:00:00	85.7 65	123 54	*				+
18 0	9/12/16 0 17:00:19	65.4 1:00:00	90.5 63	125 52	*				+
19 0	9/12/16 0 18:00:19	64.2 1:00:00	85.4 64	122 54	*				+

dp station.TXT

20	9/12/16	60.7	80.9	119	*		+
0	19:00:19	1:00:00	61	57			
21	9/12/16	59.6	77.4	117	*		+
0	20:00:19	1:00:00	60	56			
22	9/12/16	57.1	64.5	<117	*	+	
0	21:00:19	1:00:00	58	54			
23	9/12/16	56.6	75.9	<117	*		+
0	22:00:19	1:00:00	58	52			
24	9/12/16	54.6	62.1	<117	*	+	
0	23:00:19	1:00:00	56	51			
25	9/13/16	53.7	61.0	<117	*	+	
0	0:00:19	1:00:00	56	50			
26	9/13/16	51.7	59.5	<117	*	+	
0	1:00:19	PARTIAL	54	46			

** AMPLITUDE DISTRIBUTION REPORT **

TOTAL SAMPLES = 748800

dB	SAMPLES	% OF TOTAL
42	43	.00
43	136 .	.01
44	528 .	.07
45	1483 +	.19
46	2400 +	.32
47	4447 *	.59
48	6991 *	.93
49	11936 **	1.59
50	19088 ***	2.54
51	24871 ***	3.32
52	38402 *****	5.12
53	53763 *****	7.17
54	60814 *****	8.12
55	68527 *****	9.15
56	84537 *****	11.28
57	92106 *****	12.30
58	101678 *****	13.57
59	70451 *****	9.40
60	43644 *****	5.82
61	21094 ***	2.81
62	11152 *	1.48
63	6557 *	.87
64	4519 *	.60
65	3610 +	.48
66	2518 +	.33
67	2299 +	.30
68	2295 +	.30
69	1852 +	.24
70	1628 +	.21
71	1036 +	.13
72	940 +	.12
73	785 +	.10
74	655 .	.08
75	472 .	.06

dp station.TXT

76	378 .	.05
77	274 .	.03
78	178 .	.02
79	184 .	.02
80	169 .	.02
81	105 .	.01
82	75 .	.01
83	37 .	.00
84	41 .	.00
85	38 .	.00
86	19 .	.00
87	24 .	.00
88	13 .	.00
89	6 .	.00
90	2 .	.00

Ln(0.0) = 90dB
 Ln(10.0) = 60dB
 Ln(50.0) = 56dB
 Ln(99.9) = 45dB

	NO CUTOFF	80.0dB CUTOFF	90.0dB CUTOFF
Ldod	58.3dB	45.5dB	42.0dB
Losha	57.7dB	43.3dB	42.0dB
Leq(6)	57.4dB	42.6dB	42.0dB

Calculated Ldn from long-term noise monitoring data - LT-2 Pimlico

	TIME	dBA	Remove LOG	10 dBA Penalized Values	5 dBA Penalized Values
9/12/2016	Midnight 0 / 24	53.6	229087	2290868	724436
	am 1:00	100 52.4	173780	1737801	549541
	2:00	200 52.9	194984	1949845	616595
	3:00	300 55.1	323594	3235937	1023293
	4:00	400 58.0	630957	6309573	1995262
	5:00	500 58.2	660693	6606934	2089296
	6:00	600 60.3	1071519	10715193	3388442
	7:00	700 60.6	1148154	11481536	3630781
	8:00	800 59.7	933254	9332543	2951209
	9:00	900 59.4	870964	8709636	2754229
	10:00	1000 59.9	977237	9772372	3090295
	11:00	1100 60.5	1122018	11220185	3548134
	12:00	1200 60.9	1230269	12302688	3890451
	pm 1:00	1300 61.0	1258925	12589254	3981072
	2:00	1400 61.4	1380384	13803843	4365158
	3:00	1500 62.0	1584893	15848932	5011872
	4:00	1600 61.4	1380384	13803843	4365158
	5:00	1700 59.2	831764	8317638	2630268
	6:00	1800 59.9	977237	9772372	3090295
	7:00	1900 59.2	831764	8317638	2630268
	8:00	2000 58.5	707946	7079458	2238721
	9:00	2100 57.0	501187	5011872	1584893
	10:00	2200 57.0	501187	5011872	1584893
	pm 11:00	2300 56.8	478630	4786301	1513561

Leq Morning Peak Hour 7:00-10:00 a.m.

60 dBA

Leq Evening Peak Hour 4:00-8:00 p.m.

60 dBA

Leq Nighttime 10:00 pm-7:00 a.m. (not penalized)

57 dBA

Leq Daytime 7:00 am-10:00 p.m.

60 dBA

Leq 24-Hour

59 dBA

Ldn: 10 dBA penalty for noise between 10:00 p.m. and 7:00 a.m.

64 dBA

**CNEL: 5 dBA penalty for noise between 7:00p.m. and 10:00 p.m.,
and 10 dBA penalty for noise between
10:00 p.m. and 7:00 a.m.**

64 dBA

CNEL - Ldn 0.31646673

Pimlico.TXT

METROSONICS db-308 SN 2456 V2.3 3/87

CURRENT DATE: 9/13/16
CURRENT TIME: 13:15:12

Long-term monitoring LT-2 Pimlico

CALIBRATED: 9/11/16 @ 10:02:37

DISPLAY RANGE: 41.9dB TO 137.9dB

DOUBLING RATE: 3 dB

FILTER: A WGHT

RESPONSE: SLOW

SCHEDULED RUN: OFF

START DATE: 9/12/16
START TIME: 0:00:00
LENGTH: 26:00:00

** OVERALL REPORT **

TEST STARTING DATE: 9/12/16
TEST STARTING TIME: 0:00:19
TEST LENGTH: 1DAYS 2:00:00

Lav = 59.0dB
Lav 80= 41.9dB
Lav 90= 41.9dB
SEL =108.5dB

Lmax = 79.1dB ON 9/12/16 @ 16:51:34
Lpk = 120dB ON 9/12/16 @ 15:14:08

TIME OVER 115dB 0D 0:00:00.00

DOSE CRITERION: 90dB

8 HR DOSE (80dB CUTOFF)= 0.00%
8 HR DOSE (90dB CUTOFF)= 0.00%

** TIME HISTORY REPORT **

MODE: CONTINUOUS
PERIOD LENGTH: 1:00:00
TIME HISTORY CUTOFF: NONE
Ln(1): 33.0% Ln(2): 90.0%

INT#	START	Lav	Lmax	Lpk
TAG#	TIME	ET	L1	L2

Pimlico.TXT

1	9/12/16	53.6	66.1	<116	*		+	
0	0:00:19	1:00:00	53	49				
2	9/12/16	52.4	63.8	<116	*		+	
0	1:00:19	1:00:00	52	47				
3	9/12/16	52.9	62.9	<116	*		+	
0	2:00:19	1:00:00	53	47				
4	9/12/16	55.1	63.3	<116	*		+	
0	3:00:19	1:00:00	55	50				
5	9/12/16	58.0	68.2	<116	*		+	
0	4:00:19	1:00:00	58	55				
6	9/12/16	58.2	66.8	<116	*		+	
0	5:00:19	1:00:00	58	54				
7	9/12/16	60.3	72.0	<116	*			+
0	6:00:19	1:00:00	60	57				
8	9/12/16	60.6	72.8	<116	*			+
0	7:00:19	1:00:00	60	58				
9	9/12/16	59.7	73.0	<116	*			+
0	8:00:19	1:00:00	59	56				
10	9/12/16	59.4	74.2	<116	*			+
0	9:00:19	1:00:00	59	56				
11	9/12/16	59.9	73.2	<116	*			+
0	10:00:19	1:00:00	60	56				
12	9/12/16	60.5	72.6	<116	*			+
0	11:00:19	1:00:00	60	58				
13	9/12/16	60.9	75.4	<116	*			+
0	12:00:19	1:00:00	60	58				
14	9/12/16	61.0	73.9	<116	*			+
0	13:00:19	1:00:00	60	58				
15	9/12/16	61.4	77.3	<116	*			+
0	14:00:19	1:00:00	61	58				
INT#	START	Lav	Lmax	Lpk				
TAG#	TIME	ET	L1	L2				
16	9/12/16	62.0	77.9	120	*			+
0	15:00:19	1:00:00	61	58				
17	9/12/16	61.4	79.1	<116	*			+
0	16:00:19	1:00:00	60	57				
18	9/12/16	59.2	75.8	<116	*			+
0	17:00:19	1:00:00	58	55				
19	9/12/16	59.9	72.5	<116	*			+
0	18:00:19	1:00:00	59	57				

Pimlico.TXT

20	9/12/16	59.2	73.7	<116	*	+
0	19:00:19	1:00:00	59	56		
21	9/12/16	58.5	73.0	<116	*	+
0	20:00:19	1:00:00	58	55		
22	9/12/16	57.0	69.2	<116	*	+
0	21:00:19	1:00:00	57	53		
23	9/12/16	57.0	74.1	<116	*	+
0	22:00:19	1:00:00	56	52		
24	9/12/16	56.8	68.6	<116	*	+
0	23:00:19	1:00:00	57	53		
25	9/13/16	54.9	67.4	<116	*	+
0	0:00:19	1:00:00	55	49		
26	9/13/16	53.1	65.6	<116	*	+
0	1:00:19	PARTIAL	53	46		

** AMPLITUDE DISTRIBUTION REPORT **

TOTAL SAMPLES = 748800

dB	SAMPLES	% OF TOTAL
41	613 .	.08
42	705 .	.09
43	879 +	.11
44	1441 +	.19
45	2267 +	.30
46	4180 *	.55
47	6319 *	.84
48	9311 *	1.24
49	13516 **	1.80
50	16814 **	2.24
51	21680 ***	2.89
52	25778 ***	3.44
53	29371 ****	3.92
54	30292 ****	4.04
55	47246 *****	6.30
56	67924 *****	9.07
57	76775 *****	10.25
58	102112 *****	13.63
59	105482 *****	14.08
60	84817 *****	11.32
61	50365 *****	6.72
62	26434 ****	3.53
63	10614 *	1.41
64	4872 *	.65
65	2619 +	.34
66	1638 +	.21
67	1320 +	.17
68	1054 +	.14
69	688 .	.09
70	611 .	.08
71	433 .	.05
72	269 .	.03
73	177 .	.02
74	86 .	.01

Pimlico.TXT

75	52			.00
76	27			.00
77	11			.00
78	5			.00
79	3			.00

Ln(0.0) = 79dB
Ln(10.0) = 61dB
Ln(50.0) = 58dB
Ln(99.9) = 42dB

	NO CUTOFF	80.0dB CUTOFF	90.0dB CUTOFF
Ldod	58.1dB	41.0dB	41.0dB
Losha	57.9dB	41.0dB	41.0dB
Leq(6)	57.7dB	41.0dB	41.0dB

Calculated Ldn from long-term noise monitoring data - LT-3 Future Isabel Neighborhood

	TIME	dBA	Remove LOG	10 dBA Penalized Values	5 dBA Penalized Values
9/14/2016	Midnight 0 / 24	50.4	109648	1096478	346737
	am 1:00	100 48.4	69183	691831	218776
	2:00	200 53.2	208930	2089296	660693
	3:00	300 54.4	275423	2754229	870964
	4:00	400 58.0	630957	6309573	1995262
	5:00	500 55.0	316228	3162278	1000000
	6:00	600 56.0	398107	3981072	1258925
	7:00	700 57.3	537032	5370318	1698244
	8:00	800 57.1	512861	5128614	1621810
	9:00	900 59.1	812831	8128305	2570396
	10:00	1000 57.0	501187	5011872	1584893
	11:00	1100 57.5	562341	5623413	1778279
	12:00	1200 57.0	501187	5011872	1584893
	pm 1:00	1300 57.1	512861	5128614	1621810
	2:00	1400 58.2	660693	6606934	2089296
	3:00	1500 56.5	446684	4466836	1412538
	4:00	1600 57.0	501187	5011872	1584893
	5:00	1700 58.5	707946	7079458	2238721
	6:00	1800 57.4	549541	5495409	1737801
	7:00	1900 56.9	489779	4897788	1548817
	8:00	2000 55.8	380189	3801894	1202264
	9:00	2100 55.0	316228	3162278	1000000
	10:00	2200 54.5	281838	2818383	891251
	pm 11:00	2300 52.1	162181	1621810	512861

Leq Morning Peak Hour 7:00-10:00 a.m.

57.9 dBA

Leq Evening Peak Hour 4:00-8:00 p.m.

57 dBA

Leq Nighttime 10:00 pm-7:00 a.m. (not penalized)

54 dBA

Leq Daytime 7:00 am-10:00 p.m.

57 dBA

Leq 24-Hour

56 dBA

Ldn: 10 dBA penalty for noise between 10:00 p.m. and 7:00 a.m.

61.3 dBA

**CNEL: 5 dBA penalty for noise between 7:00p.m. and 10:00 p.m.,
and 10 dBA penalty for noise between
10:00 p.m. and 7:00 a.m.**

62 dBA

CNEL - Ldn 0.32971965

METROSONICS db-308 SN 2593 V2.3 3/87

CURRENT DATE: 9/15/16
CURRENT TIME: 13:27:38

Long-term Monitoring LT-3

CALIBRATED: 9/13/16 @ 14:17:51

DISPLAY RANGE: 41.9dB TO 137.9dB

DOUBLING RATE: 3 dB

FILTER: A WGHT

RESPONSE: SLOW

SCHEDULED RUN: OFF

START DATE: 9/14/16
START TIME: 0:00:00
LENGTH: 26:00:00

** OVERALL REPORT **

TEST STARTING DATE: 9/14/16
TEST STARTING TIME: 0:00:19
TEST LENGTH: 1DAYS 2:00:00

Lav = 56.1dB
Lav 80= 41.9dB
Lav 90= 41.9dB
SEL =105.7dB

Lmax = 78.0dB ON 9/14/16 @ 4:17:34
Lpk < 116dB

TIME OVER 115dB 0D 0:00:00.00

DOSE CRITERION: 90dB

8 HR DOSE (80dB CUTOFF)= 0.00%
8 HR DOSE (90dB CUTOFF)= 0.00%

** TIME HISTORY REPORT **

MODE: CONTINUOUS
PERIOD LENGTH: 1:00:00
TIME HISTORY CUTOFF: NONE
Ln(1): 10.0% Ln(2): 90.0%

INT#	START	Lav	Lmax	Lpk
TAG#	TIME	ET	L1	L2

Future Isabel.TXT

1	9/14/16	50.4	62.3	<116	*	+		
0	0:00:19	1:00:00	52	47				
2	9/14/16	48.4	62.1	<116	*	+		
0	1:00:19	1:00:00	50	45				
3	9/14/16	53.2	64.8	<116	*	+		
0	2:00:19	1:00:00	55	49				
4	9/14/16	54.4	63.3	<116	*	+		
0	3:00:19	1:00:00	56	51				
5	9/14/16	58.0	78.0	<116	*			+
0	4:00:19	1:00:00	59	55				
6	9/14/16	55.0	65.6	<116	*	+		
0	5:00:19	1:00:00	56	53				
7	9/14/16	56.0	62.7	<116	*	+		
0	6:00:19	1:00:00	57	54				
8	9/14/16	57.3	74.5	<116	*			+
0	7:00:19	1:00:00	58	53				
9	9/14/16	57.1	71.4	<116	*			+
0	8:00:19	1:00:00	59	53				
10	9/14/16	59.1	70.4	<116	*			+
0	9:00:19	1:00:00	60	56				
11	9/14/16	57.0	66.8	<116	*	+		
0	10:00:19	1:00:00	61	51				
12	9/14/16	57.5	74.5	<116	*			+
0	11:00:19	1:00:00	60	51				
13	9/14/16	57.0	69.7	<116	*			+
0	12:00:19	1:00:00	59	53				
14	9/14/16	57.1	68.0	<116	*			+
0	13:00:19	1:00:00	58	54				
15	9/14/16	58.2	66.1	<116	*	+		
0	14:00:19	1:00:00	59	55				
INT#	START	Lav	Lmax	Lpk				
TAG#	TIME	ET	L1	L2				
16	9/14/16	56.5	66.0	<116	*	+		
0	15:00:19	1:00:00	58	53				
17	9/14/16	57.0	68.7	<116	*			+
0	16:00:19	1:00:00	58	54				
18	9/14/16	58.5	70.7	<116	*			+
0	17:00:19	1:00:00	60	56				
19	9/14/16	57.4	71.8	<116	*			+
0	18:00:19	1:00:00	58	55				

Future Isabel.TXT

20	9/14/16	56.9	68.3	<116	*	+
0	19:00:19	1:00:00	58	55		
21	9/14/16	55.8	69.7	<116	*	+
0	20:00:19	1:00:00	57	53		
22	9/14/16	55.0	63.7	<116	*	+
0	21:00:19	1:00:00	56	53		
23	9/14/16	54.5	68.9	<116	*	+
0	22:00:19	1:00:00	56	51		
24	9/14/16	52.1	74.5	<116	*	+
0	23:00:19	1:00:00	53	48		
25	9/15/16	50.5	60.6	<116	*	+
0	0:00:19	1:00:00	52	47		
26	9/15/16	51.2	59.9	<116	*	+
0	1:00:19	PARTIAL	53	47		

** AMPLITUDE DISTRIBUTION REPORT **

TOTAL SAMPLES = 748800

dB	SAMPLES	% OF TOTAL
42	32	.00
43	616	.08
44	1750	.23
45	3416	.45
46	8557	1.14
47	14438	1.92
48	20353	2.71
49	31279	4.17
50	31899	4.26
51	36028	4.81
52	45447	6.06
53	71865	9.59
54	79154	10.57
55	111757	14.92
56	99825	13.33
57	76700	10.24
58	53544	7.15
59	28159	3.76
60	15486	2.06
61	7828	1.04
62	4383	.58
63	2476	.33
64	1287	.17
65	676	.09
66	481	.06
67	495	.06
68	321	.04
69	227	.03
70	149	.01
71	52	.00
72	33	.00
73	41	.00
74	28	.00
75	3	.00

Future Isabel.TXT

76	6			.00
77	8			.00
78	1			.00

Ln(0.0) = 78dB
Ln(10.0) = 58dB
Ln(50.0) = 55dB
Ln(99.9) = 44dB

	NO CUTOFF	80.0dB CUTOFF	90.0dB CUTOFF
Ldod	55.4dB	41.0dB	41.0dB
Losha	55.1dB	41.0dB	41.0dB
Leq(6)	55.0dB	41.0dB	41.0dB

Calculated Ldn from long-term noise monitoring data - LT-4 Campus Drive

	TIME	dBA	Remove LOG	10 dBA Penalized Values	5 dBA Penalized Values
9/14/2016	Midnight 0 / 24	51.2	131826	1318257	416869
	am 1:00	100 48.8	75858	758578	239883
	2:00	200 50.1	102329	1023293	323594
	3:00	300 53.7	234423	2344229	741310
	4:00	400 56.5	446684	4466836	1412538
	5:00	500 58.6	724436	7244360	2290868
	6:00	600 60.4	1096478	10964782	3467369
	7:00	700 62.6	1819701	18197009	5754399
	8:00	800 61.4	1380384	13803843	4365158
	9:00	900 62.9	1949845	19498446	6165950
	10:00	1000 64.1	2570396	25703958	8128305
	11:00	1100 62.0	1584893	15848932	5011872
	12:00	1200 64.5	2818383	28183829	8912509
	pm 1:00	1300 65.4	3467369	34673685	10964782
	2:00	1400 63.2	2089296	20892961	6606934
	3:00	1500 62.6	1819701	18197009	5754399
	4:00	1600 61.5	1412538	14125375	4466836
	5:00	1700 61.8	1513561	15135612	4786301
	6:00	1800 63.1	2041738	20417379	6456542
	7:00	1900 61.1	1288250	12882496	4073803
	8:00	2000 59.1	812831	8128305	2570396
	9:00	2100 60.9	1230269	12302688	3890451
	10:00	2200 56.8	478630	4786301	1513561
	pm 11:00	2300 52.3	169824	1698244	537032

Leq Morning Peak Hour 7:00-10:00 a.m.

62.3 dBA

Leq Evening Peak Hour 4:00-8:00 p.m.

62 dBA

Leq Nighttime 10:00 pm-7:00 a.m. (not penalized)

56 dBA

Leq Daytime 7:00 am-10:00 p.m.

63 dBA

Leq 24-Hour

61 dBA

Ldn: 10 dBA penalty for noise between 10:00 p.m. and 7:00 a.m.

64.2 dBA

**CNEL: 5 dBA penalty for noise between 7:00p.m. and 10:00 p.m.,
and 10 dBA penalty for noise between
10:00 p.m. and 7:00 a.m.**

65 dBA

CNEL - Ldn 0.47442345

METROSONICS db-308 SN 2458 V2.3 3/87 montage.TXT

CURRENT DATE: 9/15/16
CURRENT TIME: 12:58:56

Long Term Monitoring LT-4 Montage

CALIBRATED: 9/13/16 @ 13:45:12

DISPLAY RANGE: 42.4dB TO 138.4dB

DOUBLING RATE: 3 dB

FILTER: A WGHT

RESPONSE: SLOW

SCHEDULED RUN: OFF

START DATE: 9/14/16
START TIME: 0:00:00
LENGTH: 26:00:00

** OVERALL REPORT **

TEST STARTING DATE: 9/14/16
TEST STARTING TIME: 0:00:19
TEST LENGTH: 1DAYS 2:00:00

Lav = 60.8dB
Lav 80= 52.7dB
Lav 90= 48.1dB
SEL =110.4dB

Lmax = 96.5dB ON 9/14/16 @ 13:24:06
Lpk = 124dB ON 9/14/16 @ 13:24:06

TIME OVER 115dB 0D 0:00:00.00

DOSE CRITERION: 90dB

8 HR DOSE (80dB CUTOFF)= 0.05%
8 HR DOSE (90dB CUTOFF)= 0.02%

** TIME HISTORY REPORT **

MODE: CONTINUOUS
PERIOD LENGTH: 1:00:00
TIME HISTORY CUTOFF: NONE
Ln(1): 10.0% Ln(2): 90.0%

INT#	START	Lav	Lmax	Lpk
TAG#	TIME	ET	L1	L2

20	9/14/16	61.1	74.8	<117	montage.TXT	*	+
0	19:00:19	1:00:00	63	55			
21	9/14/16	59.1	71.8	<117		*	+
0	20:00:19	1:00:00	62	53			
22	9/14/16	60.9	78.5	<117		*	+
0	21:00:19	1:00:00	63	54			
23	9/14/16	56.8	73.2	<117		*	+
0	22:00:19	1:00:00	60	50			
24	9/14/16	52.3	78.7	<117		*	+
0	23:00:19	1:00:00	52	47			
25	9/15/16	50.4	67.9	<117		*	+
0	0:00:19	1:00:00	51	46			
26	9/15/16	51.0	77.0	<117		*	+
0	1:00:19	PARTIAL	51	45			

** AMPLITUDE DISTRIBUTION REPORT **

TOTAL SAMPLES = 748800

dB	SAMPLES	% OF TOTAL
42	176 .	.02
43	1635 +	.21
44	4930 *	.65
45	11212 *	1.49
46	18620 **	2.48
47	26336 ****	3.51
48	30846 ****	4.11
49	34930 *****	4.66
50	26895 ****	3.59
51	22114 ***	2.95
52	19127 ***	2.55
53	23020 ***	3.07
54	29914 ****	3.99
55	40162 *****	5.36
56	56017 *****	7.48
57	60078 *****	8.02
58	65405 *****	8.73
59	59147 *****	7.89
60	54536 *****	7.28
61	46655 *****	6.23
62	33184 ****	4.43
63	25030 ***	3.34
64	17650 **	2.35
65	12727 **	1.69
66	8289 *	1.10
67	6249 *	.83
68	5206 *	.69
69	3046 +	.40
70	1946 +	.25
71	1117 +	.14
72	723 .	.09
73	540 .	.07
74	287 .	.03
75	240 .	.03
76	174 .	.02

montage.TXT

77	153	.	.02
78	93	.	.01
79	55		.00
80	74		.00
81	49		.00
82	37		.00
83	25		.00
84	30		.00
85	32		.00
86	20		.00
87	14		.00
88	15		.00
89	16		.00
90	7		.00
91	5		.00
92	5		.00
93	1		.00

dB	SAMPLES	% OF TOTAL
94	2	.00
95	2	.00
96	2	.00

Ln(0.0) = 96dB
 Ln(10.0) = 63dB
 Ln(50.0) = 57dB
 Ln(99.9) = 43dB

	NO CUTOFF	80.0dB CUTOFF	90.0dB CUTOFF
Ldod	59.1dB	45.3dB	43.0dB
Losha	58.4dB	43.1dB	42.2dB
Leq(6)	58.1dB	42.5dB	42.1dB

Calculated Ldn from long-term noise monitoring data - LT-5 Saddle Back Circle

	TIME	dBA	Remove LOG	10 dBA Penalized Values	5 dBA Penalized Values		
9/14/2016	Midnight	0 / 24	56.6	457088	4570882	1445440	
	am	1:00	100	55.0	316228	3162278	1000000
		2:00	200	55.5	354813	3548134	1122018
		3:00	300	58.5	707946	7079458	2238721
		4:00	400	61.1	1288250	12882496	4073803
		5:00	500	62.0	1584893	15848932	5011872
		6:00	600	62.6	1819701	18197009	5754399
		7:00	700	62.9	1949845	19498446	6165950
		8:00	800	62.6	1819701	18197009	5754399
		9:00	900	64.8	3019952	30199517	9549926
		10:00	1000	63.5	2238721	22387211	7079458
		11:00	1100	62.0	1584893	15848932	5011872
		12:00	1200	60.6	1148154	11481536	3630781
	pm	1:00	1300	62.2	1659587	16595869	5248075
		2:00	1400	61.5	1412538	14125375	4466836
		3:00	1500	64.7	2951209	29512092	9332543
		4:00	1600	62.7	1862087	18620871	5888437
		5:00	1700	63.5	2238721	22387211	7079458
		6:00	1800	63.5	2238721	22387211	7079458
		7:00	1900	62.1	1621810	16218101	5128614
		8:00	2000	60.5	1122018	11220185	3548134
		9:00	2100	60.1	1023293	10232930	3235937
		10:00	2200	58.8	758578	7585776	2398833
	pm	11:00	2300	56.9	489779	4897788	1548817

Leq Morning Peak Hour 7:00-10:00 a.m.

63.5 dBA

Leq Evening Peak Hour 4:00-8:00 p.m.

63 dBA

Leq Nighttime 10:00 pm-7:00 a.m. (not penalized)

59 dBA

Leq Daytime 7:00 am-10:00 p.m.

63 dBA

Leq 24-Hour

62 dBA

Ldn: 10 dBA penalty for noise between 10:00 p.m. and 7:00 a.m.

66.4 dBA

**CNEL: 5 dBA penalty for noise between 7:00p.m. and 10:00 p.m.,
and 10 dBA penalty for noise between
10:00 p.m. and 7:00 a.m.**

67 dBA

CNEL - Ldn 0.32251707

METROSONICS db-308 SN 2456 V2.3 3/87 Saddleback.TXT

CURRENT DATE: 9/15/16
CURRENT TIME: 13:12:56

Long-term monitoring LT-5 Saddleback

CALIBRATED: 9/13/16 @ 14:01:35

DISPLAY RANGE: 41.9dB TO 137.9dB

DOUBLING RATE: 3 dB

FILTER: A WGHT

RESPONSE: SLOW

SCHEDULED RUN: OFF

START DATE: 9/14/16
START TIME: 0:00:00
LENGTH: 26:00:00

** OVERALL REPORT **

TEST STARTING DATE: 9/14/16
TEST STARTING TIME: 0:00:19
TEST LENGTH: 1DAYS 2:00:00

Lav = 61.5dB
Lav 80= 48.5dB
Lav 90= 41.9dB
SEL =111.0dB

Lmax = 88.0dB ON 9/14/16 @ 8:09:30
Lpk < 116dB

TIME OVER 115dB 0D 0:00:00.00

DOSE CRITERION: 90dB

8 HR DOSE (80dB CUTOFF)= 0.02%
8 HR DOSE (90dB CUTOFF)= 0.00%

** TIME HISTORY REPORT **

MODE: CONTINUOUS
PERIOD LENGTH: 1:00:00
TIME HISTORY CUTOFF: NONE
Ln(1): 33.0% Ln(2): 90.0%

INT#	START	Lav	Lmax	Lpk
TAG#	TIME	ET	L1	L2

Saddleback.TXT

1	9/14/16	56.6	75.6	<116	*			+	
0	0:00:19	1:00:00	56	50					
2	9/14/16	55.0	66.4	<116	*		+		
0	1:00:19	1:00:00	55	49					
3	9/14/16	55.5	65.9	<116	*		+		
0	2:00:19	1:00:00	56	49					
4	9/14/16	58.5	68.3	<116	*		+		
0	3:00:19	1:00:00	59	54					
5	9/14/16	61.1	74.3	<116	*			+	
0	4:00:19	1:00:00	61	58					
6	9/14/16	62.0	77.3	<116	*			+	
0	5:00:19	1:00:00	61	59					
7	9/14/16	62.6	73.6	<116	*			+	
0	6:00:19	1:00:00	62	59					
8	9/14/16	62.9	80.5	<116	*			+	
0	7:00:19	1:00:00	62	58					
9	9/14/16	62.6	88.0	<116	*				+
0	8:00:19	1:00:00	60	57					
10	9/14/16	64.8	86.8	<116	*				+
0	9:00:19	1:00:00	63	59					
11	9/14/16	63.5	74.2	<116	*		+		
0	10:00:19	1:00:00	63	60					
12	9/14/16	62.0	81.1	<116	*			+	
0	11:00:19	1:00:00	60	57					
13	9/14/16	60.6	72.6	<116	*		+		
0	12:00:19	1:00:00	60	57					
14	9/14/16	62.2	80.5	<116	*			+	
0	13:00:19	1:00:00	60	57					
15	9/14/16	61.5	71.8	<116	*		+		
0	14:00:19	1:00:00	61	57					

INT#	START	Lav	Lmax	Lpk
TAG#	TIME	ET	L1	L2

16	9/14/16	64.7	85.7	<116	*			+
0	15:00:19	1:00:00	62	58				
17	9/14/16	62.7	81.0	<116	*			+
0	16:00:19	1:00:00	62	59				
18	9/14/16	63.5	75.5	<116	*		+	
0	17:00:19	1:00:00	63	60				
19	9/14/16	63.5	86.7	<116	*			+
0	18:00:19	1:00:00	62	58				

Saddleback.TXT

20	9/14/16	62.1	86.4	<116	*		+
0	19:00:19	1:00:00	60	56			
21	9/14/16	60.5	77.2	<116	*		+
0	20:00:19	1:00:00	60	56			
22	9/14/16	60.1	77.7	<116	*		+
0	21:00:19	1:00:00	60	56			
23	9/14/16	58.8	70.2	<116	*	+	
0	22:00:19	1:00:00	58	54			
24	9/14/16	56.9	70.2	<116	*	+	
0	23:00:19	1:00:00	57	52			
25	9/15/16	56.2	73.0	<116	*		+
0	0:00:19	1:00:00	56	51			
26	9/15/16	55.8	66.8	<116	*	+	
0	1:00:19	PARTIAL	56	49			

** AMPLITUDE DISTRIBUTION REPORT **

TOTAL SAMPLES = 748800

dB	SAMPLES	% OF TOTAL
41	38	.00
42	104 .	.01
43	231 .	.03
44	456 .	.06
45	618 .	.08
46	1132 +	.15
47	1909 +	.25
48	3256 +	.43
49	6285 *	.83
50	8157 *	1.08
51	11682 **	1.56
52	15750 **	2.10
53	20594 ***	2.75
54	21855 ***	2.91
55	32858 ****	4.38
56	48307 *****	6.45
57	56649 *****	7.56
58	77673 *****	10.37
59	90275 *****	12.05
60	98726 *****	13.18
61	83502 *****	11.15
62	65374 *****	8.73
63	40046 *****	5.34
64	24630 ***	3.28
65	13433 **	1.79
66	7605 *	1.01
67	5065 *	.67
68	3732 +	.49
69	2190 +	.29
70	1734 +	.23
71	1165 +	.15
72	1329 +	.17
73	937 +	.12
74	455 .	.06
75	310 .	.04

Saddleback.TXT

76	204 .	.02
77	118 .	.01
78	85 .	.01
79	101 .	.01
80	75 .	.01
81	31	.00
82	20	.00
83	19	.00
84	30	.00
85	24	.00
86	27	.00
87	3	.00
88	1	.00

Ln(0.0) = 88dB
 Ln(10.0) = 63dB
 Ln(50.0) = 59dB
 Ln(99.9) = 44dB

	NO CUTOFF	80.0dB CUTOFF	90.0dB CUTOFF
Ldod	60.4dB	43.1dB	41.0dB
Losha	60.0dB	41.7dB	41.0dB
Leq(6)	59.8dB	41.3dB	41.0dB

Calculated Ldn from long-term noise monitoring data - LT-6 Murietta Blvd.

	TIME	dBA	Remove LOG	10 dBA Penalized Values	5 dBA Penalized Values
9/16/2016	Midnight 0 / 24	53.9	245471	2454709	776247
	am 1:00	100 50.1	102329	1023293	323594
	2:00	200 50.6	114815	1148154	363078
	3:00	300 51.4	138038	1380384	436516
	4:00	400 56.6	457088	4570882	1445440
	5:00	500 59.5	891251	8912509	2818383
	6:00	600 61.7	1479108	14791084	4677351
	7:00	700 64.7	2951209	29512092	9332543
	8:00	800 64.6	2884032	28840315	9120108
	9:00	900 64.7	2951209	29512092	9332543
	10:00	1000 63.1	2041738	20417379	6456542
	11:00	1100 63.2	2089296	20892961	6606934
	12:00	1200 63.3	2137962	21379621	6760830
	pm 1:00	1300 63.2	2089296	20892961	6606934
	2:00	1400 63.4	2187762	21877616	6918310
	3:00	1500 64.8	3019952	30199517	9549926
	4:00	1600 63.8	2398833	23988329	7585776
	5:00	1700 64.0	2511886	25118864	7943282
	6:00	1800 64.0	2511886	25118864	7943282
	7:00	1900 62.6	1819701	18197009	5754399
	8:00	2000 65.5	3548134	35481339	11220185
	9:00	2100 60.5	1122018	11220185	3548134
	10:00	2200 59.7	933254	9332543	2951209
	pm 11:00	2300 57.4	549541	5495409	1737801

Leq Morning Peak Hour 7:00-10:00 a.m.

64.7 dBA

Leq Evening Peak Hour 4:00-8:00 p.m.

64 dBA

Leq Nighttime 10:00 pm-7:00 a.m. (not penalized)

57 dBA

Leq Daytime 7:00 am-10:00 p.m.

64 dBA

Leq 24-Hour

62 dBA

Ldn: 10 dBA penalty for noise between 10:00 p.m. and 7:00 a.m.

65.5 dBA

**CNEL: 5 dBA penalty for noise between 7:00p.m. and 10:00 p.m.,
and 10 dBA penalty for noise between
10:00 p.m. and 7:00 a.m.**

66 dBA

CNEL - Ldn 0.66090831

Murietta.txt

METROSONICS db-308 SN 2456 V2.3 3/87

CURRENT DATE: 9/19/16
CURRENT TIME: 9:00:11

Long-term Monitoring LT-6 Murrietta

CALIBRATED: 9/15/16 @ 13:17:06

DISPLAY RANGE: 41.9dB TO 137.9dB

DOUBLING RATE: 3 dB

FILTER: A WGHT

RESPONSE: SLOW

SCHEDULED RUN: OFF

START DATE: 9/16/16
START TIME: 0:00:00
LENGTH: 26:00:00

** OVERALL REPORT **

TEST STARTING DATE: 9/16/16
TEST STARTING TIME: 0:00:19
TEST LENGTH: 1DAYS 2:00:00

Lav = 62.1dB
Lav 80= 51.1dB
Lav 90= 48.2dB
SEL =111.6dB

Lmax = 96.7dB ON 9/16/16 @ 20:25:37
Lpk < 116dB

TIME OVER 115dB 0D 0:00:00.00

DOSE CRITERION: 90dB

8 HR DOSE (80dB CUTOFF)= 0.04%
8 HR DOSE (90dB CUTOFF)= 0.02%

** TIME HISTORY REPORT **

MODE: CONTINUOUS
PERIOD LENGTH: 1:00:00
TIME HISTORY CUTOFF: NONE
Ln(1): 33.0% Ln(2): 90.0%

INT#	START	Lav	Lmax	Lpk
TAG#	TIME	ET	L1	L2

Murietta.txt

1	9/16/16	53.9	68.9	<116	*	+	
0	0:00:19	1:00:00	45	41			
2	9/16/16	50.1	68.7	<116	*	+	
0	1:00:19	1:00:00	41	41			
3	9/16/16	50.6	68.3	<116	*	+	
0	2:00:19	1:00:00	42	41			
4	9/16/16	51.4	68.9	<116	*	+	
0	3:00:19	1:00:00	43	41			
5	9/16/16	56.6	75.3	<116	*		+
0	4:00:19	1:00:00	51	43			
6	9/16/16	59.5	75.4	<116	*		+
0	5:00:19	1:00:00	58	43			
7	9/16/16	61.7	73.5	<116	*		+
0	6:00:19	1:00:00	61	46			
8	9/16/16	64.7	76.4	<116	*		+
0	7:00:19	1:00:00	64	52			
9	9/16/16	64.6	75.4	<116	*		+
0	8:00:19	1:00:00	65	51			
10	9/16/16	64.7	87.1	<116	*		+
0	9:00:19	1:00:00	63	51			
11	9/16/16	63.1	76.4	<116	*		+
0	10:00:19	1:00:00	63	49			
12	9/16/16	63.2	74.5	<116	*		+
0	11:00:19	1:00:00	63	50			
13	9/16/16	63.3	79.1	<116	*		+
0	12:00:19	1:00:00	63	52			
14	9/16/16	63.2	79.8	<116	*		+
0	13:00:19	1:00:00	63	50			
15	9/16/16	63.4	75.7	<116	*		+
0	14:00:19	1:00:00	64	51			
INT#	START	Lav	Lmax	Lpk			
TAG#	TIME	ET	L1	L2			
16	9/16/16	64.8	85.0	<116	*		+
0	15:00:19	1:00:00	65	52			
17	9/16/16	63.8	76.7	<116	*		+
0	16:00:19	1:00:00	64	52			
18	9/16/16	64.0	75.6	<116	*		+
0	17:00:19	1:00:00	64	53			
19	9/16/16	64.0	83.5	<116	*		+
0	18:00:19	1:00:00	64	53			

Murietta.txt

20	9/16/16	62.6	74.1	<116	*	+	
0	19:00:19	1:00:00	63	49			
21	9/16/16	65.5	96.7	<116	*		+
0	20:00:19	1:00:00	61	47			
22	9/16/16	60.5	75.0	<116	*	+	
0	21:00:19	1:00:00	60	45			
23	9/16/16	59.7	79.7	<116	*		+
0	22:00:19	1:00:00	58	44			
24	9/16/16	57.4	74.5	<116	*	+	
0	23:00:19	1:00:00	55	42			
25	9/17/16	56.0	72.5	<116	*	+	
0	0:00:19	1:00:00	53	41			
26	9/17/16	55.0	73.3	<116	*	+	
0	1:00:19	PARTIAL	47	41			

** AMPLITUDE DISTRIBUTION REPORT **

TOTAL SAMPLES = 748800

dB	SAMPLES		% OF TOTAL
41	85798	*****	11.45
42	24560	***	3.27
43	25037	***	3.34
44	20776	***	2.77
45	20412	***	2.72
46	18889	***	2.52
47	14312	**	1.91
48	11973	**	1.59
49	12558	**	1.67
50	11243	**	1.50
51	12691	**	1.69
52	14186	**	1.89
53	14758	**	1.97
54	16575	**	2.21
55	19878	***	2.65
56	28570	****	3.81
57	27407	****	3.66
58	32328	****	4.31
59	32409	****	4.32
60	35386	*****	4.72
61	35770	*****	4.77
62	39743	*****	5.30
63	39103	*****	5.22
64	38368	*****	5.12
65	33167	****	4.42
66	28305	****	3.78
67	24164	***	3.22
68	16794	**	2.24
69	6933	*	.92
70	3633	+	.48
71	1441	+	.19
72	581	.	.07
73	310	.	.04
74	208	.	.02

Murietta.txt

75	155	.02
76	72	.00
77	34	.00
78	35	.00
79	34	.00
80	24	.00
81	29	.00
82	27	.00
83	34	.00
84	24	.00
85	25	.00
86	16	.00
87	3	.00
88	3	.00
89	1	.00
90	2	.00
91	2	.00
92	3	.00

dB	SAMPLES	% OF TOTAL
93	2	.00
94	2	.00
95	3	.00
96	4	.00

Ln(0.0) = 96dB
 Ln(10.0) = 66dB
 Ln(50.0) = 57dB
 Ln(99.9) = 41dB

	NO CUTOFF	80.0dB CUTOFF	90.0dB CUTOFF
Ldod	60.4dB	43.7dB	42.2dB
Losha	59.6dB	41.8dB	41.2dB
Leq(6)	59.0dB	41.4dB	41.1dB

Calculated Ldn from long-term noise monitoring data - LT-7 Laughlin road

	TIME	dBA	Remove LOG	10 dBA Penalized Values	5 dBA Penalized Values
9/16/2016	Midnight 0 / 24	53.2	208930	2089296	660693
	am 1:00	100 52.6	181970	1819701	575440
		2:00 200 54.1	257040	2570396	812831
		3:00 300 56.4	436516	4365158	1380384
		4:00 400 60.4	1096478	10964782	3467369
		5:00 500 61.0	1258925	12589254	3981072
		6:00 600 59.4	870964	8709636	2754229
		7:00 700 59.9	977237	9772372	3090295
		8:00 800 58.3	676083	6760830	2137962
		9:00 900 54.9	309030	3090295	977237
		10:00 1000 53.3	213796	2137962	676083
		11:00 1100 53.9	245471	2454709	776247
		12:00 1200 51.7	147911	1479108	467735
	pm 1:00	1300 51.8	151356	1513561	478630
		2:00 1400 50.9	123027	1230269	389045
		3:00 1500 52.8	190546	1905461	602560
		4:00 1600 54.5	281838	2818383	891251
		5:00 1700 55.3	338844	3388442	1071519
		6:00 1800 56.2	416869	4168694	1318257
		7:00 1900 57.9	616595	6165950	1949845
		8:00 2000 56.7	467735	4677351	1479108
		9:00 2100 56.8	478630	4786301	1513561
		10:00 2200 58.5	707946	7079458	2238721
	pm 11:00	2300 56.6	457088	4570882	1445440

Leq Morning Peak Hour 7:00-10:00 a.m.

58.2 dBA

Leq Evening Peak Hour 4:00-8:00 p.m.

56 dBA

Leq Nighttime 10:00 pm-7:00 a.m. (not penalized)

58 dBA

Leq Daytime 7:00 am-10:00 p.m.

56 dBA

Leq 24-Hour

57 dBA

Ldn: 10 dBA penalty for noise between 10:00 p.m. and 7:00 a.m.

64.0 dBA

**CNEL: 5 dBA penalty for noise between 7:00p.m. and 10:00 p.m.,
and 10 dBA penalty for noise between
10:00 p.m. and 7:00 a.m.**

64 dBA

CNEL - Ldn 0.23647004

Laughlin.txt

METROSONICS db-308 SN 2458 V2.3 3/87

CURRENT DATE: 9/19/16
CURRENT TIME: 9:17:48

Long-term monitoring Laughlin Road LT-7

CALIBRATED: 9/15/16 @ 13:03:21

DISPLAY RANGE: 42.5dB TO 138.5dB

DOUBLING RATE: 3 dB

FILTER: A WGHT

RESPONSE: SLOW

SCHEDULED RUN: OFF

START DATE: 9/16/16
START TIME: 0:00:00
LENGTH: 26:00:00

** OVERALL REPORT **

TEST STARTING DATE: 9/16/16
TEST STARTING TIME: 0:00:19
TEST LENGTH: 1DAYS 2:00:00

Lav = 56.6dB
Lav 80= 42.5dB
Lav 90= 42.5dB
SEL =106.2dB

Lmax = 75.8dB ON 9/16/16 @ 17:26:45
Lpk < 117dB

TIME OVER 115dB 0D 0:00:00.00

DOSE CRITERION: 90dB

8 HR DOSE (80dB CUTOFF)= 0.00%
8 HR DOSE (90dB CUTOFF)= 0.00%

** TIME HISTORY REPORT **

MODE: CONTINUOUS
PERIOD LENGTH: 1:00:00
TIME HISTORY CUTOFF: NONE
Ln(1): 10.0% Ln(2): 90.0%

INT#	START	Lav	Lmax	Lpk
TAG#	TIME	ET	L1	L2

Laughlin.txt

1	9/16/16	53.2	64.9	<117	*		+	
0	0:00:19	1:00:00	55	50				
2	9/16/16	52.6	60.6	<117	*	+		
0	1:00:19	1:00:00	54	50				
3	9/16/16	54.1	60.9	<117	*	+		
0	2:00:19	1:00:00	56	51				
4	9/16/16	56.4	65.1	<117	*		+	
0	3:00:19	1:00:00	58	53				
5	9/16/16	60.4	67.1	<117		*		+
0	4:00:19	1:00:00	61	59				
6	9/16/16	61.0	70.6	<117		*		+
0	5:00:19	1:00:00	62	59				
7	9/16/16	59.4	68.3	<117		*		+
0	6:00:19	1:00:00	60	57				
8	9/16/16	59.9	70.6	<117		*		+
0	7:00:19	1:00:00	61	57				
9	9/16/16	58.3	74.9	<117		*		+
0	8:00:19	1:00:00	59	55				
10	9/16/16	54.9	70.0	<117	*			+
0	9:00:19	1:00:00	57	51				
11	9/16/16	53.3	70.5	<117	*			+
0	10:00:19	1:00:00	55	49				
12	9/16/16	53.9	70.6	<117	*			+
0	11:00:19	1:00:00	55	49				
13	9/16/16	51.7	63.5	<117	*		+	
0	12:00:19	1:00:00	53	48				
14	9/16/16	51.8	63.8	<117	*		+	
0	13:00:19	1:00:00	54	48				
15	9/16/16	50.9	68.1	<117	*			+
0	14:00:19	1:00:00	53	46				
INT#	START	Lav	Lmax	Lpk				
TAG#	TIME	ET	L1	L2				
16	9/16/16	52.8	68.8	<117	*			+
0	15:00:19	1:00:00	55	47				
17	9/16/16	54.5	69.9	<117	*			+
0	16:00:19	1:00:00	56	51				
18	9/16/16	55.3	75.8	<117	*			+
0	17:00:19	1:00:00	56	51				
19	9/16/16	56.2	64.4	<117	*		+	
0	18:00:19	1:00:00	58	53				

Laughlin.txt

20	9/16/16	57.9	65.5	<117	*	+
0	19:00:19	1:00:00	59	55		
21	9/16/16	56.7	66.7	<117	*	+
0	20:00:19	1:00:00	58	54		
22	9/16/16	56.8	65.6	<117	*	+
0	21:00:19	1:00:00	58	54		
23	9/16/16	58.5	69.2	<117	*	+
0	22:00:19	1:00:00	60	55		
24	9/16/16	56.6	64.1	<117	*	+
0	23:00:19	1:00:00	58	53		
25	9/17/16	55.2	68.0	<117	*	+
0	0:00:19	1:00:00	57	51		
26	9/17/16	56.8	64.9	<117	*	+
0	1:00:19	PARTIAL	59	52		

** AMPLITUDE DISTRIBUTION REPORT **

TOTAL SAMPLES = 748800

dB	SAMPLES	% OF TOTAL
42	9	.00
43	129 .	.01
44	428 .	.05
45	861 +	.11
46	4051 *	.54
47	9150 *	1.22
48	16735 **	2.23
49	31041 ****	4.14
50	42583 *****	5.68
51	54409 *****	7.26
52	67659 *****	9.03
53	71017 *****	9.48
54	66871 *****	8.93
55	65429 *****	8.73
56	74620 *****	9.96
57	59571 *****	7.95
58	59532 *****	7.95
59	50065 *****	6.68
60	43552 *****	5.81
61	20034 ***	2.67
62	5837 *	.77
63	2303 +	.30
64	1041 +	.13
65	671 .	.08
66	402 .	.05
67	246 .	.03
68	230 .	.03
69	129 .	.01
70	86 .	.01
71	18	.00
72	19	.00
73	21	.00
74	16	.00
75	35	.00

Laughlin.txt

Ln(0.0) = 75dB
Ln(10.0) = 59dB
Ln(50.0) = 55dB
Ln(99.9) = 45dB

	NO CUTOFF	80.0dB CUTOFF	90.0dB CUTOFF
Ldod	55.8dB	42.0dB	42.0dB
Losha	55.5dB	42.0dB	42.0dB
Leq(6)	55.4dB	42.0dB	42.0dB

Calculated Ldn from long-term noise monitoring data - LT-8 Vasco Road

	TIME	dBA	Remove LOG	10 dBA Penalized Values	5 dBA Penalized Values
9/16/2016	Midnight 0 / 24	56.3	426580	4265795	1348963
	am 1:00	100 53.5	223872	2238721	707946
	2:00	200 54.6	288403	2884032	912011
	3:00	300 57.5	562341	5623413	1778279
	4:00	400 63.4	2187762	21877616	6918310
	5:00	500 64.9	3090295	30902954	9772372
	6:00	600 65.2	3311311	33113112	10471285
	7:00	700 67.1	5128614	51286138	16218101
	8:00	800 67.4	5495409	54954087	17378008
	9:00	900 65.4	3467369	34673685	10964782
	10:00	1000 72.8	19054607	190546072	60255959
	11:00	1100 65.7	3715352	37153523	11748976
	12:00	1200 68.8	7585776	75857758	23988329
	pm 1:00	1300 66.3	4265795	42657952	13489629
	2:00	1400 66.0	3981072	39810717	12589254
	3:00	1500 66.6	4570882	45708819	14454398
	4:00	1600 67.0	5011872	50118723	15848932
	5:00	1700 66.5	4466836	44668359	14125375
	6:00	1800 65.9	3890451	38904514	12302688
	7:00	1900 64.4	2754229	27542287	8709636
	8:00	2000 63.4	2187762	21877616	6918310
	9:00	2100 62.8	1905461	19054607	6025596
	10:00	2200 61.9	1548817	15488166	4897788
	pm 11:00	2300 60.4	1096478	10964782	3467369

Leq Morning Peak Hour 7:00-10:00 a.m.

66.7 dBA

Leq Evening Peak Hour 4:00-8:00 p.m.

66 dBA

Leq Nighttime 10:00 pm-7:00 a.m. (not penalized)

62 dBA

Leq Daytime 7:00 am-10:00 p.m.

67 dBA

Leq 24-Hour

66 dBA

Ldn: 10 dBA penalty for noise between 10:00 p.m. and 7:00 a.m.

69.3 dBA

CNEL: 5 dBA penalty for noise between 7:00p.m. and 10:00 p.m., and 10 dBA penalty for noise between 10:00 p.m. and 7:00 a.m.

70 dBA

CNEL - Ldn 0.30308699

METROSONICS db-308 SN 2593 V2.3 3/87

CURRENT DATE: 9/19/16
CURRENT TIME: 9:21:05

Long-term monitoring LT-8 Vasco

CALIBRATED: 9/15/16 @ 13:32:37

DISPLAY RANGE: 41.9dB TO 137.9dB

DOUBLING RATE: 3 dB

FILTER: A WGHT

RESPONSE: SLOW

SCHEDULED RUN: OFF

START DATE: 9/16/16
START TIME: 0:00:00
LENGTH: 26:00:00

** OVERALL REPORT **

TEST STARTING DATE: 9/16/16
TEST STARTING TIME: 0:00:19
TEST LENGTH: 1DAYS 2:00:00

Lav = 65.5dB
Lav 80= 58.9dB
Lav 90= 56.1dB
SEL =115.0dB

Lmax = 95.4dB ON 9/16/16 @ 10:16:40
Lpk = 116dB ON 9/16/16 @ 10:16:40

TIME OVER 115dB 0D 0:00:00.00

DOSE CRITERION: 90dB

8 HR DOSE (80dB CUTOFF)= 0.24%
8 HR DOSE (90dB CUTOFF)= 0.12%

** TIME HISTORY REPORT **

MODE: CONTINUOUS
PERIOD LENGTH: 1:00:00
TIME HISTORY CUTOFF: NONE
Ln(1): 10.0% Ln(2): 90.0%

INT#	START	Lav	Lmax	Lpk
TAG#	TIME	ET	L1	L2

1	9/16/16	56.3	83.6	<116	*					+
0	0:00:19	1:00:00	59	41						
2	9/16/16	53.5	72.1	<116	*		+			
0	1:00:19	1:00:00	57	41						
3	9/16/16	54.6	72.9	<116	*		+			
0	2:00:19	1:00:00	56	41						
4	9/16/16	57.5	83.4	<116	*					+
0	3:00:19	1:00:00	59	41						
5	9/16/16	63.4	88.8	<116	*					+
0	4:00:19	1:00:00	66	43						
6	9/16/16	64.9	80.4	<116	*				+	
0	5:00:19	1:00:00	69	46						
7	9/16/16	65.2	80.2	<116	*				+	
0	6:00:19	1:00:00	69	48						
8	9/16/16	67.1	83.8	<116	*					+
0	7:00:19	1:00:00	70	50						
9	9/16/16	67.4	83.6	<116	*					+
0	8:00:19	1:00:00	70	51						
10	9/16/16	65.4	77.3	<116	*			+		
0	9:00:19	1:00:00	69	48						
11	9/16/16	72.8	95.4	116			*			+
0	10:00:19	1:00:00	70	51						
12	9/16/16	65.7	82.7	<116	*				+	
0	11:00:19	1:00:00	68	53						
13	9/16/16	68.8	92.3	<116	*					+
0	12:00:19	1:00:00	71	56						
14	9/16/16	66.3	85.1	<116	*					+
0	13:00:19	1:00:00	69	52						
15	9/16/16	66.0	86.6	<116	*					+
0	14:00:19	1:00:00	69	52						
INT#	START	Lav	Lmax	Lpk						
TAG#	TIME	ET	L1	L2						
16	9/16/16	66.6	83.7	<116	*					+
0	15:00:19	1:00:00	69	56						
17	9/16/16	67.0	84.9	<116	*					+
0	16:00:19	1:00:00	69	57						
18	9/16/16	66.5	82.6	<116	*					+
0	17:00:19	1:00:00	69	57						
19	9/16/16	65.9	81.0	<116	*				+	
0	18:00:19	1:00:00	69	50						

Vasco.txt

20	9/16/16	64.4	80.6	<116	*	+
0	19:00:19	1:00:00	68	49		
21	9/16/16	63.4	76.7	<116	*	+
0	20:00:19	1:00:00	67	47		
22	9/16/16	62.8	77.6	<116	*	+
0	21:00:19	1:00:00	67	47		
23	9/16/16	61.9	77.3	<116	*	+
0	22:00:19	1:00:00	66	48		
24	9/16/16	60.4	76.7	<116	*	+
0	23:00:19	1:00:00	64	47		
25	9/17/16	57.2	73.9	<116	*	+
0	0:00:19	1:00:00	62	44		
26	9/17/16	56.1	76.9	<116	*	+
0	1:00:19	PARTIAL	60	44		

** AMPLITUDE DISTRIBUTION REPORT **

TOTAL SAMPLES = 748800

dB	SAMPLES	% OF TOTAL
41	63205 *****	8.44
42	11542 **	1.54
43	11911 **	1.59
44	21279 ***	2.84
45	20115 ***	2.68
46	18001 **	2.40
47	17681 **	2.36
48	17452 **	2.33
49	20440 ***	2.72
50	17138 **	2.28
51	15933 **	2.12
52	14197 **	1.89
53	12930 **	1.72
54	13003 **	1.73
55	15303 **	2.04
56	20772 ***	2.77
57	19639 ***	2.62
58	23134 ***	3.08
59	25132 ***	3.35
60	29795 ****	3.97
61	31460 ****	4.20
62	35026 *****	4.67
63	35152 *****	4.69
64	37789 *****	5.04
65	34659 *****	4.62
66	33611 *****	4.48
67	35278 *****	4.71
68	32923 *****	4.39
69	21341 ***	2.85
70	16703 **	2.23
71	9728 *	1.29
72	5893 *	.78
73	3308 +	.44
74	2091 +	.27

Vasco.txt

75	1443	+	.19
76	976	+	.13
77	643	.	.08
78	442	.	.05
79	396	.	.05
80	246	.	.03
81	210	.	.02
82	227	.	.03
83	171	.	.02
84	99	.	.01
85	61	.	.00
86	51	.	.00
87	43	.	.00
88	32	.	.00
89	25	.	.00
90	37	.	.00
91	40	.	.00
92	50	.	.00

dB	SAMPLES	% OF TOTAL
93	21	.00
94	15	.00
95	8	.00

Ln(0.0) = 95dB
 Ln(10.0) = 68dB
 Ln(50.0) = 59dB
 Ln(99.9) = 41dB

	NO CUTOFF	80.0dB CUTOFF	90.0dB CUTOFF
Ldod	63.2dB	48.8dB	43.5dB
Losha	62.2dB	45.2dB	42.7dB
Leq(6)	61.5dB	43.1dB	41.6dB

Croak.txt

METROSONICS db-308 SN 2456 V2.3 3/87

CURRENT DATE: 2/15/17
CURRENT TIME: 8:36:42

Croak Road Residence Short-term monitoring

CALIBRATED: 2/14/17 @ 15:03:44

DISPLAY RANGE: 42.0dB TO 138.0dB

DOUBLING RATE: 3 dB

FILTER: A WGHT

RESPONSE: SLOW

SCHEDULED RUN: OFF

START DATE: 1/01/85
START TIME: 0:00:00
LENGTH: 1:00:00

** OVERALL REPORT **

TEST STARTING DATE: 2/14/17
TEST STARTING TIME: 17:37:19
TEST LENGTH: 0DAYS 0:21:41

Lav = 66.0dB
Lav 80= 42.0dB
Lav 90= 42.0dB
SEL = 97.0dB

Lmax = 78.9dB ON 2/14/17 @ 17:38:02
Lpk < 117dB

TIME OVER 115dB 0D 0:00:00.00

DOSE CRITERION: 90dB

8 HR DOSE (80dB CUTOFF)= 0.00%
8 HR PROJ. DOSE (80dB CUTOFF)= 0.00%
8 HR DOSE (90dB CUTOFF)= 0.00%
8 HR PROJ. DOSE (90dB CUTOFF)= 0.00%

** TIME HISTORY REPORT **

MODE: CONTINUOUS
PERIOD LENGTH: 0:20:00
TIME HISTORY CUTOFF: NONE
Ln(1): 10.0% Ln(2): 90.0%

Croak.txt

INT# TAG#	START TIME	Lav ET	Lmax L1	Lpk L2		
1 0	2/14/17 17:37:19	65.7 0:20:00	78.9 66	<117 64	*	+
2 0	2/14/17 17:57:19	68.2 PARTIAL	74.1 71	<117 65	*	+

** AMPLITUDE DISTRIBUTION REPORT **

TOTAL SAMPLES = 10411

dB	SAMPLES		% OF TOTAL
62	107	*	1.02
63	625	*****	6.00
64	2340	*****	22.47
65	3707	*****	35.60
66	2526	*****	24.26
67	625	*****	6.00
68	191	**	1.83
69	94	*	.90
70	75	*	.72
71	49	+	.47
72	30	+	.28
73	26	+	.24
74	8	.	.07
75	2	.	.01
76	1	.	.00
77	3	.	.02
78	2	.	.01

Ln(0.0) = 78dB
 Ln(10.0) = 67dB
 Ln(50.0) = 65dB
 Ln(99.9) = 62dB

	NO CUTOFF	80.0dB CUTOFF	90.0dB CUTOFF
Ldod	65.4dB	42.0dB	42.0dB
Losha	65.4dB	42.0dB	42.0dB
Leq(6)	65.3dB	42.0dB	42.0dB

File Name	LxT_Data.048
Serial Number	0004338
Model	SoundTrack LxT®
Firmware Version	2.301
User	Sanchez
Location	End of Hartman Road
Job Description	BART Extension Livermore
Note	

Measurement Description

Start	2017-05-02 14:30:03
Stop	2017-05-02 14:41:43
Duration	00:11:39.4
Run Time	00:11:39.4
Pause	00:00:00.0
Pre Calibration	2017-05-02 11:13:29
Post Calibration	None
Calibration Deviation	---

Overall Settings

RMS Weight	A Weighting		
Peak Weight	Z Weighting		
Detector	Slow		
Preamp	PRMLxT2B		
Microphone Correction	Off		
Integration Method	Linear		
Overload	143.4 dB		
	A	C	Z
Under Range Peak	99.8	96.8	101.8 dB
Under Range Limit	36.9	34.9	42.9 dB
Noise Floor	24.4	24.8	32.1 dB

Results

LAeq	50.1 dB	
LAE	78.6 dB	
EA	8.010 $\mu\text{Pa}^2\text{h}$	
EA8	329.840 $\mu\text{Pa}^2\text{h}$	
EA40	1.649 mPa^2h	
LZpeak (max)	2017-05-02 14:40:30	101.3 dB
LASmax	2017-05-02 14:33:59	63.1 dB
LASmin	2017-05-02 14:30:27	30.8 dB
SEA	-99.9 dB	

LAS > 85.0 dB (Exceedance Counts / Duration)	0	0.0 s
LAS > 115.0 dB (Exceedance Counts / Duration)	0	0.0 s
LZpeak > 135.0 dB (Exceedance Counts / Duration)	0	0.0 s
LZpeak > 137.0 dB (Exceedance Counts / Duration)	0	0.0 s
LZpeak > 140.0 dB (Exceedance Counts / Duration)	0	0.0 s

LCeq	60.0 dB
LAeq	50.1 dB
LCeq - LAeq	9.9 dB
LAeq	52.5 dB
LAeq	50.1 dB
LAeq - LAeq	2.3 dB
# Overloads	0
Overload Duration	0.0 s

Dose Settings

Dose Name	OSHA-1	OSHA-2
Exchange Rate	5	5 dB
Threshold	90	80 dB
Criterion Level	90	90 dB
Criterion Duration	8	8 h

Results

Dose	-99.9	-99.9 %
Projected Dose	-99.9	-99.9 %
TWA (Projected)	-99.9	-99.9 dB
TWA (t)	-99.9	-99.9 dB
Lep (t)	34.0	34.0 dB

Statistics

LAS5.00	57.7 dB
LAS10.00	56.9 dB
LAS33.30	38.9 dB
LAS50.00	36.7 dB
LAS66.60	35.2 dB
LAS90.00	33.1 dB

G.6 Noise Model Data – Sound Level Meter Certification



Certificate of Calibration

Certificate No: 55147172456DB308

Submitted By: ESA ENERGY
2600 CAPITOL AVE STE 200
SACRAMENTO, CA 95816

Serial Number: 2456DB308 Date Received: 10/2/2015
Customer ID: Date Issued: 10/5/2015
Model: DB-308 V2 DOSIMETER Valid Until: 10/5/2016

Test Conditions: Model Conditions:
Temperature: 18°C to 29°C As Found: IN TOLERANCE
Humidity: 20% to 80% As Left: IN TOLERANCE
Barometric Pressure: 890 mbar to 1050 mbar

SubAssemblies:

Description: Serial Number:

Calibrated per Procedure: 308V-020-02

Reference Standard(s):

I.D. Number	Device	Last Calibration Date	Calibration Due
EF000138	QUEST-CAL	12/16/2014	12/16/2015
ET0000556	B&K ENSEMBLE	10/15/2014	10/15/2015

Measurement Uncertainty:

+/- 2.2% ACOUSTIC (0.19DB)
Estimated at 95% Confidence Level (k=2)

Calibrated By: Bryan Rasmussen 10/5/2015
BRYAN RASMUSSEN Service Technician

This report certifies that all calibration equipment used in the test is traceable to NIST, and applies only to the unit identified under equipment above. This report must not be reproduced except in its entirety without the written approval of 3M Detection Solutions.



Certificate of Calibration

Certificate No: 55147172458DB308

Submitted By: ESA ENERGY
2600 CAPITOL AVE STE 200
SACRAMENTO, CA 95816

Serial Number: 2458DB308 Date Received: 10/2/2015
Customer ID: Date Issued: 10/5/2015
Model: DB-308 V2 DOSIMETER Valid Until: 10/5/2016

Test Conditions: Model Conditions:
Temperature: 18°C to 29°C As Found: IN TOLERANCE
Humidity: 20% to 80% As Left: IN TOLERANCE
Barometric Pressure: 890 mbar to 1050 mbar

SubAssemblies:

Description: Serial Number:

Calibrated per Procedure:308V-020-02

Reference Standard(s):

I.D. Number	Device	Last Calibration Date	Calibration Due
EF000138	QUEST-CAL	12/16/2014	12/16/2015
ET0000556	B&K ENSEMBLE	10/15/2014	10/15/2015

Measurement Uncertainty:

+/- 2.2% ACOUSTIC (0.19DB)
Estimated at 95% Confidence Level (k=2)

Calibrated By: Bryan Rasmussen 10/5/2015
BRYAN RASMUSSEN Service Technician

This report certifies that all calibration equipment used in the test is traceable to NIST, and applies only to the unit identified under equipment above. This report must not be reproduced except in its entirety without the written approval of 3M Detection Solutions.



SUMMARY REPORT

WORK ORDER: 5514717

10/5/2015

Related Event Type

CALIBRATION - STANDARD

Repair Notes: This unit passed test.

Model Name

DB-308 V2 DOSIMETER

Serial Number

2456DB308

Performed By

BRYAN RASMUSSEN

CALIBRATION - STANDARD

Repair Notes: This unit passed test.

DB-308 V2 DOSIMETER

2458DB308

BRYAN RASMUSSEN

Calibration Certificate

Certificate Number 2017002074

Customer:

ESA Energy
2600 Capital Avenue
Sacramento, CA 95816, United States

Model Number	LxT2	Procedure Number	D0001.8378
Serial Number	0004338	Technician	Ron Harris
Test Results	Pass	Calibration Date	24 Feb 2017
Initial Condition	AS RECEIVED same as shipped	Calibration Due	24 Feb 2018
Description	SoundTrack LxT Class 2 Class 2 Sound Level Meter Firmware Revision: 2.301	Temperature	22.84 °C ± 0.25 °C
		Humidity	51 %RH ± 2.0 %RH
		Static Pressure	86.02 kPa ± 0.13 kPa

Evaluation Method Tested electrically using Larson Davis PRMLxT2B S/N 036170 and an 18.0 pF capacitor to simulate microphone capacitance. Data reported in dB re 20 µPa assuming a microphone sensitivity of 35.5 mV/Pa.

Compliance Standards Compliant to Manufacturer Specifications and the following standards when combined with Calibration Certificate from procedure D0001.8384:

IEC 60651:2001 Type 2	ANSI S1.4-2014 Class 2
IEC 60804:2000 Type 2	ANSI S1.4 (R2006) Type 2
IEC 61252:2002	ANSI S1.11 (R2009) Class 2
IEC 61260:2001 Class 2	ANSI S1.25 (R2007)
IEC 61672:2013 Class 2	ANSI S1.43 (R2007) Type 2

Issuing lab certifies that the instrument described above meets or exceeds all specifications as stated in the referenced procedure (unless otherwise noted). It has been calibrated using measurement standards traceable to the International System of Units (SI) through the National Institute of Standards and Technology (NIST), or other national measurement institutes, and meets the requirements of ISO/IEC 17025:2005. **Test points marked with a ‡ in the uncertainties column do not fall within this laboratory's scope of accreditation.**

The quality system is registered to ISO 9001:2008.

This calibration is a direct comparison of the unit under test to the listed reference standards and did not involve any sampling plans to complete. No allowance has been made for the instability of the test device due to use, time, etc. Such allowances would be made by the customer as needed.

The uncertainties were computed in accordance with the ISO Guide to the Expression of Uncertainty in Measurement (GUM). A coverage factor of approximately 2 sigma (k=2) has been applied to the standard uncertainty to express the expanded uncertainty at approximately 95% confidence level.

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Correction data from Larson Davis LxT Manual for SoundTrack LxT & SoundExpert Lxt, I770.01 Rev J Supporting Firmware Version 2.301, 2015-04-30

Calibration Check Frequency: 1000 Hz; Reference Sound Pressure Level: 114 dB re 20 µPa

Larson Davis, a division of PCB Piezotronics, Inc
1681 West 820 North
Provo, UT 84601, United States
716-684-0001



**APPENDIX H:
AIR QUALITY TECHNICAL TABLES**

**Table 1
Construction Schedule
BART to Livermore Extension
Livermore, California**

Construction Tie	Segment Number	2020				2021				2022				2023				2024				Total Duration (months)
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	
Conventional BART (Project)																						
Hopyard to Hacienda	4					*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	36
Hacienda to Tassajara	6					*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	36
Tassajara Interchange	7					*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	24
Tassajara to Fallon	8					*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	36
Fallon Interchange	9					*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	24
Fallon to Airway	10					*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	36
Airway Interchange	11					*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	24
Airway to Isabel Station	12					*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	36
Isabel Interchange	13	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	18
Isabel Station BART	14	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	48
Parking Garage / Surface South	16		*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	18
Isabel Station to Yard	17	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	48
Maintenance Facility / Yard	19						*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	30
Campus Access Road	N/A								*													3
Hacienda Staging	N/A					*																3
Airway Staging	N/A					*																3
Isabel Staging	N/A	*																				3
Maintenance Facility / Yard Staging	N/A								*													3
DMU Alternative (EMU Option)																						
D/P Station Cross Transfer Platform	3	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	48
Hopyard to Hacienda	4	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	39
Hacienda Interchange	5	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	48
Hacienda to Tassajara	6					*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	36
Tassajara Interchange	7					*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	24
Tassajara to Fallon	8					*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	36
Fallon Interchange	9					*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	24
Fallon to Airway	10					*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	36
Airway Interchange	11					*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	24
Airway to Isabel Station	12					*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	36
Isabel Interchange	13	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	18
Isabel Station DMU/EMU	15	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	48
Parking Garage / Surface South	16		*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	18
Isabel Station to Yard	17	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	42
Maintenance Facility / Yard	18						*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	30
Hacienda Staging	N/A	*																				3
Airway Staging	N/A					*																3
Isabel Staging	N/A	*																				3
Maintenance Facility / Yard Staging	N/A								*													3
Express Bus/BRT Alternative																						
Hopyard Interchange	1	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	33
D/P Station Express Bus Platform	2	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	45
Hopyard to Hacienda	4	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	33
Hacienda Interchange	5	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	33
Pleasanton Station	20	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	33
Laughlin At Grade Parking	22	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	33
Hacienda Staging	N/A	*																				3

Notes:

¹ Construction phasing based on Project-specific assumptions.

² It was assumed that one month of staging would occur at the start of nearby construction. For example, for Conventional BART, Hacienda Staging would occur for the first month of construction activity at the Hopyard to Hacienda and Hacienda to Tassajara segments.

Abbreviations:

- BART - Bay Area Rapid Transit
- BRT - Bus Rapid Transit
- DMU - Diesel Multiple Units
- D/P - Dublin Pleasanton
- EMU - Electrical Multiple Units

Table 2
Construction Off-Road Equipment List
BART to Livermore Extension
Livermore, California

Equipment Type	Horsepower	Load Factor	Total Usage Hours		
			Conventional BART (Project)	DMU Alternative (EMU Option)	Express Bus/BRT Alternative
Excavator	163	0.38	12,014	6,376	1,231
Dozer	255	0.40	10,109	5,365	1,036
Compactor	172	0.42	19,891	10,556	2,039
Loader	98	0.37	24,790	13,157	2,541
Dump Truck	400	0.38	19,281	10,233	1,976
Scrapers	362	0.48	9,638	5,115	988
Grader	175	0.41	6,589	3,497	675
Paver	126	0.42	452	528	91
Vibrator Compactor	81	0.38	179	210	36
Pile Drivers	206	0.50	1,840	2,320	1,680
Forklift	89	0.20	52,324	11,753	615
Crane	226	0.29	5,239	2,868	615
Air Compressors	78	0.48	210	210	120
Construction Generators	84	0.74	4,000	3,520	1,840

Notes:

- ¹ Horsepower and load factor are CalEEMod[®] (version 2013.2.2) defaults for calendar year 2020.
² Hours include those associated with construction and staging equipment use. Hours do not include those associated with minor bus infrastructure improvements.

Abbreviations:

- BART - Bay Area Rapid Transit
 BRT - Bus Rapid Transit
 CalEEMod[®] - California Emissions Estimator Model
 DMU - Diesel Multiple Units
 EMU - Electrical Multiple Units

References:

California Air Pollution Control Officers Association (CAPCOA). 2013. CalEEMod. Available at: <http://www.caleemod.com>.

Table 3
Construction Off-Road Emissions
BART to Livermore Extension
Livermore, California

Project and Alternatives	Construction Duration (days)	Emissions									
		Unmitigated					Mitigated				
		ROG	NO _x	Exhaust PM ₁₀	Exhaust PM _{2.5}	CO ₂ e ⁴	ROG	NO _x	Exhaust PM ₁₀	Exhaust PM _{2.5}	CO ₂ e ⁴
		lb/day					MT/Project	lb/day			
Conventional BART (Project)	1,460	5.8	60	2.9	2.7	5,337	2.5	21	1.1	1.0	5,337
DMU Alternative (EMU Option)	1,460	3.0	31	1.5	1.4	2,867	1.5	13	0.67	0.62	2,867
Express Bus/BRT Alternative	1,551	0.67	6.9	0.32	0.30	706	0.60	6.1	0.28	0.26	706
Enhanced Bus Alternative	61	2.3	24	1.2	1.1	92	2.3	24	1.2	1.1	92

Notes:

- Off-road construction emissions were calculated using CalEEMod[®] (version 2013.2.2) based on the construction equipment details presented in Table 2.
- Mitigated emissions reflect the use of Tier 4 final equipment for specific equipment types, as listed below.
 Conventional BART (Project) - compactors, dozers, dump trucks, scraping equipment, and loaders
 DMU Alternative (EMU Option) - compactors, dozers, dump trucks, and scraping equipment
 Express Bus/BRT Alternative - compactors
- Enhanced bus improvements are included for all alternatives. The bus improvements were conservatively approximated by scaling the sum of Conventional BART construction emissions, excluding Maintenance Facility/Yard activity, by the relative construction durations (i.e., BART Emissions*2 months/48 months). For each alternative, the total emissions is equal to the original scenario-specific emissions, plus the additional approximate emissions from bus improvements.
- Global warming potentials based on Intergovernmental Panel on Climate Change (IPCC) Fourth Assessment Report.

Abbreviations:

- BART - Bay Area Rapid Transit
- BRT - Bus Rapid Transit
- CalEEMod[®] - California Emissions Estimator Model
- CO₂e - carbon dioxide equivalent
- DMU - Diesel Multiple Units
- EMU - Electrical Multiple Units
- lb - pound
- MT - metric ton
- NO - nitric oxide
- NO₂ - nitrogen dioxide
- NO_x - nitrogen oxide compounds (NO + NO₂)
- PM₁₀ - particulate matter with an aerodynamic diameter less than 10 microns
- PM_{2.5} - particulate matter with an aerodynamic diameter of 2.5 microns or less
- ROG - reactive organic gas

References:

- California Air Pollution Control Officers Association (CAPCOA). 2013. CalEEMod. Available at: <http://www.caleemod.com>.
- Intergovernmental Panel on Climate Change (IPCC). 2007. Fourth Assessment Report. Available at http://www.ipcc.ch/ipccreports/sar/wg1/ipcc_sar_wg1_full_report.pdf. Accessed: December 2016.

Table 4
Construction On-Road Trips
BART to Livermore Extension
Livermore, California

Project and Alternatives	Trip Type	Roundtrips	Total VMT
Conventional BART (Project)	Worker	92,814	2,301,794
	Vendor	63,522	927,414
	Hauling	53,056	2,122,240
DMU Alternative (EMU Option)	Worker	92,814	2,301,794
	Vendor	72,718	1,061,683
	Hauling	64,027	2,561,080
Express Bus/BRT Alternative	Worker	85,223	2,113,530
	Vendor	16,463	278,342
	Hauling	14,378	575,120

Notes:

- ¹ Trip lengths were based on CalEEMod[®] (version 2013.2.2) defaults for workers, vendors, and hauling, consistent with CalEEMod[®] User's Guide Appendix D. Worker trips are 12.4 miles, vendor trips are 7.3 miles, and hauling trips are 20 miles.
- ² Vendor and hauling trip rates were based on Project-specific construction assumptions.
- ³ Worker trips were calculated assuming 100 roundtrips/day of construction (Project-specific assumption) and were adjusted to account for carpool and public transportation rates.

Abbreviations:

- BART - Bay Area Rapid Transit
 BRT - Bus Rapid Transit
 CalEEMod[®] - California Emissions Estimator Model
 DMU - Diesel Multiple Units
 EMU - Electrical Multiple Units
 VMT - Vehicle Miles Traveled

References:

California Air Pollution Control Officers Association (CAPCOA). 2013. CalEEMod. Available at: <http://www.caleemod.com>.

**Table 5
 Construction On-Road Emission Factors
 BART to Livermore Extension
 Livermore, California**

Trip Type	Fleet Mix	Unit	ROG	NOx	Exhaust PM ₁₀	Exhaust PM _{2.5}	CO ₂ e ¹
Worker	50% Light Duty Auto 25% Light Duty Trucks 1 25% Light Duty Trucks 2	g/mile	0.10	0.09	0.0020	0.0019	316
		g/trip	0.44	0.15	0.0026	0.0024	71
Vendor	100% Medium-Heavy Duty Trucks	g/mile	0.14	2.25	0.043	0.042	1,206
		g/trip	0.26	7.01	0.022	0.022	527
Hauling	100% Heavy-Heavy Duty Trucks	g/mile	0.15	4.41	0.020	0.019	1,652
		g/trip	0.21	7.22	0.025	0.025	565

Notes:

- ¹ Emission factors for each trip type were based on EMFAC2014 emission factors for Alameda County, Calendar Year 2020.
- ² Worker trip emission factors were weighted based on light duty auto, light duty trucks 1 and light duty trucks 2 emission factors and the fleet mix.
- ³ Global warming potentials based on Intergovernmental Panel on Climate Change (IPCC) Fourth Assessment Report.

Abbreviations:

- BART - Bay Area Rapid Transit
- CO₂e - carbon dioxide equivalent
- EMFAC - California Air Resources Board Emissions Factor Model
- g - gram
- NO - nitric oxide
- NO₂ - nitrogen dioxide
- NO_x - nitrogen oxide compounds (NO + NO₂)
- PM₁₀ - particulate matter with an aerodynamic diameter less than 10 microns
- PM_{2.5} - particulate matter with an aerodynamic diameter of 2.5 microns or less
- ROG - reactive organic gas

References:

- California Air Resources Board (ARB). 2014. EMFAC2014. Available at: <https://www.arb.ca.gov/emfac/2014/>
- Intergovernmental Panel on Climate Change (IPCC). 2007. Fourth Assessment Report. Available at http://www.ipcc.ch/ipccreports/sar/wg_I/ipcc_sar_wg_I_full_report.pdf. Accessed: December 2016.

Table 6
Construction On-Road Emissions
BART to Livermore Extension
Livermore, California

Project and Alternatives	Construction Duration (days)	Emissions (lb/day)				
		lb/day				MT/Project
		ROG	NO _x	Exhaust PM ₁₀	Exhaust PM _{2.5}	CO ₂ e
Conventional BART (Project)	1,460	1.3	21	0.15	0.14	5,682
DMU Alternative (EMU Option)	1,460	1.4	25	0.17	0.16	6,591
Express Bus/BRT Alternative	1,551	0.65	5.9	0.044	0.042	2,118
Enhanced Bus Alternative	61	1.1	16	0.12	0.11	189

Notes:

- ¹ On-road construction emissions for the Project, DMU Alternative (EMU Option), and Express Bus/BRT Alternative are calculated based on the total trips and vehicle miles in Table 4 and the emission factors in Table 5.
- ² Enhanced bus improvements are included for all alternatives. The bus improvements were conservatively approximated by scaling the sum of Conventional BART construction emissions, excluding Maintenance Facility/Yard activity, by the relative construction durations (i.e., BART Emissions*2 months/48 months). For each alternative, the total emissions is equal to the original scenario-specific emissions, plus the additional approximate emissions from bus improvements.

Abbreviations:

- BART - Bay Area Rapid Transit
- BRT - Bus Rapid Transit
- CO₂e - carbon dioxide equivalent
- DMU - Diesel Multiple Units
- EMU - Electrical Multiple Units
- lb - pound
- MT - metric ton
- NO - nitric oxide
- NO₂ - nitrogen dioxide
- NO_x - nitrogen oxide compounds (NO + NO₂)
- PM₁₀ - particulate matter with an aerodynamic diameter less than 10 microns
- PM_{2.5} - particulate matter with an aerodynamic diameter of 2.5 microns or less
- ROG - reactive organic gas

Table 7
Construction Total Emissions
BART to Livermore Extension
Livermore, California

Project and Alternatives ^{1,2}	Construction Duration (days)	Unmitigated Emissions					Mitigated Emissions ³				
		ROG	NO _x	Exhaust PM ₁₀	Exhaust PM _{2.5}	CO ₂ e	ROG	NO _x	Exhaust PM ₁₀	Exhaust PM _{2.5}	CO ₂ e
		lb/day				MT/Project	lb/day				MT/Project
Conventional BART (Project)	1,460	17	80	3.1	2.8	11,019	14	42	1.3	1.2	11,019
DMU Alternative (EMU Option)	1,460	13	56	1.6	1.5	9,458	12	37	0.84	0.78	9,458
Express Bus/BRT Alternative	1,551	2.8	13	0.36	0.34	2,824	2.7	12	0.32	0.30	2,824
Enhanced Bus Alternative	61	13	40	1.3	1.2	281	Not Mitigated				
BAAQMD Significance Threshold (lb/day)		54	54	82	54	-	54	54	82	54	-

Notes:

- ¹ Total construction emissions include contributions from off-road equipment activity (Table 3), on-road traffic (Table 6), structural modifications associated with bus improvements (for Project and all alternatives), architectural coating of buildings (for the Conventional BART and DMU Alternative), and parking lot paving (for the DMU Alternative).
- ² Enhanced bus improvements are included for all alternatives. The bus improvements were conservatively approximated by scaling the sum of Conventional BART construction emissions, excluding Maintenance Facility/Yard activity, by the relative construction durations (i.e., BART Emissions*2 months/48 months). For each alternative, the total emissions is equal to the original scenario-specific emissions, plus the additional approximate emissions from bus improvements.
- ³ Emissions associated with the Enhanced Bus Alternative are not mitigated.

Abbreviations:

BART - Bay Area Rapid Transit
 BRT - Bus Rapid Transit
 CO₂e - carbon dioxide equivalent
 DMU - Diesel Multiple Units
 EMU - Electrical Multiple Units
 lb - pound
 MT - metric ton

NO - nitric oxide
 NO₂ - nitrogen dioxide
 NO_x - nitrogen oxide compounds (NO + NO₂)
 PM₁₀ - particulate matter with an aerodynamic diameter less than 10 microns
 PM_{2.5} - particulate matter with an aerodynamic diameter of 2.5 microns or less
 ROG - reactive organic gas

Table 8
Average Daily Construction-Related Emissions
BART to Livermore Extension
Livermore, California

Average Daily Construction Emissions (pounds/day)				
	ROG	NO_x	Exhaust PM₁₀/DPM^a	Exhaust PM_{2.5}
Conventional BART (Project)				
Off-Road Equipment Emissions	5.8	60	2.9	2.7
Truck and Vehicle Emissions	1.3	21	0.15	0.14
Paving Off-Gas Emissions	--	--	--	--
Architectural Coating Emissions	10	--	--	--
Total	17	80	3.1	2.8
Significance Thresholds	54	54	82	54
Above Threshold?	No	Yes	No	No
Average Daily Construction Emissions (pounds/day)				
	ROG	NO_x	Exhaust PM₁₀/DPM^a	Exhaust PM_{2.5}
DMU Alternative (EMU Option)				
Off-Road Equipment Emissions	3.0	31	1.5	1.4
Truck and Vehicle Emissions	1.4	25	0.17	0.16
Paving Off-Gas Emissions	--	--	--	--
Architectural Coating Emissions	8.8	--	--	--
Total	13	56	1.6	1.5
Significance Thresholds	54	54	82	54
Above Threshold?	No	Yes	No	No
Average Daily Construction Emissions (pounds/day)				
	ROG	NO_x	Exhaust PM₁₀/DPM^a	Exhaust PM_{2.5}
Express Bus/BRT Alternative				
Off-Road Equipment Emissions	0.67	6.9	0.32	0.30
Truck and Vehicle Emissions	0.65	5.9	0.044	0.042
Paving Off-Gas Emissions	0.0051	--	--	--
Architectural Coating Emissions	1.5	--	--	--
Total	2.8	13	0.36	0.34
Significance Thresholds	54	54	82	54
Above Threshold?	No	No	No	No
Average Daily Construction Emissions (pounds/day)				
	ROG	NO_x	Exhaust PM₁₀/DPM^a	Exhaust PM_{2.5}
Enhanced Bus Alternative				
Off-Road Equipment Emissions	2.3	24	1.2	1.1
Truck and Vehicle Emissions	1.1	16	0.12	0.11
Paving Off-Gas Emissions	--	--	--	--
Architectural Coating Emissions	9.2	--	--	--
Total	13	40	1.3	1.2
Significance Thresholds	54	54	82	54
Above Threshold?	No	No	No	No

Notes:

- For purposes of this analysis, it is conservatively assumed that all PM₁₀ is DPM.
- Paving off-gas emissions from asphalt are calculated for the Laughlin Surface Parking Lot part of the Express Bus/BRT Alternative. It is assumed that new surface roads, I-580, and covered parking lots will not require asphalt paving.
- Construction emissions for the Enhanced Bus Alternative are very conservatively based on scaling construction emissions from Conventional BART (excluding the Maintenance Facility/Yard construction activity) based on the duration of construction. Construction of the Conventional BART Project is estimated to take 48 months while the Enhanced Bus Alternative is estimated to take 2 months. The emissions shown in this table are average daily construction emissions (i.e., emissions divided by time). Therefore the average daily construction emissions for the Enhanced Bus Alternative are similar to the emissions for the Conventional BART Project, even though total emissions will be significantly less.

Table 9
Mitigated Average Daily Construction-Related Emissions
(DMU Alternative (EMU Option))
BART to Livermore Extension
Livermore, California

Average Daily Construction Emissions (pounds/day)				
	ROG	NO_x	Exhaust PM₁₀/DPM^a	Exhaust PM_{2.5}
Conventional BART (Project)				
Off-Road Equipment Emissions	2.5	21	1.1	1.0
Truck and Vehicle Emissions	1.3	21	0.15	0.14
Paving Off-Gas Emissions	0	0	0	0
Architectural Coating Emissions	10	0	0	0
Total	14	42	1.3	1.2
Significance Thresholds	54	54	82	54
Above Threshold?	No	No	No	No
Average Daily Construction Emissions (pounds/day)				
	ROG	NO_x	Exhaust PM₁₀/DPM^a	Exhaust PM_{2.5}
DMU Alternative (EMU Option)				
Off-Road Equipment Emissions	1.5	13	0.67	0.62
Truck and Vehicle Emissions	1.4	25	0.17	0.16
Paving Off-Gas Emissions	0	0	0	0
Architectural Coating Emissions	8.8	0	0	0
Total	12	37	0.84	0.78
Significance Thresholds	54	54	82	54
Above Threshold?	No	No	No	No

Notes:

a. For purposes of this analysis, it is conservatively assumed that all PM₁₀ is DPM.

Table 10
Mitigated Average Daily Construction-Related Emissions
(Conventional BART and Express Bus/BRT Alternative)
BART to Livermore Extension
Livermore, California

	Average Daily Construction Emissions (pounds/day)			
	ROG	NO _x	Exhaust PM ₁₀ /DPM ^a	Exhaust PM _{2.5}
Express Bus/BRT Alternative				
Off-Road Equipment Emissions	0.60	6.1	0.28	0.26
Truck and Vehicle Emissions	0.65	5.9	0.044	0.042
Paving Off-Gas Emissions	0.0051	0	0	0
Architectural Coating Emissions	1.5	0	0	0
Total	2.7	12	0.32	0.30
Significance Thresholds	54	54	82	54
Above Threshold?	No	No	No	No

Notes:

a. For purposes of this analysis, it is conservatively assumed that all PM₁₀ is DPM.

**Table 11
 Operational Emission Inventory Components
 BART to Livermore Extension
 Livermore, California**

Emission Component	Conventional BART (Project)	DMU Alternative (EMU Option)	Express Bus/BRT Alternative	Enhanced Bus Alternative
Mobile Vehicles				
Passenger Vehicles	X	X	X	X
Buses	X	X	X	X
Maintenance Trucks	X	X		
Shuttle Van	X			
Transit Operations				
BART Operation	X	X	X	
DMU/EMU Operation		X		
Station and Maintenance Area Operations				
Station Electricity	X	X		
Emergency Generators	X	X		
Water and Wastewater	X	X	X	X
Solid Waste	X	X	X	X
Solvent Use	X	X		
Area Coating	X	X	X	
Solar PV Generation	X	X		
Forklifts	X	X		

Notes:

¹ Not all emission components are sources of emissions. For example, avoided emissions due to solar PV electricity generation and diverted passenger vehicle trips are quantified as negative emissions.

Abbreviations:

- BART - Bay Area Rapid Transit
- BRT - Bus Rapid Transit
- DMU - Diesel Multiple Units
- EMU - Electrical Multiple Units
- PV - photovoltaic

Table 12
Operational Mobile Emission Factors
BART to Livermore Extension
Livermore, California

Operational Year	Trip Type	Fleet Mix	Fuel Type	Unit	Emission Factors ¹				
					ROG	NO _x	PM ₁₀	PM _{2.5}	CO ₂ e ⁴
2025	Passenger Vehicles ²	50% Light Duty Auto 25% Light Duty Trucks 1 25% Light Duty Trucks 2	Gas, Diesel, Electric	g/mile	0.0091	0.046	0.046	0.019	249
				g/trip	0.50	0.068	0.0023	0.0021	58
	Non-LAVTA Buses	100% Urban Buses	Diesel	g/mile	0.82	19	1.2	0.74	2,404
				g/trip	9.1	96	2.6	2.5	9,766
	LAVTA Buses	100% Urban Buses	Diesel	g/mile	0.82	4.8	0.040	0.040	2,043
				g/trip	9.1	96	2.6	2.5	8,302
	Maintenance Trucks	100% Light-Heavy Duty Trucks 1	Diesel	g/mile	0.16	1.7	0.11	0.060	556
				g/trip	3.2	58	0.70	0.67	3,874
	Shuttle Van	100% Light-Heavy Duty Trucks 1	Diesel	g/mile	0.16	1.7	0.11	0.060	556
				g/trip	3.2	58	0.70	0.67	3,874
2040	Passenger Vehicles ²	50% Light Duty Auto 25% Light Duty Trucks 1 25% Light Duty Trucks 2	Gas, Diesel, Electric	g/mile	0.004	0.021	0.045	0.018	184
				g/trip	0.22	0.016	0.0011	0.0010	40
	Non-LAVTA Buses	100% Urban Buses	Diesel	g/mile	0.20	5.0	0.95	0.45	2,117
				g/trip	2.8	35	0.89	0.85	8,731
	LAVTA Buses	100% Urban Buses	Diesel	g/mile	0.20	4.8	0.040	0.040	1,800
				g/trip	2.8	35	0.89	0.85	7,421
	Maintenance Trucks	100% Light-Heavy Duty Trucks 1	Diesel	g/mile	0.13	0.29	0.10	0.045	524
				g/trip	3.2	31	0.41	0.39	3,606
	Shuttle Van	100% Light-Heavy Duty Trucks 1	Diesel	g/mile	0.13	0.29	0.10	0.045	524
				g/trip	3.2	31	0.41	0.39	3,606

Notes:

- ¹ Emission factors for each trip type were based on EMFAC2014 emission factors for Alameda County, Calendar Years 2025 and 2040. Idling emission factors in g/idle-hour for urban buses and light-heavy duty trucks were calculated using EMFAC2014's Project-Level assessment for Alameda County.
- ² Passenger vehicle emission factors were weighted based on light duty auto, light duty trucks 1 and light duty trucks 2 emission factors and the fleet mix.
- ³ The LAVTA urban bus PM₁₀ and NO_x emission factors in g/mile were calculated based on an emissions factor of 0.01 g/bhp-hr and 1.2 g/bhp-hr, respectively (as required by the ARB Fleet Rule for Transit Agencies - Urban Bus Requirements, 13 CRR §2023.1), and a conversion factor from ARB's Carl Moyer Program Guidelines Appendix D Table D-28 for urban buses. Specific PM and NO_x reduction information was not available for non-LAVTA bus lines associated with the project, thus EMFAC2014-based emission factors are conservatively used.
- ⁴ Global warming potentials based on Intergovernmental Panel on Climate Change (IPCC) Fourth Assessment Report.

Abbreviations:

- ARB - California Air Resources Board
- BART - Bay Area Rapid Transit
- CO₂e - carbon dioxide equivalent
- EMFAC - California Air Resources Board Emissions Factor Model
- g - gram
- NO - nitric oxide
- NO₂ - nitrogen dioxide
- NO_x - nitrogen oxide compounds (NO + NO₂)
- PM₁₀ - particulate matter with an aerodynamic diameter less than 10 microns
- PM_{2.5} - particulate matter with an aerodynamic diameter of 2.5 microns or less
- ROG - reactive organic gas

References:

- California Air Resources Board (ARB). 2014. EMFAC2014. Available at: <https://www.arb.ca.gov/emfac/2014/>
- California Air Resources Board (ARB). 2015. Carl Moyer Program Guidelines. Available at: <https://www.arb.ca.gov/carmoyer/guidelines/>
- Intergovernmental Panel on Climate Change (IPCC). 2007. Fourth Assessment Report. Available at http://www.ipcc.ch/ipccreports/sar/wg1/ipcc_sar_wg1_full_report.pdf. Accessed: December 2016.

Table 13
Operational Passenger Vehicle Emissions
BART to Livermore Extension
Livermore, California

Operational Year	Scenario	Project and Alternatives	Net New Annual VMT ¹	Net New Annual Trips ¹	Emissions ²				
					tons/yr				
					ROG	NO _x	PM ₁₀	PM _{2.5}	CO ₂ e
2025	Project	Conventional BART (Project)	-38,250,574	-1,590,000	-1.3	-2.1	-2.0	-0.82	-9,616
		DMU Alternative (EMU Option)	-28,578,215	-1,290,000	-0.99	-1.5	-1.5	-0.61	-7,191
		Express Bus/BRT Alternative	-13,357,023	-510,000	-0.41	-0.72	-0.69	-0.29	-3,355
		Enhanced Bus Alternative	-75,668	-90,000	-0.05	-0.01	-0.004	-0.002	-24
	Cumulative	Conventional BART + INP + garage	-32,649,225	-1,770,000	-1.3	-1.8	-1.7	-0.70	-8,232
		DMU/EMU + INP + garage	-21,858,079	-1,350,000	-0.96	-1.2	-1.1	-0.47	-5,521
		Express Bus/BRT + garage	-19,509,613	-750,000	-0.61	-1.0	-1.0	-0.42	-4,901
		Enhanced Bus + garage	-8,705,948	-330,000	-0.27	-0.47	-0.447	-0.186	-2,187
2040	Project	Conventional BART (Project)	-73,770,403	-2,473,847	-0.9	-1.7	-3.7	-1.5	-13,669
		DMU Alternative (EMU Option)	-42,745,966	-1,476,313	-0.53	-1.0	-2.1	-0.9	-7,922
		Express Bus/BRT Alternative	-28,586,697	-1,091,502	-0.38	-0.67	-1.4	-0.58	-5,302
		Enhanced Bus Alternative	-2,722,388	-2,816,263	-0.70	-0.11	-0.14	-0.06	-614
	Cumulative	Conventional BART + INP + garage	-82,390,212	-2,981,257	-1.1	-1.9	-4.1	-1.67	-15,275
		DMU/EMU + INP + garage	-49,924,896	-1,779,220	-0.63	-1.2	-2.5	-1.01	-9,255
		Express Bus/BRT + garage	-34,691,838	-1,084,605	-0.40	-0.8	-1.7	-0.70	-6,425
		Enhanced Bus + garage	-8,834,264	-232,518	-0.09	-0.21	-0.44	-0.18	-1,634

Notes:

¹ Passenger vehicle VMT and trips are project-specific estimates provided by Cambridge Systematics. The Project has a net negative impact on passenger vehicle traffic activity, resulting in negative (avoided) emissions.

² Operational on-road passenger vehicle emissions calculated based on the passenger vehicle total trips and vehicle miles and the emission factors shown in Table 12.

Abbreviations:

- | | |
|---|--|
| BART - Bay Area Rapid Transit | NO - nitric oxide |
| BRT - bus rapid transit | NO ₂ - nitrogen dioxide |
| CH ₄ - methane | NO _x - nitrogen oxide compounds (NO + NO ₂) |
| CO ₂ - carbon dioxide | N ₂ O - nitrous oxide |
| CO ₂ e - carbon dioxide equivalent | PM ₁₀ - particulate matter with an aerodynamic diameter less than 10 microns |
| DMU - Diesel Multiple Units | PM _{2.5} - particulate matter with an aerodynamic diameter of 2.5 microns or less |
| EMU - Electrical Multiple Units | ROG - reactive organic gas |
| INP - Isabel Neighborhood Plan | VMT - vehicle miles traveled |
| MT - metric tons | yr - year |

Table 14
Operational Bus Emissions
BART to Livermore Extension
Livermore, California

Operational Year	Scenario	Project and Alternatives	Net New Annual VMT ¹	Net New Annual Trips ¹	Emissions ²				
					tons/yr				
					ROG	NO _x	PM ₁₀	PM _{2.5}	CO ₂ e
2025	Project and Cumulative	Conventional BART (Project)	592,392	29,896	0.56	4.3	0.11	0.08	1,251
		DMU Alternative (EMU Option)	592,392	29,896	0.56	4.3	0.11	0.08	1,251
		Express Bus/BRT Alternative	738,089	29,628	0.69	4.2	0.04	0.04	1,528
		Enhanced Bus Alternative	660,713	28,068	0.62	3.7	0.04	0.04	1,369
2040	Project and Cumulative	Conventional BART (Project)	592,392	29,896	0.14	3.2	0.08	0.05	1,103
		DMU Alternative (EMU Option)	592,392	29,896	0.14	3.2	0.08	0.05	1,103
		Express Bus/BRT Alternative	738,089	29,628	0.17	4.0	0.03	0.03	1,347
		Enhanced Bus Alternative	660,713	28,068	0.15	3.6	0.03	0.03	1,207

Notes:

¹ Bus activity changes attributed to the Project are based on schedule information provided by Arup, as shown in the Bus Operations Memo (August 2015) and updated in February 2017. Net New Annual VMT is based on the number of net new trips between the Project (or Alternative) and No Project, provided in the Bus Operations Memo. Ramboll Environ estimated route distance using Google Earth and GIS tools. Net New Trips multiplied by the Trip Length gives the Net New Annual VMT. The Net New Annual VMT used in the Air Quality, Greenhouse Gas, and Energy sections may differ from the Net New Annual VMT used in the Transportation section due to different methods in deriving trip length. However, differences are expected to be small (less than 5%), and the VMT used for the Air Quality, Greenhouse Gas, and Energy analysis is more conservative.

² Operational on-road bus emissions calculated based on the bus total trips and vehicle miles and the emission factors in Table 12. It was assumed that each bus trip includes five minutes of idling.

Abbreviations:

BART - Bay Area Rapid Transit
 BRT - Bus Rapid Transit
 CO₂e - carbon dioxide equivalent
 DMU - Diesel Multiple Units
 EMU - Electrical Multiple Units
 MT - metric tons
 NO - nitric oxide

NO₂ - nitrogen dioxide
 NO_x - nitrogen oxide compounds (NO + NO₂)
 PM₁₀ - particulate matter with an aerodynamic diameter less than 10 microns
 PM_{2.5} - particulate matter with an aerodynamic diameter of 2.5 microns or less
 ROG - reactive organic gas
 VMT - vehicle miles traveled
 yr - year

References:

Arup. February 2017. *Final Proposed Bus Operating Plans for BLVX Alternatives.*

Table 15
Operational Maintenance Truck and Shuttle Emissions
BART to Livermore Extension
Livermore, California

Source	Operational Year	Scenario	Project and Alternatives	Net New Annual VMT ¹ mile/yr	Net New Annual Idling ¹ hours/yr	Emissions ²				
						tons/yr				
						ROG	NO _x	PM ₁₀	PM _{2.5}	CO _{2e}
Maintenance Trucks	2025	Project and Cumulative	Conventional BART (Project)	8,030	122	1.9E-03	2.3E-02	1.1E-03	6.2E-04	4.9
			DMU Alternative (EMU Option)	8,030	122	1.9E-03	2.3E-02	1.1E-03	6.2E-04	4.9
			Express Bus/BRT Alternative	0	0	0	0	0	0	0
			Enhanced Bus Alternative	0	0	0	0	0	0	0
	2040	Project and Cumulative	Conventional BART (Project)	8,030	122	1.6E-03	6.8E-03	9.2E-04	4.5E-04	4.6
			DMU Alternative (EMU Option)	8,030	122	1.6E-03	6.8E-03	9.2E-04	4.5E-04	4.6
			Express Bus/BRT Alternative	0	0	0	0	0	0	0
			Enhanced Bus Alternative	0	0	0	0	0	0	0
Shuttles	2025	Project and Cumulative	Conventional BART (Project)	7,300	243	2.2E-03	2.9E-02	1.1E-03	6.6E-04	5.0
			DMU Alternative (EMU Option)	0	0	0	0	0	0	0
			Express Bus/BRT Alternative	0	0	0	0	0	0	0
			Enhanced Bus Alternative	0	0	0	0	0	0	0
	2040	Project and Cumulative	Conventional BART (Project)	7,300	243	1.9E-03	1.1E-02	9.0E-04	4.7E-04	4.7
			DMU Alternative (EMU Option)	0	0	0	0	0	0	0
			Express Bus/BRT Alternative	0	0	0	0	0	0	0
			Enhanced Bus Alternative	0	0	0	0	0	0	0

Notes:

- ¹ Annual VMT and idling hours provided by Project sponsor based on expected maintenance yard operations. Two maintenance trucks are expected to travel approximately 11 miles per day and idle for a total of 10 minutes per day.
- ² Operational maintenance truck emissions calculated based on the maintenance truck total vehicle miles and idling hours and the emission factors in Table 12.
- ³ Operational shuttle emissions calculated based on the shuttle total vehicle miles and idling hours and the emission factors in Table 12.

Abbreviations:

BART - Bay Area Rapid Transit
 BRT - Bus Rapid Transit
 CO_{2e} - carbon dioxide equivalent
 DMU - Diesel Multiple Units
 EMU - Electrical Multiple Units
 INP - Isabel Neighborhood Plan
 MT - metric tons
 NO - nitric oxide

NO₂ - nitrogen dioxide
 NO_x - nitrogen oxide compounds (NO + NO₂)
 PM₁₀ - particulate matter with an aerodynamic diameter less than 10 microns
 PM_{2.5} - particulate matter with an aerodynamic diameter of 2.5 microns or less
 ROG - reactive organic gas
 VMT - vehicle miles traveled
 yr - year

Table 16
Operational BART Emissions
BART to Livermore Extension
Livermore, California

Operational Year	Scenario	Project and Alternatives	Net New Annual Rail Car-Miles ¹	Emissions ^{2,3}				
				tons/yr				MT/yr
				ROG	NO _x	PM ₁₀	PM _{2.5}	CO ₂ e
2025	Project and Cumulative	Conventional BART (Project)	2,895,844	0	0	0	0	664
		DMU Alternative (EMU Option)	558,771	0	0	0	0	128
		Express Bus/BRT Alternative	111,839	0	0	0	0	26
		Enhanced Bus Alternative	-	0	0	0	0	0
2040	Project and Cumulative	Conventional BART (Project)	2,942,659	0	0	0	0	674
		DMU Alternative (EMU Option)	1,165,551	0	0	0	0	267
		Express Bus/BRT Alternative	495,158	0	0	0	0	113
		Enhanced Bus Alternative	-	0	0	0	0	0

Notes:

- ¹ Annual rail car-miles and trips provided by Connetics Transportation Group based on expected BART operations.
- ² Emissions account for electricity demand for BART operations and energy demand for rail car maintenance. Electricity use was estimated using a traction electricity demand of 4.51 kWh/rail car-mile from the 2009 BART to Livermore Draft Environmental Impact Report, Section 3.15, Energy (2009). Traction electricity demand was based on historical traction electricity consumption data and rail car-miles. Maintenance energy was based on an energy demand of 7,060 BTU/rail car-mile, as published in the Caltrans Energy and Transportation Systems report, Table E-13
- ³ The electricity CO₂e emission factor is based on BART 2017 electricity portfolio projections, which is assumed to serve as a conservative assumption of electricity intensity for Project years 2025 and 2040. Global warming potentials used in these projections are based on the Intergovernmental Panel on Climate Change (IPCC) Second Assessment Report (SAR). The impact of using SAR potentials as opposed to Fourth Assessment Report potentials (which is used throughout the rest of the GHG analysis) is expected to be less than 2%.

Abbreviations:

- | | |
|---|--|
| BART - Bay Area Rapid Transit | NO - nitric oxide |
| BRT - Bus Rapid Transit | NO ₂ - nitrogen dioxide |
| BTU - British thermal unit | NO _x - nitrogen oxide compounds (NO + NO ₂) |
| CO ₂ e - carbon dioxide equivalent | PM ₁₀ - particulate matter with an aerodynamic diameter less than 10 microns |
| DMU - Diesel Multiple Units | PM _{2.5} - particulate matter with an aerodynamic diameter of 2.5 microns or less |
| EMU - Electrical Multiple Units | ROG - reactive organic gas |
| kWh - kilowatt-hour | VMT - vehicle miles traveled |
| MT - metric tons | yr - year |

References:

- Bay Area Rapid Transit. *E-mail communications with N. Miksis*. January 2017.
- California Department of Transportation. *Energy and Transportation Systems*. 1983. Available online at: ftp://ftp.odot.state.or.us/techserv/Geo-Environmental/Air_Noise_Energy/Energy/. Accessed: December 2016.

Table 17
Operational DMU Emissions
BART to Livermore Extension
Livermore, California

Operational Year	Scenario	Project and Alternatives	Net New Annual Rail Car-Miles ¹	Net New Annual Trips ¹	Emissions ^{2,3}				
					tons/yr				
					mile/yr	trips/yr	ROG	NO _x	PM ₁₀
2025	Project and Cumulative	Conventional BART (Project)	0	0	0	0	0	0	0
		DMU Alternative (EMU Option)	776,400	25,265	0.77	1.5	0.077	0.077	2,404
		Express Bus/BRT Alternative	0	0	0	0	0	0	0
		Enhanced Bus Alternative	0	0	0	0	0	0	0
2040	Project and Cumulative	Conventional BART (Project)	0	0	0	0	0	0	0
		DMU Alternative (EMU Option)	864,100	27,439	0.86	1.7	0.086	0.086	2,675
		Express Bus/BRT Alternative	0	0	0	0	0	0	0
		Enhanced Bus Alternative	0	0	0	0	0	0	0

Notes:

- ¹ Annual rail car-miles and trips provided by Connetics Transportation Group based on expected DMU operations.
- ² Emissions account for energy use for DMU operations and energy demand for rail car maintenance. Energy use rates for running (in kWh/mile) were based on the 2008 LTK Report, "DMU and LRV Comparison," where DMU rates were modeled after eBART DMU operations. DMU energy use rates are estimated to be 4.5 kWh/rail car-mile and account for Project-specific assumptions for average rail cars per train and miles per roundtrip. Maintenance energy was based on an energy demand of 7,060 BTU/rail car-mile, as published in the Caltrans Energy and Transportation Systems report, Table E-13 (1983). Global warming potentials for direct (non-electricity) emissions are based on Intergovernmental Panel on Climate Change (IPCC) Fourth Assessment Report.
- ³ It is assumed that the unit uses electricity while idling at stations. The electricity CO₂e emission factor is based on BART 2017 electricity portfolio projections, which is assumed to serve as a conservative assumption of electricity intensity for Project years 2025 and 2040. Global warming potentials used in these projections are based on the Intergovernmental Panel on Climate Change (IPCC) Second Assessment Report (SAR). The impact of using SAR potentials as opposed to Fourth Assessment Report potentials (which is used throughout the rest of the GHG analysis) is expected to be less than 2%.

Abbreviations:

BART - Bay Area Rapid Transit	NO - nitric oxide
BRT - Bus Rapid Transit	NO ₂ - nitrogen dioxide
BTU - British thermal unit	NO _x - nitrogen oxide compounds (NO + NO ₂)
CO ₂ e - carbon dioxide equivalent	PM ₁₀ - particulate matter with an aerodynamic diameter less than 10 microns
DMU - Diesel Multiple Units	PM _{2.5} - particulate matter with an aerodynamic diameter of 2.5 microns or less
EMU - Electrical Multiple Units	ROG - reactive organic gas
kWh - kilowatt-hour	yr - year
MT - metric tons	

References:

- Bay Area Rapid Transit. *E-mail communications with N. Miksis*. January 2017.
- California Air Pollution Control Officers Association (CAPCOA). 2013. CalEEMod. Available at: <http://www.caleemod.com>.
- California Department of Transportation. *Energy and Transportation Systems*. 1983. Available online at: ftp://ftp.odot.state.or.us/techserv/Geo-Environmental/Air_Noise_Energy/Energy/. Accessed: December 2016.
- Intergovernmental Panel on Climate Change (IPCC). 2007. Fourth Assessment Report. Available at http://www.ipcc.ch/ipccreports/sar/wg_I/ipcc_sar_wg_I_full_report.pdf. Accessed: December 2016.
- LTK Engineering Services. *eBART Phase I Project to Hillcrest Terminal: DMU and LRV Comparison*. 2008.

Table 18
Operational EMU Emissions
BART to Livermore Extension
Livermore, California

Operational Year	Scenario	Project and Alternatives	Net New Annual Car-Miles ¹	Net New Annual Trips	Emissions ^{2,3}				
					tons/yr				
					mile/yr	trips/yr	ROG	NO _x	PM ₁₀
2025	Project and Cumulative	Conventional BART (Project)	0	0	0	0	0	0	0
		DMU Alternative (EMU Option)	776,400	25,265	0	0	0	0	171
		Express Bus/BRT Alternative	0	0	0	0	0	0	0
		Enhanced Bus Alternative	0	0	0	0	0	0	0
2040	Project and Cumulative	Conventional BART (Project)	0	0	0	0	0	0	0
		DMU Alternative (EMU Option)	864,100	27,439	0	0	0	0	190
		Express Bus/BRT Alternative	0	0	0	0	0	0	0
		Enhanced Bus Alternative	0	0	0	0	0	0	0

Notes:

- ¹ Annual VMT and trips provided by Connetics Transportation Group based on expected EMU operations.
- ² Emissions account for energy use for EMU operations and energy demand for car maintenance. Energy use rates for running (in kWh/mile) and idling (in kWh/idle-minute) were based on the 2008 LTK Report, "DMU and LRV Comparison," where EMU factors were modeled after electric LRV operations. EMU energy use rates are estimated to be 4.3 kWh/car-mile and 1.8 kWh/idle-minute, and account for Project-specific assumptions for average cars per train, miles per roundtrip, and idling time per trip. Maintenance energy was based on an energy demand of 7,060 BTU/car-mile, as published in the Caltrans Energy and Transportation Systems report, Table E-13 (1983).
- ³ The electricity CO_{2e} emission factor is based on BART 2017 electricity portfolio projections, which is assumed to serve as a conservative assumption of electricity intensity for Project years 2025 and 2040. Global warming potentials used in these projections are based on the Intergovernmental Panel on Climate Change (IPCC) Second Assessment Report (SAR). The impact of using SAR potentials as opposed to Fourth Assessment Report potentials (which is used throughout the rest of the GHG analysis) is expected to be less than 2%.

Abbreviations:

- | | |
|--|--|
| BART - Bay Area Rapid Transit | MT - metric tons |
| BRT - Bus Rapid Transit | NO - nitric oxide |
| BTU - British thermal unit | NO ₂ - nitrogen dioxide |
| CalEEMod [®] - California Emissions Estimator Model | NO _x - nitrogen oxide compounds (NO + NO ₂) |
| CO _{2e} - carbon dioxide equivalent | PM ₁₀ - particulate matter with an aerodynamic diameter less than 10 microns |
| DMU - Diesel Multiple Units | PM _{2.5} - particulate matter with an aerodynamic diameter of 2.5 microns or less |
| EMU - Electrical Multiple Units | ROG - reactive organic gas |
| kWh - kilowatt-hour | yr - year |

References:

- Bay Area Rapid Transit. *E-mail communications with N. Miksis*. January 2017.
- California Air Pollution Control Officers Association (CAPCOA). 2013. CalEEMod. Available at: <http://www.caleemod.com>.
- California Department of Transportation. *Energy and Transportation Systems*. 1983. Available online at: ftp://ftp.odot.state.or.us/techserv/Geo-Environmental/Air_Noise_Energy/Energy/. Accessed: December 2016.
- Intergovernmental Panel on Climate Change (IPCC). 2007. Fourth Assessment Report. Available at http://www.ipcc.ch/ipccreports/sar/wg_1/ipcc_sar_wg_1_full_report.pdf. Accessed: December 2016.
- LTK Engineering Services. *eBART Phase I Project to Hillcrest Terminal: DMU and LRV Comparison*. 2008.

Table 19
Operational Station Electricity
BART to Livermore Extension
Livermore, California

Operational Year	Scenario	Project and Alternatives	Electricity Usage ¹ (kWh/year)	Emissions ²				
				tons/yr				MT/yr
				ROG	NO _x	PM ₁₀	PM _{2.5}	CO ₂ e
2025	Project and Cumulative	Conventional BART (Project)	2,847,609	0	0	0	0	126
		DMU Alternative (EMU Option)	2,847,609	0	0	0	0	126
		Express Bus/BRT Alternative	-	0	0	0	0	-
		Enhanced Bus Alternative	-	0	0	0	0	-
2040	Project and Cumulative	Conventional BART (Project)	2,847,609	0	0	0	0	126
		DMU Alternative (EMU Option)	2,847,609	0	0	0	0	126
		Express Bus/BRT Alternative	-	0	0	0	0	-
		Enhanced Bus Alternative	-	0	0	0	0	-

Notes:

¹ Electricity use is based on the average, including losses, from calendar years 2012-2014 for an existing and comparable BART station in East Dublin/Pleasanton.

² The electricity CO₂e emission factor is based on BART 2017 electricity portfolio projections, which is assumed to serve as a conservative assumption of electricity intensity for Project years 2025 and 2040. Global warming potentials used in these projections are based on the Intergovernmental Panel on Climate Change (IPCC) Second Assessment Report (SAR). The impact of using SAR potentials as opposed to Fourth Assessment Report potentials (which is used throughout the rest of the GHG analysis) is expected to be less than 2%.

Abbreviations:

BAAQMD - Bay Area Air Quality Management District
 BRT - Bus Rapid Transit
 BART - Bay Area Rapid Transit
 CalEEMod[®] - California Emissions Estimator Model
 CO₂e - carbon dioxide equivalent
 DMU - Diesel Multiple Units
 EMU - Electrical Multiple Units
 kWh - kilowatt-hour

MT - metric tons
 NO - nitric oxide
 NO₂ - nitrogen dioxide
 NO_x - nitrogen oxide compounds (NO + NO₂)
 PM₁₀ - particulate matter with an aerodynamic diameter less than 10 microns
 PM_{2.5} - particulate matter with an aerodynamic diameter of 2.5 microns or less
 ROG - reactive organic gas
 yr - year

References:

Bay Area Rapid Transit. *E-mail communications with N. Miksis*. January 2017.
 California Air Pollution Control Officers Association (CAPCOA). 2013. CalEEMod. Available at: <http://www.caleemod.com>.
 Intergovernmental Panel on Climate Change (IPCC). 2007. Fourth Assessment Report. Available at http://www.ipcc.ch/ipccreports/sar/wg_1/ipcc_sar_wg_1_full_report.pdf. Accessed: December 2016.

Table 20
Operational Generator Emissions
BART to Livermore Extension
Livermore, California

Isabel Station Engine Parameters	ROG	NO _x	PM ₁₀	PM _{2.5}	CO ₂ e
ARB Diesel-Fired Emission Factor (g/bhp-hr) ¹	0.26	4.6	0.02	0.02	526
Annual Usage (hr/yr)	24				
Rated Power (bhp)	3,351				

Operational Year	Scenario	Project and Alternatives	Isabel Station Generator Emissions ²				
			tons/yr				MT/yr
			ROG	NO _x	PM ₁₀	PM _{2.5}	CO ₂ e
2025 and 2040	Project and Cumulative	Conventional BART (Project)	0.023	0.40	0.002	0.002	42
		DMU Alternative (EMU Option)	0.023	0.40	0.002	0.002	42
		Express Bus/BRT Alternative	0	0	0	0	0
		Enhanced Bus Alternative	0	0	0	0	0

Maintenance Facility Engine Parameters	ROG	NO _x	PM ₁₀	PM _{2.5}	CO ₂ e
ARB Diesel-Fired Emission Factor (g/bhp-hr) ¹	0.16	2.9	0.15	0.15	526
Annual Usage (hr/yr)	50				
Rated Power (bhp)	670				

Operational Year	Scenario	Project and Alternatives	Maintenance Facility Generator Emissions ³				
			tons/yr				MT/yr
			ROG	NO _x	PM ₁₀	PM _{2.5}	CO ₂ e
2025 and 2040	Project and Cumulative	Conventional BART (Project)	0.006	0.11	0.006	0.006	18
		DMU Alternative (EMU Option)	0.006	0.11	0.006	0.006	18
		Express Bus/BRT Alternative	0	0	0	0	0
		Enhanced Bus Alternative	0	0	0	0	0

Notes:

- ¹ Diesel engine emission factors for NMHC, NO_x, PM₁₀, and PM_{2.5} based on ARB Off-Road Compression-Ignition (Diesel) Engine Tier 2 Standards. Emission factors for ROG and TOG were converted from NMHC using USEPA hydrocarbon conversion factors (USEPA 2010). Emission factor for CO₂ from AP-42, Section 3.4 (USEPA 1996). PM₁₀ and PM_{2.5} emission factors for the Isabel Station engine assume 85% control with the use of a diesel particulate filter (DPF).
- ² Emissions assume one 2500-kW (3351-HP) emergency generator operated 24 hours/year for non-emergency maintenance and testing. Note that this analysis conservatively assumes operation at 100% capacity (load factor = 1) during emissions tests.
- ³ Emissions assume one 500-kW (670-HP) emergency generator operated 50 hours/year for non-emergency maintenance and testing. Note that this analysis conservatively assumes operation at 100% capacity (load factor = 1) during emissions tests.

Abbreviations:

ARB - [California] Air Resources Board	kW - kilowatt
BART - Bay Area Rapid Transit	MT - metric tons
bhp - brake horsepower	NMHC - non-methane hydrocarbons
BRT - Bus Rapid Transit	NO - nitric oxide
CO ₂ - carbon dioxide	NO ₂ - nitrogen dioxide
CO ₂ e - carbon dioxide equivalent	NO _x - nitrogen oxide compounds (NO + NO ₂)
DMU - Diesel Multiple Units	PM ₁₀ - particulate matter with an aerodynamic diameter less than 10 microns
DPF - Diesel Particulate Filter	PM _{2.5} - particulate matter with an aerodynamic diameter of 2.5 microns or less
EMU - Electrical Multiple Units	ROG - reactive organic gas
g - gram	TOG - total organic gas
hr - hour	USEPA - United States Environmental Protection Agency
HP - horsepower	yr - year

References:

- ARB/USEPA. Table 1: ARB and USEPA Off-Road Compression-Ignition (Diesel) Engine Standards. Available online at: http://www.arb.ca.gov/msprog/ordiesel/documents/Off-Road_Diesel_Std.xls
- USEPA. 1996. AP 42, Volume I, Fifth Edition (1996). §3.3 Gasoline And Diesel Industrial Engines. Available online at: <http://www.epa.gov/ttn/chief/ap42/ch03/final/c03s03.pdf>
- USEPA. 2010. Conversion Factors for Hydrocarbon Emission Components, NR-002d. EPA-420-R-10-015. July. Available online at: <http://www.epa.gov/otaq/models/nonrmdml/nonrmdml2010/420r10015.pdf>

Table 21
Operational Solvent Emissions
BART to Livermore Extension
Livermore, California

Operational Year	Scenario	Project and Alternatives	Solvent Usage ¹ (gal/year)	Emissions ²				
				tons/yr				MT/yr
				ROG	NO _x	PM ₁₀	PM _{2.5}	CO _{2e}
2025 and 2040	Project and Cumulative	Conventional BART (Project)	20	0.08	0	0	0	0
		DMU Alternative (EMU Option)	20	0.08	0	0	0	0
		Express Bus/BRT Alternative	0	0	0	0	0	0
		Enhanced Bus Alternative	0	0	0	0	0	0

Notes:

¹ Solvent usage in the form of brake cleaners and wipe cleaner solvents are estimated to be less than 20 gallons per year, with total emissions not to exceed 150 pounds/year, in accordance with the BAAQMD permitting exemption in Regulation 2-1-118-9.1

² VOC content in solvents and surface cleaners will comply with the BAAQMD VOC limit in Regulation 8-4-302.3.

Abbreviations:

BAAQMD - Bay Area Air Quality Management District
 BRT - Bus Rapid Transit
 BART - Bay Area Rapid Transit
 CO_{2e} - carbon dioxide equivalent
 DMU - Diesel Multiple Units
 EMU - Electrical Multiple Units
 gal - gallons
 MT - metric tons

NO - nitric oxide
 NO₂ - nitrogen dioxide
 NO_x - nitrogen oxide compounds (NO + NO₂)
 PM₁₀ - particulate matter with an aerodynamic diameter less than 10 microns
 PM_{2.5} - particulate matter with an aerodynamic diameter of 2.5 microns or less
 ROG - reactive organic gas
 VOC - volatile organic compounds
 yr - year

References:

Bay Area Air Quality Management District. Current Rules. Available at: <http://www.baaqmd.gov/rules-and-compliance/current-rules>. Accessed: December 2016.

Table 22
Operational Area Coating Emissions
BART to Livermore Extension
Livermore, California

Operational Year	Scenario	Alternative	Total Floor Area	Total Building Surface Area ¹	Application Rate ²	Paint VOC EF ³		Emissions ⁴				
			square feet	square feet		Indoor	Outdoor	lbs/yr				MT/yr
						g/L	g/L	ROG	NO _x	PM ₁₀	PM _{2.5}	CO ₂ e
2025 and 2040	Project and Cumulative	Conventional BART (Project)	1,379,033	2,758,066	10%	100	150	1,438	-	-	-	-
		DMU Alternative (EMU Option)	1,172,599	2,345,199	10%	100	150	1,223	-	-	-	-
		Express Bus/BRT Alternative	291,967	329,308	10%	100	150	172	-	-	-	-
		Enhanced Bus Alternative	-	-	-	-	-	-	-	-	-	-

Notes:

- ¹ Consistent with CalEEMod[®] (version 2013.2.2), non-residential building surface area is assumed to be 2 times the floor area. Also consistent with CalEEMod[®], the parking painted area is assumed to be 6% of the total surface area.
- ² Consistent with CalEEMod[®], 10% of all surfaces are assumed to be coated each year.
- ³ Based on BAAQMD paint VOC regulations, 100 g/L for flat paints, generally used indoors, and 150 g/L for all other architectural coatings. Building area is assumed to be 75% indoors and 25% outdoors, consistent with CalEEMod[®].
- ⁴ Uses CalEEMod[®] assumption that 1 gallon of paint covers 180 square feet.

Abbreviations:

- | | |
|--|--|
| BAAQMD - Bay Area Air Quality Management District | MT - metric tons |
| BART - Bay Area Rapid Transit | NO _x - nitrogen oxide compounds (NO + NO ₂) |
| BRT - Bus Rapid Transit | NO ₂ - nitrogen dioxide |
| CalEEMod [®] - California Emissions Estimator Model | NO - nitric oxide |
| CO ₂ e - carbon dioxide equivalent | PM ₁₀ - particulate matter with an aerodynamic diameter less than 10 microns |
| DMU - Diesel Multiple Units | PM _{2.5} - particulate matter with an aerodynamic diameter of 2.5 microns or less |
| EF - emission factor | ROG - reactive organic gas |
| EMU - Electrical Multiple Units | VOC - volatile organic compounds |
| g - gram | yr - year |
| L - liter | |

References:

California Air Pollution Control Officers Association (CAPCOA). 2013. CalEEMod. Available at: <http://www.caleemod.com>.

Table 23
Operational Water and Wastewater Emissions
BART to Livermore Extension
Livermore, California

Operational Year	Scenario	Project and Alternatives	Water Consumption ¹ gallon/yr	Emission Source	2025 and 2040 Emissions ^{2,3} MT CO ₂ e/yr	
					2025 and 2040	
2025 and 2040	Project and Cumulative	Conventional BART (Project)	5,488,117	Indirect Emissions from Water and Wastewater		
				Supply Water		1.54
				Treat Water		0.08
				Distribute Water		0.93
				Treat Wastewater		1.39
				Direct Emissions from Wastewater Treatment		
				Septic Tank		2.37
				Aerobic Processes		2.08
				Facultative Lagoons		0.83
2025 and 2040	Project and Cumulative	DMU Alternative (EMU Option)	3,636,758	Indirect Emissions from Water and Wastewater		
				Supply Water		1.02
				Treat Water		0.05
				Distribute Water		0.61
				Treat Wastewater		0.92
				Direct Emissions from Wastewater Treatment		
				Septic Tank		1.86
				Aerobic Processes		1.63
				Facultative Lagoons		0.65
2025 and 2040	Project and Cumulative	Express Bus/BRT Alternative	1,326,426	Indirect Emissions from Water and Wastewater		
				Supply Water		0.37
				Treat Water		0.02
				Distribute Water		0.22
				Treat Wastewater		0.34
				Direct Emissions from Wastewater Treatment		
				Septic Tank		0.74
				Aerobic Processes		0.65
				Facultative Lagoons		0.26
2025 and 2040	Project and Cumulative	Enhanced Bus Alternative	688,715	Indirect Emissions from Water and Wastewater		
				Supply Water		0.19
				Treat Water		0.01
				Distribute Water		0.12
				Treat Wastewater		0.17
				Direct Emissions from Wastewater Treatment		
				Septic Tank		0.42
				Aerobic Processes		0.37
				Facultative Lagoons		0.15

Notes:

- ¹ Water consumption includes use at the Dublin/Pleasanton and Isabel stations, the Maintenance Facility, and wayside facilities. Estimates of consumption are primarily based on historical usage at existing and comparable BART facilities, scaled for anticipated level of activity. Energy use consists of upstream electricity to supply, treat, and distribute water and downstream electricity to treat wastewater.
- ² Water electricity intensity factors and wastewater treatment emission factors consistent with CalEEMod[®] (version 2013.2.2), for Alameda County.
- ³ The electricity CO₂e emission factor is based on PG&E CO₂ projections for 2020 and CalEEMod[®] (version 2013.2.2) defaults for CH₄ and N₂O. This is a conservative estimate, as electricity GHG emissions are expected to decrease by 2025 and 2040. Global warming potentials are based on Intergovernmental Panel on Climate Change (IPCC) Fourth Assessment Report.

Abbreviations:

ARB - [California] Air Resources Board	DMU - Diesel Multiple Units
BART - Bay Area Rapid Transit	EMU - Electrical Multiple Units
CalEEMod [®] - California Emissions Estimator Model	GHG - greenhouse gas
CH ₄ - methane	MT - metric tons
CO ₂ - carbon dioxide	N ₂ O - nitrous oxide
CO ₂ e - carbon dioxide equivalent	yr - year

References:

- Bay Area Rapid Transit. *BLX Utilities Demand Table*. May 2017.
- California Air Pollution Control Officers Association (CAPCOA). 2013. CalEEMod. Available at: <http://www.caleemod.com>.
- Intergovernmental Panel on Climate Change (IPCC). 2007. Fourth Assessment Report. Available at http://www.ipcc.ch/ipccreports/sar/wg_1/ipcc_sar_wg_1_full_report.pdf. Accessed: December 2016.

Table 24
Operational Solid Waste Emissions
BART to Livermore Extension
Livermore, California

Operational Year	Scenario	Project and Alternatives	Waste Disposal ¹ ton/yr	2025 and 2040 Emissions ^{2,3} MT CO ₂ e/yr
2025 and 2040	Project and Cumulative	Conventional BART (Project)	888	447
2025 and 2040	Project and Cumulative	DMU Alternative (EMU Option)	458	231
2025 and 2040	Project and Cumulative	Express Bus/BRT Alternative	206	103
2025 and 2040	Project and Cumulative	Enhanced Bus Alternative	103	52

Notes:

¹ Waste estimates include disposal at the Dublin/Pleasanton and Isabel stations, the Maintenance Facility, and wayside facilities. Estimates of disposal are primarily based on historical generation at existing and comparable BART facilities, scaled for anticipated level of activity.

² Solid waste landfill gas emissions calculation consistent with CalEEMod[®] (version 2013.2.2), for Alameda County.

³ Global warming potentials based on Intergovernmental Panel on Climate Change (IPCC) Fourth Assessment Report.

Abbreviations:

ARB - [California] Air Resources Board	EMU - Electrical Multiple Units
BART - Bay Area Rapid Transit	GHG - greenhouse gas
CalEEMod [®] - California Emissions Estimator Model	IPCC - Intergovernmental Panel on Climate Change
CH ₄ - methane	MT - metric tons
CO ₂ - carbon dioxide	N ₂ O - nitrous oxide
CO ₂ e - carbon dioxide equivalent	yr - year
DMU - Diesel Multiple Units	

References:

Bay Area Rapid Transit. *BLX Utilities Demand Table*. May 2017.
 Intergovernmental Panel on Climate Change (IPCC). 2007. Fourth Assessment Report. Available at http://www.ipcc.ch/ipccreports/sar/wg_I/ipcc_sar_wg_I_full_report.pdf. Accessed: December 2016.
 California Air Pollution Control Officers Association (CAPCOA). 2013. CalEEMod. Available at: <http://www.caleemod.com>.

Table 25
Operational Forklift Emissions
BART to Livermore Extension
Livermore, California

Alternative	Parameters	Unit	Value
Conventional BART (Project) and DMU Alternative (EMU Option)	Hours of Operation per Day	hr/day	8
	Operation Day per Year	days/year	365
	# of Forklift Needed	# of forklift	2
	Forklift Horsepower ¹	HP	75
	Forklift Load Factor ²	-	0.20
	Unit Conversion	kW/hp	0.75
	Energy Efficiency ³	-	0.64
	2025/2040 CO ₂ e Intensity Factor ⁴	lb/MWh	97.3
	2025/2040 Total Forklift Emissions	MT CO₂e/yr	4.5

Notes:

¹ Industrial average based on review of electric forklift product specifications.

² Default values from ARB's In-Use Offroad Equipment Inventory Model (OFFROAD2011).

³ The equipment energy efficiency is estimated by multiplying the average Charge Return Factor and Power Factor present in PG&E's efficient forklift battery charger fact sheet.

Charge Return Factor: the ratio of energy supplied to the battery to energy delivered by the battery.

Power Factor: the ratio of real power performing work to apparent power in an electrical system.

⁴ The electricity CO₂e emission factor is based on BART 2017 electricity portfolio projections, which is assumed to serve as a conservative assumption of electricity intensity for Project years 2025 and 2040. Global warming potentials used in these projections are based on the Intergovernmental Panel on Climate Change (IPCC) Second Assessment Report (SAR). The impact of using SAR potentials as opposed to Fourth Assessment Report potentials (which is used throughout the rest of the GHG analysis) is expected to be less than 2%.

Abbreviations:

ARB - [California] Air Resources Board

BART - Bay Area Rapid Transit

CO₂e - carbon dioxide equivalent

DMU - Diesel Multiple Units

EMU - Electrical Multiple Units

GHG - greenhouse gas

hp - horsepower

hr - hour

kW - kilowatt

lb - pound

MT - metric tons

MWh - megawatt-hour

PG&E - Pacific Gas and Electric Company

yr - year

References:

Bay Area Rapid Transit. *E-mail communications with N. Miksis*. January 2017.

Intergovernmental Panel on Climate Change (IPCC). 2007. Fourth Assessment Report. Available at http://www.ipcc.ch/ipccreports/sar/wg_1/ipcc_sar_wg_1_full_report.pdf. Accessed: December 2016.

Pacific Gas and Electric (PG&E). 2009. Emerging Technologies Fact Sheet: Efficient Forklift Battery Charger. Available at: https://www.pge.com/includes/docs/pdfs/mybusiness/energysavingsrebates/moneybacksolutions/grocery/fb_ib/forklift_battery_charger_fs.pdf. Accessed: December 2016.

Table 26
Operational Solar PV Greenhouse Gas Emission Reductions
BART to Livermore Extension
Livermore, California

Project and Alternatives	Parameters	Unit	Value
Conventional BART (Project) and DMU Alternative (EMU Option)	DC System Size ¹	kW	1000
	Annual Average Solar Radiation ¹	kWh/m ² /day	5.59
	Annual Electricity Generation ¹	kWh/year	1,557,588
	2025/2040 CO ₂ e Intensity Factor ²	lb/MWh	97.3
	2025 Solar PV Emissions	MT CO₂e/yr	-69
	2040 Solar PV Emissions		-59

Notes:

- ¹ System size, average solar radiation, and annual system generation were determined using default commercial rooftop solar array assumptions in the National Renewable Energy Laboratory's PVWatts tool. Available online at: <http://pvwatts.nrel.gov/pvwatts.php>
- ² The electricity CO₂e emission factor is based on BART 2017 electricity portfolio projections, which is assumed to serve as a conservative assumption of electricity intensity for Project years 2025 and 2040. Global warming potentials used in these projections are based on the Intergovernmental Panel on Climate Change (IPCC) Second Assessment Report (SAR). The impact of using SAR potentials as opposed to Fourth Assessment Report potentials (which is used throughout the rest of the GHG analysis) is expected to be less than 2%.

Abbreviations:

BART - Bay Area Rapid Transit	kWh - kilowatt-hour
CO ₂ e - carbon dioxide equivalent	lb - pound
DC - direct current	m ² - square meters
DMU - Diesel Multiple Units	MT - metric tons
EMU - Electrical Multiple Units	MWh - megawatt-hour
hp - horsepower	PV - photovoltaic
hr - hour	yr - year
kW - kilowatt	

References:

Bay Area Rapid Transit. *E-mail communications with N. Miksis*. January 2017.

Intergovernmental Panel on Climate Change (IPCC). 2007. Fourth Assessment Report. Available at http://www.ipcc.ch/ipccreports/sar/wg_1/ipcc_sar_wg_1_full_report.pdf. Accessed: December 2016.

Table 27
Average Net New Daily Operational Emissions (2025)
BART to Livermore Extension
Livermore, California

	Average Net New Daily Operational Emissions (pounds/day)			
	ROG	NO_x	PM₁₀	PM_{2.5}
Conventional BART (Project)				
Mobile Sources				
General Traffic	-6.9	-11	-11	-4.5
Buses	3.1	23	0.59	0.42
Maintenance Trucks	0.01	0.1	0.006	0.003
Shuttle Van	0.01	0.2	0.006	0.004
Stationary Sources				
Standby Diesel Generator (Isabel Station)	0.12	2.2	0.011	0.011
Standby Diesel Generator (Maintenance Facility)	0.03	0.6	0.030	0.030
Area Sources				
Solvent Use	0.41	-	-	-
Area Coating	3.9	-	-	-
Total	0.75	15	-10	-4.0
Significance Thresholds	54	54	82	54
Above Threshold?	No	No	No	No
Average Net New Daily Operational Emissions (pounds/day)				
	ROG	NO_x	PM₁₀	PM_{2.5}
DMU Alternative				
Mobile Sources				
General Traffic	-5.4	-8.5	-8.0	-3.4
Buses	3.1	23	0.59	0.42
DMU	4.2	8.5	0.42	0.42
Maintenance Trucks	0.010	0.13	0.0060	0.0034
Stationary Sources				
Standby Diesel Generator (Isabel Station)	0.12	2.2	0.011	0.011
Standby Diesel Generator (Maintenance Facility)	0.03	0.6	0.030	0.030
Area Sources				
Solvent Use	0.41	-	-	-
Area Coating	3.4	-	-	-
Total	5.8	26	-7.0	-2.5
Significance Thresholds	54	54	82	54
Above Threshold?	No	No	No	No
Average Net New Daily Operational Emissions (pounds/day)				
	ROG	NO_x	PM₁₀	PM_{2.5}
EMU Option				
Mobile Sources				
General Traffic	-5.4	-8.5	-8.0	-3.4
Buses	3.1	23	0.59	0.42
Maintenance Trucks	0.010	0.13	0.0060	0.0034
Stationary Sources				
Standby Diesel Generator (Isabel Station)	0.12	2.2	0.011	0.011
Standby Diesel Generator (Maintenance Facility)	0.03	0.6	0.030	0.030
Area Sources				
Solvent Use	0.41	-	-	-
Area Coating	3.4	-	-	-
Total	1.6	18	-7.4	-2.9
Significance Thresholds	54	54	82	54
Above Threshold?	No	No	No	No

	Average Net New Daily Operational Emissions (pounds/day)			
	ROG	NO_x	PM₁₀	PM_{2.5}
Express Bus/BRT Alternative				
Mobile Sources				
General Traffic	-2.3	-3.9	-3.8	-1.6
Buses	3.8	23	0.22	0.22
Area Sources				
Area Coating	0.47	-	-	-
Total	2.0	19	-3.5	-1.3
Significance Thresholds	54	54	82	54
Above Threshold?	No	No	No	No
	Average Net New Daily Operational Emissions (pounds/day)			
	ROG	NO_x	PM₁₀	PM_{2.5}
Enhanced Bus Alternative				
Mobile Sources				
General Traffic	-0.27	-0.058	-0.022	-0.010
Buses	3.4	21	0.20	0.20
Total	3.1	20	0.17	0.19
Significance Thresholds	54	54	82	54
Above Threshold?	No	No	No	No

Table 28
Net New Annual Operational Emissions (2025)
BART to Livermore Extension
Livermore, California

	Maximum Net New Annual Operational Emissions (short tons/year)			
	ROG	NO_x	PM₁₀	PM_{2.5}
Conventional BART (Project)				
Mobile Sources				
General Traffic	-1.3	-2.1	-2.0	-0.82
Buses	0.56	4.3	0.11	0.076
Maintenance Trucks	0.0019	0.0230	0.0011	0.00062
Shuttle Van	0.0022	0.0294	0.0011	0.00066
Stationary Sources				
Standby Diesel Generator (Isabel Station)	0.023	0.40	0.0020	0.0020
Standby Diesel Generator (Maintenance Facility)	0.006	0.11	0.0055	0.0055
Area Sources				
Solvent Use	0.075	-	-	-
Area Coating	0.72	-	-	-
Total	0.14	2.8	-1.8	-0.73
Significance Thresholds	10	10	15	10
Above Threshold?	No	No	No	No
Maximum Net New Annual Operational Emissions (short tons/year)				
	ROG	NO_x	PM₁₀	PM_{2.5}
DMU Alternative				
Mobile Sources				
General Traffic	-1.0	-1.5	-1.5	-0.61
Buses	0.56	4.3	0.11	0.076
DMU	0.77	1.5	0.077	0.077
Maintenance Trucks	0.0019	0.023	0.0011	0.00062
Stationary Sources				
Standby Diesel Generator (Isabel Station)	0.023	0.40	0.0020	0.0020
Standby Diesel Generator (Maintenance Facility)	0.006	0.11	0.0055	0.0055
Area Sources				
Solvent Use	0.075	-	-	-
Area Coating	0.61	-	-	-
Total	1.1	4.8	-1.3	-0.45
Significance Thresholds	10	10	15	10
Above Threshold?	No	No	No	No
Maximum Net New Annual Operational Emissions (short tons/year)				
	ROG	NO_x	PM₁₀	PM_{2.5}
EMU Option				
Mobile Sources				
General Traffic	-1.0	-1.5	-1.5	-0.61
Buses	0.56	4.3	0.11	0.076
Maintenance Trucks	0.0019	0.023	0.0011	0.00062
Stationary Sources				
Standby Diesel Generator (Isabel Station)	0.023	0.40	0.0020	0.0020
Standby Diesel Generator (Maintenance Facility)	0.006	0.11	0.0055	0.0055
Area Sources				
Solvent Use	0.075	-	-	-
Area Coating	0.61	-	-	-
Total	0.29	3.2	-1.4	-0.53
Significance Thresholds	10	10	15	10

Above Threshold?	No	No	No	No
Maximum Net New Annual Operational Emissions (short tons/year)				
	ROG	NO_x	PM₁₀	PM_{2.5}
Express Bus/BRT Alternative				
Mobile Sources				
General Traffic	-0.41	-0.72	-0.69	-0.29
Buses	0.69	4.2	0.040	0.039
Area Sources				
Area Coating	0.09	-	-	-
Total	0.37	3.4	-0.65	-0.25
Significance Thresholds	10	10	15	10
Above Threshold?	No	No	No	No
Maximum Net New Annual Operational Emissions (short tons/year)				
	ROG	NO_x	PM₁₀	PM_{2.5}
Enhanced Bus Alternative				
Mobile Sources				
General Traffic	-0.050	-0.011	-0.0041	-0.0018
Buses	0.62	3.7	0.036	0.036
Total	0.57	3.7	0.032	0.034
Significance Thresholds	10	10	15	10
Above Threshold?	No	No	No	No

Table 29
Average Net New Daily Operational Emissions (2040)
BART to Livermore Extension
Livermore, California

	Average Net New Daily Operational Emissions (pounds/day)			
	ROG	NO _x	PM ₁₀	PM _{2.5}
Conventional BART (Project)				
Mobile Sources				
General Traffic	-4.9	-9.5	-20	-8.2
Buses	0.75	18	0.5	0.3
Maintenance Trucks	0.009	0.04	0.005	0.002
Shuttle Van	0.01	0.06	0.005	0.003
Stationary Sources				
Standby Diesel Generator (Isabel Station)	0.12	2.2	0.011	0.011
Standby Diesel Generator (Maintenance Facility)	0.03	0.6	0.030	0.030
Area Sources				
Solvent Use	0.41	-	-	-
Area Coating	3.9	-	-	-
Total	0.37	11	-20	-7.9
Significance Thresholds	54	54	82	54
Above Threshold?	No	No	No	No
Average Net New Daily Operational Emissions (pounds/day)				
	ROG	NO_x	PM₁₀	PM_{2.5}
DMU Alternative				
Mobile Sources				
General Traffic	-2.9	-5.5	-12	-4.8
Buses	0.8	18	0.5	0.30
DMU	4.7	9.4	0.5	0.47
Maintenance Trucks	0.0087	0.037	0.0051	0.00247
Stationary Sources				
Standby Diesel Generator (Isabel Station)	0.12	2.2	0.011	0.011
Standby Diesel Generator (Maintenance Facility)	0.03	0.6	0.030	0.030
Area Sources				
Solvent Use	0.41	-	-	-
Area Coating	3.4	-	-	-
Total	6.5	25	-11	-3.9
Significance Thresholds	54	54	82	54
Above Threshold?	No	No	No	No
Average Net New Daily Operational Emissions (pounds/day)				
	ROG	NO_x	PM₁₀	PM_{2.5}
EMU Option				
Mobile Sources				
General Traffic	-2.9	-5.5	-12	-4.8
Buses	0.75	18	0.5	0.3
Maintenance Trucks	0.0087	0.037	0.0051	0.00247
Stationary Sources				
Standby Diesel Generator (Isabel Station)	0.12	2.2	0.011	0.011
Standby Diesel Generator (Maintenance Facility)	0.03	0.6	0.030	0.030
Area Sources				
Solvent Use	0.41	-	-	-
Area Coating	3.4	-	-	-
Total	1.8	15	-11	-4.4
Significance Thresholds	54	54	82	54
Above Threshold?	No	No	No	No

	Average Net New Daily Operational Emissions (pounds/day)			
	ROG	NO_x	PM₁₀	PM_{2.5}
Express Bus/BRT Alternative				
Mobile Sources				
General Traffic	-2.1	-3.7	-7.9	-3.2
Buses	0.93	22	0.192	0.191
Area Sources				
Area Coating	0.47	-	-	-
Total	-0.68	18	-7.7	-3.0
Significance Thresholds	54	54	82	54
Above Threshold?	No	No	No	No
	Average Net New Daily Operational Emissions (pounds/day)			
	ROG	NO_x	PM₁₀	PM_{2.5}
Enhanced Bus Alternative				
Mobile Sources				
General Traffic	-3.8	-0.62	-0.77	-0.32
Buses	0.83	19.6	0.17	0.17
Total	-3.0	19	-0.59	-0.15
Significance Thresholds	54	54	82	54
Above Threshold?	No	No	No	No

Table 30
Net New Annual Operational Emissions (2040)
BART to Livermore Extension
Livermore, California

	Maximum Net New Annual Operational Emissions (short tons/year)			
	ROG	NO_x	PM₁₀	PM_{2.5}
Conventional BART (Project)				
Mobile Sources				
General Traffic	-0.90	-1.7	-3.7	-1.5
Buses	0.14	3.2	0.084	0.054
Maintenance Trucks	0.002	0.007	0.0009	0.0005
Shuttle Van	0.002	0.01	0.0009	0.0005
Stationary Sources				
Standby Diesel Generator (Isabel Station)	0.023	0.40	0.0020	0.0020
Standby Diesel Generator (Maintenance Facility)	0.006	0.11	0.0055	0.0055
Area Sources				
Solvent Use	0.075	-	-	-
Area Coating	0.72	-	-	-
Total	0.068	2.0	-3.6	-1.4
Significance Thresholds	10	10	15	10
Above Threshold?	No	No	No	No
DMU Alternative				
Mobile Sources				
General Traffic	-0.53	-1.0	-2.1	-0.87
Buses	0.14	3.2	0.084	0.054
DMU	0.86	1.7	0.086	0.086
Maintenance Trucks	0.002	0.007	0.0009	0.0005
Stationary Sources				
Standby Diesel Generator (Isabel Station)	0.023	0.40	0.0020	0.0020
Standby Diesel Generator (Maintenance Facility)	0.006	0.11	0.0055	0.0055
Area Sources				
Solvent Use	0.075	-	-	-
Area Coating	0.61	-	-	-
Total	1.2	4.5	-2.0	-0.72
Significance Thresholds	10	10	15	10
Above Threshold?	No	No	No	No
EMU Option				
Mobile Sources				
General Traffic	-0.53	-1.0	-2.1	-0.87
Buses	0.14	3.2	0.084	0.054
Maintenance Trucks	0.002	0.007	0.0009	0.0005
Stationary Sources				
Standby Diesel Generator (Isabel Station)	0.023	0.40	0.0020	0.0020
Standby Diesel Generator (Maintenance Facility)	0.006	0.11	0.0055	0.0055
Area Sources				
Solvent Use	0.075	-	-	-
Area Coating	0.61	-	-	-
Total	0.32	2.8	-2.1	-0.81
Significance Thresholds	10	10	15	10
Above Threshold?	No	No	No	No

Maximum Net New Annual Operational Emissions (short tons/year)				
	ROG	NO_x	PM₁₀	PM_{2.5}
Express Bus/BRT Alternative				
Mobile Sources				
General Traffic	-0.38	-0.67	-1.4	-0.58
Buses	0.17	4.0	0.035	0.035
Area Sources				
Area Coating	0.086	-	-	-
Total	-0.12	3.3	-1.4	-0.55
Significance Thresholds	10	10	15	10
Above Threshold?	No	No	No	No
Maximum Net New Annual Operational Emissions (short tons/year)				
	ROG	NO_x	PM₁₀	PM_{2.5}
Enhanced Bus Alternative				
Mobile Sources				
General Traffic	-0.70	-0.11	-0.14	-0.058
Buses	0.15	3.6	0.031	0.031
Total	-0.54	3.5	-0.11	-0.027
Significance Thresholds	10	10	15	10
Above Threshold?	No	No	No	No

Table 31
Modeling Parameters for Construction, Transit Sources, and Emergency Generators
BART to Livermore Extension
Livermore, California

Source	Source Type	Source Dimension (m)	Number of Sources	Release Height ¹ (m)	Initial Horizontal Dimension ² (m)	Initial Vertical Dimension ³ (m)	Width ⁴ (m)
Construction Equipment	Volume	20	Variable	5	9.3	1.40	---
DMU	Line	Variable Length	Variable	3.6	---	3.34	9.0
Bus Routes	Line	Variable Length	Variable	3.4	---	1.79	8.6
Bus Stations (Idling)	Volume	21.5	Multiple	3.4	5	0.79	---
Maintenance Yard	Volume	20	Multiple	5	9.3	1.40	---

Source	Source Type	Source Dimension	Number of Sources	Release Height (m)	Exhaust Temperature (K)	Exit Velocity (m/s)	Stack Diameter (m)
Emergency Generator (Isabel Station) ⁵	Point	---	1	4.1	763.85	45.3	0.2
Emergency Generator (Maintenance Facility) ⁶	Point	---	1	3.66	739.82	45.3	0.18

Notes:

- ¹ The SCAQMD Localized Significance Threshold Methodology (SCAQMD 2008) was used for setting up construction volume sources. Release height for bus emission source was based on the exhaust release height from a proposed bus type.
- ² For adjacent volume sources the initial horizontal dimension was calculated as the center-to-center distance divided by 2.15; for single volume sources, center-to-center distance divided by 4.3 (USEPA 2004).
- ³ The initial vertical dimension for the construction area source is explicitly given in the SCAQMD LST methodology. For bus routes the initial vertical dimension was calculated based on the Haul Road Work Group Final Report (USEPA 2012). For idling buses, the initial vertical dimension is calculated as the release height divided by 4.3.
- ⁴ The width of the line source is consistent with the Haul Road Work Group Final Report (USEPA 2012). The vehicle width is assumed to be 2.6 meters with an additional 6 meters added (3 meters to both sides) to account for the mechanical turbulence from moving vehicles.
- ⁵ Stack parameters for the Isabel Station emergency generator were provided by the client. These correspond to a 2.5-MW Caterpillar generator set. All parameters provided were used in the modeling except exit velocity, where a more conservative default value was used (STI 2011).
- ⁶ Stack parameters for the maintenance yard emergency generator were default parameters obtained from The San Francisco Community Risk Reduction Plan: Technical Support Documentation. [Bay Area Air Quality Management District (BAAQMD), San Francisco Department of Public Health, San Francisco Planning Department. 2012]

Abbreviations:

BART - Bay Area Rapid Transit	s - seconds
HRA - Health Risk Assessment	SCAQMD - South Coast Air Quality Management District
K - degrees Kelvin	STI - Sonoma Technology, Inc.
LST - Localized Significance Thresholds	USEPA - United States Environmental Protection Agency
m - meter	

References:

- SCAQMD. 2008. Localized Significance Threshold Methodology. Available online at: <http://www.aqmd.gov/docs/default-source/ceqa/handbook/localized-significance-thresholds/final-lst-methodology-document.pdf?sfvrsn=2>
- STI. 2011. Technical Memorandum: Default modeling parameters for stationary sources.
- USEPA. 2004. User's Guide for the AMS/EPA Regulatory Model - AERMOD. September. Available online at: http://www.epa.gov/scram001/dispersion_prefrec.htm.
- USEPA. 2012. Haul Road Workgroup Final Report Submission to EPA-OAQPS. March. Available online at: https://www3.epa.gov/ttn/scram/reports/Haul_Road_Workgroup-Final_Report_Package-20120302.pdf

Table 32
Modeling Adjustment Factor
BART to Livermore Extension
Livermore, California

Receptor Type	Scenario	MAF
Daycare	Construction ¹	2.4
	Operation ²	1
Hospital	Construction ³	1
	Operation ²	1
Recreational	Construction ¹	2.4
	Operation ²	1
Residential	Construction ³	1
	Operation ²	1
School	Construction ¹	2.4
	Operation ²	1

Notes:

- ¹ Construction is assumed to occur 14 hours/day and 5 days/week when the daycare children, recreational users and school children are exposed. The models annualized construction emissions over 24 hour/day and 7 days/ week. In accordance with OEHHA's recommendation (Cal/EPA 2015), a modeling adjustment factor (MAF) of 2.4 ([24 hours/14 hours] x [7days/5 days]) was applied to the annual average concentrations used in the evaluation for the daycare children, recreational users and school children to account for an construction emission schedule of 14 hours/day, 5 days/week.
- ² Operational emissions were assumed to be continuous (i.e., 24 hours/day, 7 days/ week), therefore no adjustment was needed in the calculation of exposure point concentrations for the operational scenarios.
- ³ The models annualized construction emissions over 24 hour/day and 7 days/week. The residents were assumed to be exposed to the construction emissions continuously, therefore no adjustment is needed in the calculation of exposure point concentrations for the residents.

Abbreviations:

Cal/EPA - California Environmental Protection Agency
 MAF - Modeling Adjustment Factor
 OEHHA - Office of Environmental Health Hazard Assessment

Reference:

OEHHA. 2015. Air Toxics Hot Spots Program Risk Assessment Guidelines. Guidance Manual for Preparation of Health Risk Assessments. February.

Table 33
Exposure Parameters - Operational Scenario
BART to Livermore Extension
Livermore, California

Receptor Type	Scenario Start Year ⁶	Receptor Age Group	Exposure Parameters					
			Daily Breathing Rate (DBR)	Exposure Duration (ED)	Fraction of Time at Home (FAH)	Exposure Frequency (EF)	Averaging Time (AT)	Intake Factor, Inhalation (IF _{inh})
			[L/kg-day]	[years]	[unitless]	[days/year]	[days]	[m ³ /kg-day]
Daycare Child ¹	2025	Age 0-< 2 Years	900	2	--	250	25550	0.018
		Age 2-< 9 Years	500	4	--	250	25550	0.020
	2040	Age 0-< 2 Years	900	2	--	250	25550	0.018
		Age 2-< 9 Years	500	4	--	250	25550	0.020
Hospital ²	2025	Age 0-< 2 Years	1090	1	--	350	25550	0.015
	2040	Age 0-< 2 Years	1090	1	--	350	25550	0.015
Recreational ³	2025	Age 0-< 2 Years	300	2	--	104	25550	0.0024
		Age 2-<16 Years	130	13	--	104	25550	0.0069
		Age 2-<16 Years	130	1	--	104	25550	0.00053
		Age 16-< 30 Years	60	14	--	104	25550	0.0034
	2040	Age 0-< 2 Years	300	2	--	104	25550	0.0024
		Age 2-<16 Years	130	14	--	104	25550	0.0074
		Age 16-< 30 Years	60	14	--	104	25550	0.0034
Resident ⁴	2025	3rd Trimester	361	0.25	1	350	25550	0.0012
		Age 0-< 2 Years	1090	2	1	350	25550	0.030
		Age 2-<16 Years	572	12.75	1	350	25550	0.10
		Age 2-<16 Years	572	1.25	1	350	25550	0.010
	2040	Age 16-< 30 Years	261	14	0.73	350	25550	0.037
		3rd Trimester	361	0.25	1	350	25550	0.0012
		Age 0-< 2 Years	1090	2	1	350	25550	0.030
		Age 2-<16 Years	572	14	1	350	25550	0.11
School Child ⁵	2025	Age 2-<16 Years	520	9	--	180	25550	0.033
	2040	Age 2-<16 Years	520	9	--	180	25550	0.033

Notes:

¹ The exposure frequency for daycare children reflects default exposure frequency for workers from OEHHA (2015) assuming that daycare children are at daycare centers while the parents are at work. The total exposure duration for daycare children reflects default duration suggested by BAAQMD (2016) and OEHHA (2015). Daycare children are assumed to be at daycare centers 10 hours/day, with 2 hours conducting moderate intensity activities outdoor and 8 hours conducting light intensity activities indoor. Daily breathing rates for daycare children reflect time-weighted average of 95th percentile moderate intensity breathing rates and light intensity breathing rates from OEHHA (2015).

² The child patients are conservatively assumed to be at an in-patient medical facility for 350 days per year for one year. The daily breathing rate is conservatively assumed to be the same as the default daily breathing rates for a 0-2 year old child residents from OEHHA (2015) and BAAQMD (2016).

Table 33
Exposure Parameters - Operational Scenario
BART to Livermore Extension
Livermore, California

- ³ The recreational users are conservatively assumed to be exposed at a recreational facility near the Site 2 hours/event, 2 events/week every week. Daily breathing rates for the recreational users reflect the 95th percentile moderate intensity breathing rates from OEHHA's Hot Spots guidelines (2015).
- ⁴ The total exposure duration, and exposure frequency for residents reflect default exposure assumptions for residents from OEHHA (2015) and BAAQMD (2016). The daily breathing rates for residents reflect recommended daily breathing rates for residents from BAAQMD (2016) as follows: 95th percentile 24-hour daily breathing rate for 3rd trimester and age 0-<2 years; 80th percentile for age 2-<9, 2-<16, and 16-30 years. Fraction of time spent at home is conservatively assumed to be 1 (i.e. 24 hours/day) for age groups from the third trimester to less than 16 years old. Based on the OEHHA 2015 Guidance, the age group 16 to 30 years old is estimated to be at school or work for 6.5 hours of the day. Therefore, the fraction of time spent at home is assumed to be 0.73 (17.5 hours/24 hours per day) for this age group.
- ⁵ The exposure frequency and total exposure duration for the school children reflect default exposure frequency and duration for school children from OEHHA (2015) and BAAQMD (2016). Daily breathing rates for school children reflect the 95th percentile moderate intensity breathing rates from OEHHA (2015).
- ⁶ Two operational scenarios were evaluated for the operation beginning year in 2015 and for the full build-out in 2040.

Intake Calculation:

$$IF_{inh} = DBR * FAH * EF * ED * CF / AT$$

$$CF = 0.001 \text{ (m}^3\text{/L)}$$

Abbreviations:

AT - averaging time	IF _{inh} - intake factor
BAAQMD - Bay Area Air Quality Management District	kg - kilogram
DBR - daily breathing rate	L - liter
ED - exposure duration	m ³ - cubic meter
EF - exposure frequency	OEHHA - Office of Environmental Health Hazard Assessment
FAH - fraction of time at home	

References:

- BAAQMD. 2016. Air Toxics NSR Program Health Risk Assessment (HRA) Guidelines. January.
- OEHHA. 2015. Air Toxics Hot Spots Program Risk Assessment Guidelines. Guidance Manual for Preparation of Health Risk Assessments. February.

Table 34
Exposure Parameters - Construction Scenario
BART to Livermore Extension
Livermore, California

Receptor Type	Scenario Start Date ⁶	Receptor Age Group	Exposure Parameters					
			Daily Breathing Rate (DBR) [L/kg-day]	Exposure Duration (ED) ⁶ [years]	Fraction of Time at Home (FAH) [unitless]	Exposure Frequency (EF) [days/year]	Averaging Time (AT) [days]	Intake Factor, Inhalation (IF _{inh}) [m ³ /kg-day]
Daycare Child ¹	Year 1 Quarter 1	Age 0-<2 Years	900	2.0	--	250	25550	0.018
		Age 2-<9 Years	500	2.0	--	250	25550	0.010
	Year 2 Quarter 1	Age 0-<2 Years	900	2.0	--	250	25550	0.018
		Age 2-<9 Years	500	1.0	--	250	25550	0.0049
Hospital ²	Year 1 Quarter 1	Age 0-<2 Years	1090	1.0	--	350	25550	0.015
	Year 2 Quarter 1	Age 0-<2 Years	1090	1.0	--	350	25550	0.015
Recreational ³	Year 1 Quarter 1	Age 0-<2 Years	300	2.0	--	104	25550	0.0024
		Age 2-<16 Years	160	2.0	--	104	25550	0.0013
	Year 2 Quarter 1	Age 0-<2 Years	300	2.0	--	104	25550	0.0024
		Age 2-<16 Years	160	1.0	--	104	25550	0.0007
Resident ⁴	Year 1 Quarter 1	3rd Trimester	361	0.25	1.0	350	25550	0.0012
		Age 0-<2 Years	1090	2.0	1.0	350	25550	0.030
		Age 2-<9 Years	631	2.0	1.0	350	25550	0.017
	Year 2 Quarter 1	3rd Trimester	361	0.25	1.0	350	25550	0.0012
		Age 0-<2 Years	1090	2.0	1.0	350	25550	0.030
		Age 2-<9 Years	631	0.75	1.0	350	25550	0.0065
School Child ⁵	Year 1 Quarter 1	Age 2-<9 Years	640	4.0	--	180	25550	0.018
	Year 2 Quarter 1	Age 2-<9 Years	640	3.0	--	180	25550	0.014

Notes:

- ¹ The exposure frequency for daycare children reflects default exposure frequency for workers from OEHHA (2015) assuming that daycare children are at daycare centers while the parents are at work. Daycare children are assumed to be at daycare centers 10 hours/day, with 2 hours conducting moderate intensity activities outdoor and 8 hours conducting light intensity activities indoor. Daily breathing rates for daycare children reflect time-weighted average of 95th percentile moderate intensity breathing rates and light intensity breathing rates from OEHHA (2015).
- ² The child patients are conservatively assumed to be at an in-patient medical facility for 350 days per year for one year. The daily breathing rate is conservatively assumed to be the same as the default daily breathing rates for a 0-2 year old child residents from OEHHA (2015) and BAAQMD (2016).

Table 34
Exposure Parameters - Construction Scenario
BART to Livermore Extension
Livermore, California

- ³ The recreational users are conservatively assumed to be exposed at a recreational facility near the Site 2 hours/event, 2 events/week every week. Daily breathing rates for the recreational users reflect the 95th percentile moderate intensity breathing rates from OEHHA's Hot Spots guidelines (2015).
- ⁴ The total exposure duration, and exposure frequency for residents reflect default exposure assumptions for residents from OEHHA (2015) and BAAQMD (2016). The daily breathing rates for residents reflect recommended daily breathing rates for residents from BAAQMD (2016) as follows: 95th percentile 24-hour daily breathing rate for 3rd trimester and age 0-<2 years; 80th percentile for age 2-<9. Fraction of time spent at home is conservatively assumed to be 1 (i.e., 24 hours/day) for age groups from the third trimester to less than 9 years old.
- ⁵ The exposure frequency and total exposure duration for the school children reflect default exposure frequency and duration for school children from OEHHA (2015) and BAAQMD (2016). Daily breathing rates for school children reflect the 95th percentile moderate intensity breathing rates from OEHHA (2015).
- ⁶ Two construction scenarios were evaluated based on the two exposure starting dates that are anticipated to have the highest risks (i.e. Year 1 Quarter 1, and Year 2 Quarter 1). The exposure durations for daycare children, child patients, recreational users, and school children during construction reflect the proposed construction schedules under these two exposure starting dates. Exposure duration for hospital patients is a conservative estimate of one total year during construction.

Intake Calculation:

$$IF_{inh} = DBR * FAH * EF * ED * CF / AT$$

$$CF = 0.001 (m^3/L)$$

Abbreviations:

AT - averaging time

BAAQMD - Bay Area Air Quality Management District

DBR - daily breathing rate

ED - exposure duration

EF - exposure frequency

FAH - fraction of time at home

IF_{inh} - intake factor

kg - kilogram

L - liter

m³ - cubic meter

OEHHA - Office of Environmental Health Hazard Assessment

References:

BAAQMD. 2016. Air Toxics NSR Program Health Risk Assessment (HRA) Guidelines. January.

OEHHA. 2015. Air Toxics Hot Spots Program Risk Assessment Guidelines. Guidance Manual for Preparation of Health Risk Assessments. February.

Table 35
Carcinogenic Toxicity Value for DPM
BART to Livermore Extension
Livermore, California

Source	Chemical	Inhalation Cancer Potency Factor
		[mg/kg-day] ⁻¹
All Sources	DPM	1.1

Abbreviations:

ARB - [California] Air Resources Board
BART - Bay Area Rapid Transit
Cal/EPA - California Environmental Protection Agency
DPM - diesel particulate matter
mg/kg-day - milligrams per kilogram per day
OEHHA - Office of Environmental Health Hazard Assessment

Reference:

Cal/EPA. 2016. Consolidated Table of OEHHA/ARB Approved Risk Assessment Health Values. September. Available at:
<https://www.arb.ca.gov/toxics/healthval/contable.pdf>

Table 36
Age Sensitivity Factor
BART to Livermore Extension
Livermore, California

Receptor Type	Period	Receptor Age Group ¹	ASF ² (unitless)
All Receptors	Construction and Operation	3rd Trimester	10
		Age 0-<2 Years	10
		Age 2-<9 Years	3
		Age 2-<16 Years	3
		Age 16-30 Years	1

Notes:

¹ Age sensitivity factors are applicable for the age groups relevant to each receptor type listed in Tables 25 and 26.

² The age sensitivity factors are as recommended in the 2015 OEHHA Hot Spots Guidance (OEHHA 2015) for each age group.

Abbreviation:

ASF - Age sensitivity factor
 BART - Bay Area Rapid Transit
 OEHHA - Office of Environmental Health Hazard Assessment

References:

OEHHA. 2015. Air Toxics Hot Spots Program Risk Assessment Guidelines. Guidance Manual for Preparation of Health Risk Assessments. February.

Table 37
Stationary Source Screening Health Impacts
BART to Livermore Extension
Livermore, California

Scenario	Facility Number ¹	Facility Name	Facility Street Address	UTM Easting	UTM Northing	Distance to MEISR ²	Distance Adjustment Multiplier	Cancer Risk Scaling Factor ³	Estimated Lifetime Excess Cancer Risk ^{3,4}	Estimated PM _{2.5} Concentration ⁴
				(m)	(m)	(in a million)			(µg/m ³)	
Conventional BART (Project)	-- ⁵	--	--	--	--	--	--	--	-- ²	-- ²
DMU Alternative (EMU Option)	-- ⁵	--	--	--	--	--	--	--	-- ²	-- ²
Express Bus/BRT Alternative	18895	Bay Area Rapid Transit	5067 IRON HORSE PKWY	597,198	4,173,402	98	0.25	1.37	5.72	4.3E-03
	14075	S F Bay Area Rapid Transit District	5801 OWENS DRIVE	597,250	4,173,185	262	0.05		4.13	5.4E-03
	Total								9.9	9.7E-03
Enhanced Bus Alternative	18895	Bay Area Rapid Transit	5067 IRON HORSE PKWY	597,198	4,173,402	380	0.04	1.37	0.92	6.9E-04
	14075	S F Bay Area Rapid Transit District	5801 OWENS DRIVE	597,250	4,173,185	595	0.04		3.31	4.3E-03
	Total								4.2	5.0E-03

Notes:

- ¹ All sources within 1,000 feet of the MEISR were included as per the BAAQMD Stationary Source Screening Analysis Tool. Source information was obtained from the Alameda County Stationary Source Screening tool with additional details provided by BAAQMD.
- ² The distance presented here is from the source to the MEISR.
- ³ BAAQMD screening tools' calculated impacts are based on previous OEHHA guidance (2003). Per BAAQMD recommendations, cancer risks were conservatively scaled by a factor of 1.37 to account for the updated exposure parameters and calculation methodologies in OEHHA 2015 guidance.
- ⁴ The adjusted health impacts listed in the table above were calculated using the health impacts estimated using BAAQMD Stationary Source Screening Analysis Tool and were adjusted using the BAAQMD Diesel Risk Multiplier since all sources were diesel generators.
- ⁵ There are no permitted stationary sources within 1,000 feet of the MEISR.

Abbreviations:

- BAAQMD - Bay Area Air Quality Management District
- BART - Bay Area Rapid Transit
- BRT - Bus Rapid Transit
- DMU - Diesel Multiple Units
- EMU - Electrical Multiple Units
- ft - feet
- m - meter
- µg/m³ - microgram per cubic meter
- MEISR - Maximally Exposed Individual Sensitive Receptor
- OEHHA - Office of Environmental Health Hazard Assessment
- PM_{2.5} - particulate matter with an aerodynamic diameter of 2.5 microns or less
- UTM - Universal Transverse Mercator

References:

- BAAQMD. 2012. Stationary Source Screening Analysis Tool. Santa Clara County. May 30. Available at: <http://www.baaqmd.gov/plans-and-climate/california-environmental-quality-act-ceqa/ceqa-tools>
- OEHHA. 2015. Air Toxics Hot Spots Program Risk Assessment Guidelines. Guidance Manual for Preparation of Health Risk Assessments. February.

Table 38
Roadway Screening Health Impacts
BART to Livermore Extension
Livermore, California

Description ¹	Segment ²	Distance from Roadway to MEISR ³ (ft)	Average Daily Traffic ⁴ (vehicles/day)	MEISR	Road Direction ⁵	Direction to MEISR from Roadway	BAAQMD Screening Impacts ^{6,7,8}	
							Lifetime Excess Cancer Risk ⁶ (in a million)	PM _{2.5} Concentration (µg/m ³)
Project Impact								
Conventional BART (2040)	606515-4173176	923	10,658	Cancer Risk and PM _{2.5}	East-West	North	1.3	0.016
Cumulative Impact								
Conventional BART (2025)	605891-4173459	675	19,184	Cancer Risk and PM _{2.5}	N-S	E	3.1	0.045
	605925-4173249	621	11,260		E-W	N	2.0	0.026
	605948-4173331	454	14,722		E-W	N	3.2	0.043
	606234-4173316	239	25,081		E-W	N	8.7	0.12
	606515-4173176	918	10,509		E-W	N	1.3	0.016
	I-580	--	--		--	N	107	0.57
Total:							126	0.82
DMU Alternative (EMU Option) (2025) ⁹	605891-4173459	675	19,243	DMU/EMU Cancer Risk and EMU PM _{2.5} ⁹	N-S	E	3.1	0.045
	605925-4173249	621	11,296		E-W	N	2.0	0.026
	605948-4173331	454	11,972		E-W	N	2.6	0.035
	606234-4173316	239	25,361		E-W	N	8.8	0.12
	I-580	--	--		--	N	107	0.57
Total:							124	0.80
DMU Alternative (2025)	604438-4173353	503	12,919	DMU PM _{2.5}	N-S	W	--	0.019
	605037-4173335	279	24,752		E-W	S	--	0.056
	I-580	--	--		--	S	--	1.1
Total:							--	1.1
Express Bus/BRT Alternative (2025)	596980-4173664	709	12,174	Cancer Risk and PM _{2.5}	N-S	E	1.9	0.027
	597135-4173152	620	11,452		N-S	W	1.1	0.01
	597145-4173387	105	10,588		E-W	N	6.9	0.10
	597160-4173283	318	11,452		N-S	W	2.0	0.025
	597129-4173351	106	18,593		E-W	N	12	0.17
	597216-4173509	386	10,608		N-S	W	1.5	0.019
I-580	--	--	--	N	102	0.51		
Total:							127	0.86
Enhanced Bus Alternative (2025)	597214-4173694	97	12,178	Cancer Risk and PM _{2.5}	N-S	E	8.4	0.12
	596980-4173664	875	12,163		N-S	E	1.5	0.022
	597298-4173795	44	28,282		E-W	S	17	0.24
	I-580	--	--		--	N	40	0.20
Total:							67	0.58
Conventional BART (2040)	605864-4173514	680	10,375	Cancer Risk and PM _{2.5}	N-S	E	1.7	0.024
	605891-4173459	675	30,148		N-S	E	4.8	0.069
	605948-4173331	454	18,003		E-W	N	4.0	0.053
	606172-4173220	601	11,891		E-W	N	2.2	0.029
	I-580	--	--		--	N	107	0.57
Total:							120	0.75

Table 38
Roadway Screening Health Impacts
BART to Livermore Extension
Livermore, California

DMU Alternative (EMU Option) (2040) ⁹	605864-4173514	680	10,229	DMU/EMU Cancer Risk and EMU PM _{2.5} ⁹	N-S	E	1.6	0.024
	605891-4173459	675	29,085		N-S	E	4.6	0.067
	605948-4173331	454	14,633		E-W	N	3.2	0.043
	606172-4173220	601	11,844		E-W	N	2.1	0.028
	I-580	--	--		--	N	107	0.57
Total:							119	0.73
DMU Alternative (2040)	604438-4173353	503	15,239	DMU PM _{2.5}	N-S	W	--	0.023
	I-580	--	--		--	S	--	1.1
	Total:							--
Express Bus/BRT Alternative (2040)	596763-4173745	87	43,702	Cancer Risk and PM _{2.5}	E-W	S	17	0.23
	596980-4173664	10	13,842		N-S	E	20	0.29
	597214-4173694	763	13,946		N-S	W	0.98	0.012
	I-580	--	--		--	N	40	0.20
	Total:							78
Enhanced Bus Alternative (2040)	597214-4173694	97	13,959	Cancer Risk and PM _{2.5}	N-S	E	9.6	0.14
	596980-4173664	875	14,143		N-S	E	1.7	0.025
	597298-4173795	44	38,478		E-W	S	21	0.30
	I-580	--	--		--	N	40	0.20
	Total:							73

Notes:

- ¹ For the Project analysis, only Alternatives that have road segments with an increase in average daily traffic volume > 10,000 vehicles per day are shown. For the cumulative analysis, all roadway segments with average daily traffic volume > 10,000 vehicles per day are included.
- ² Unique road segment identifier based on the UTM Coordinates of the midpoint of the road segment (UTM Zone 10, NAD83).
- ³ For a screening assessment, the table provides health impacts to the maximally exposed individual sensitive receptor (MEISR). Distances presented represent the distance from the nearest edge of the roadway to the MEISR.
- ⁴ Peak hourly traffic volumes were provided by ARUP for 2025 and 2050 for the Proposed Project, each Alternative, and the No Project Alternative. Peak hourly traffic volumes were then scaled to average daily traffic volume. For the Project analysis, the difference in average daily traffic volume was then calculated between the Proposed Project and the No Project Alternative and each Alternative and the No Project Alternative. The above screening analysis for the Project includes individual road segments with an increase in average daily traffic volume > 10,000 vehicles per day.
- ⁵ For road segments that are neither North-South nor East-West, road direction was set to the orientation that results in higher concentrations/risks.
- ⁶ BAAQMD screening tools' calculated impacts are based on previous OEHHA guidance. Per BAAQMD recommendations, cancer risks were conservatively scaled by a factor of 1.37 to account for the updated exposure parameters and calculation methodologies in OEHHA 2015 guidance.
- ⁷ Screening estimates of health impacts were estimated with the BAAQMD Roadway Screening Analysis Calculator (BAAQMD 2015). The screening tool does not allow calculation of impacts from roadways that are over 1,000 ft from the MEIR. Roadways outside of the 1,000 ft "zone of influence" were not considered in the analysis.
- ⁸ Screening estimates of health impacts for I-580 were estimated with the BAAQMD Highway Screening Analysis Calculator (BAAQMD 2011).
- ⁹ Values are applicable for the DMU Alternative cancer risk and EMU Option cancer risk and PM_{2.5} concentration. The DMU PM_{2.5} MEISR is at a separate location.

Abbreviations:

ADT - Average Daily Traffic	INP - Isabel Neighborhood Plan
BAAQMD: Bay Area Air Quality Management District	MEISR - Maximally Exposed Individual Sensitive Receptor
BART - Bay Area Rapid Transit	µg/m ³ - microgram per cubic meter
BRT - Bus Rapid Transit	NAD83 - North American Datum 1983
DMU - Diesel Multiple Units	OEHHA - Office of Environmental Health Hazard Assessment
EMU - Electrical Multiple Units	PM _{2.5} - particulate matter with an aerodynamic diameter of 2.5 microns or less
ft - feet	UTM - Universal Transverse Mercator

References:

- BAAQMD. 2015. Roadway Screening Analysis Calculator. Available online at: <http://www.baaqmd.gov/plans-and-climate/california-environmental-quality-act-ceqa/ceqa-tools>
- BAAQMD. 2011. Highway Screening Analysis Calculator. Available online at: <http://www.baaqmd.gov/plans-and-climate/california-environmental-quality-act-ceqa/ceqa-tools>
- OEHHA. 2015. Air Toxics Hot Spots Program Risk Assessment Guidelines. Guidance Manual for Preparation of Health Risk Assessments. February.

Table 39
Odor Analysis - Construction
BART to Livermore Extension
Livermore, California

Project and Alternatives ⁴	Source Group	Emissions ¹		Maximum Concentration ²		Maximum Ratio of Concentration to Odor Threshold ³
		DPM/PM ₁₀	ROG	DPM/PM ₁₀	ROG	
		lbs/day	lbs/day	µg/m ³	µg/m ³	
Conventional BART (Project)	Off-road	2.9	5.8	0.11	0.22	0.00018
	Trucks	0.15	1.3		0.97	0.0017
DMU Alternative	Off-road	1.5	3.0	0.12	0.24	0.00019
	Trucks	0.17	1.4		0.98	0.0017
Express Bus/BRT Alternative	Off-road	0.32	0.67	0.039	0.081	0.00007
	Trucks	0.044	0.65		0.57	0.0010
Overall Maximum						0.0017

Notes:

- ¹ Average Daily Construction-Related Emissions. Concentration of odor causing chemicals for each Project Alternative is conservatively estimated using the highest ROG-to-DPM ratios. Emissions by source group are obtained from Table 8.
- ² DPM/PM₁₀ concentration represents the maximum total concentration modeled at all receptors. ROG concentration represents the maximum concentration estimated by scaling the maximum DPM concentration by ROG-to-DPM emission ratio:

$$\text{MaxConc}_{\text{ROG}} = \text{MaxConc}_{\text{DPM}} \times (\text{Emis}_{\text{ROG}} / \text{Emis}_{\text{DPM}})$$
- ³ Maximum ratio of concentration to odor threshold is determined using following methodology:
 - a) Maximum total predicted ROG concentrations were speciated using USEPA SPECIATE Database (USEPA, 2014). ROG concentrations estimated using ROG/DPM emission ratios for off-road equipment were speciated using concentration profile for offroad sources (USEPA, 2014; Profile #3161); ROG concentration derived using ROG/DPM emission ratio for trucks were speciated using concentration profile for offroad sources (USEPA, 2014; Profile 4674).
 - b) Ratios of maximum concentration over respective odor threshold concentration were calculated for all speciated ROG for which odor thresholds were available (Amoore 1983).
 - c) Value shown in table represents the maximum ratio of concentration to odor threshold of all ROG components with odor thresholds taken from the compilation of odor thresholds in Amoore (1983).
- ⁴ Construction associated with the Enhanced Bus Alternative are limited to bus improvements such as excavation, paving, and construction of bus bulbs, bus shelters, and signage and are considered to be de minimis. Therefore, an analysis of the Enhanced Bus Alternative is not included here.

Abbreviations:

BART - Bay Area Rapid Transit	PM ₁₀ - particulate matter with an aerodynamic diameter less than 10 microns
BRT - Bus Rapid Transit	DPM - diesel particulate matter
DMU - Diesel Multiple Units	ROG - reactive organic gas
lb - pound	µg - microgram
	m ³ - cubic meter

References:

Amoore, J.E. and Hautala, E., Odor as an Aid to Chemical Safety: Odor Thresholds Compared with Threshold Limit Values and Volatilities for 214 Industrial Chemicals in Air and Water Dilution, *J. Appl. Toxicology*, Vol. 3(6), 1983, pp. 272-290.

USEPA. 2014. Speciate Database, Version 4.4. February. Available at: <http://www.epa.gov/ttnchie1/software/speciate/>. Accessed June 12, 2017.

Table 40
Odor Analysis - Operational Scenario
BART to Livermore Extension
Livermore, California

Operational Year	Project and Alternatives	Source Group	Emissions ¹		Maximum Concentration ²		Maximum Ratio of Concentration to Odor Threshold ³
			DPM/PM ₁₀	ROG	DPM/PM ₁₀	ROG	
			lbs/day	lbs/day	µg/m ³	µg/m ³	
2025	Conventional BART (Project)	Buses	0.59	3.1	0.036	0.19	0.00034
	DMU Alternative	Buses	0.59	3.1	0.048	0.25	0.00044
		DMU	0.42	4.2		0.48	0.00039
	EMU Option	Buses	0.59	3.1	0.037	0.19	0.00034
	Express Bus/BRT Alternative	Buses	0.22	3.8	0.027	0.48	0.00084
	Enhanced Bus Alternative	Buses	0.20	3.4	0.042	0.72	0.00128
Overall Maximum							0.00128

Notes:

¹ Average net new daily operational emissions for a given source group. Concentration of odor causing chemicals for each Project Alternative is conservatively estimated using the highest ROG-to-DPM ratios (only applies for DMU Alternative). Emissions by source group are obtained from Table 27. Emissions of maintenance trucks, shuttle van, and standby emergency generators are significantly lower compared to that of buses and DMU and are not included.

² DPM/PM₁₀ concentration represents the maximum total concentration modeled at all receptors. ROG concentration represents the maximum concentration estimated by scaling the maximum DPM concentration by ROG-to-DPM emission ratio:

$$\text{MaxConc}_{\text{ROG}} = \text{MaxConc}_{\text{DPM}} \times \text{Emiss}_{\text{ROG}} / \text{Emiss}_{\text{DPM}}$$

³ Maximum ratio of concentration to odor threshold is determined using following methodology:

a) Maximum total predicted ROG concentrations were speciated using USEPA SPECIATE Databased (USEPA 2014). ROG concentrations estimated using ROG/DPM emission ratios for buses were speciated using concentration profiles for onroad sources (USEPA 2014; Profiles 4674 and 4741); ROG concentration derived using ROG/DPM emission ratio for DMU was speciated using concentration profile for offroad sources (USEPA 2014; Profiles 3161).

b) Ratios of maximum concentration over respective odor threshold concentration were calculated for all speciated ROG for which odor thresholds were available (Amoore 1983)

c) Value shown in table represents the maximum ratio of concentration to odor threshold of all ROG components with odor thresholds taken from the compilation of odor thresholds in Amoore (1983). For buses it also represents the maximum ratio determined using two onroad SPECIATE profiles (USEPAa, USEPAb).

Abbreviations:

BART - Bay Area Rapid Transit
 BRT - Bus Rapid Transit
 DMU - Diesel Multiple Units
 EMU - Electrical Multiple Units
 lb - pound

PM₁₀ - particulate matter with an aerodynamic diameter less than 10 microns
 DPM - diesel particulate matter
 ROG - reactive organic gas
 µg - microgram
 m³ - cubic meter

References:

Amoore, J.E. and Hautala, E., Odor as an Aid to Chemical Safety: Odor Thresholds Compared with Threshold Limit Values and Volatilities for 214 Industrial Chemicals in Air and Water Dilution, *J. Appl. Toxicology*, Vol. 3(6), 1983, pp. 272-290.

USEPA. 2014. Speciate Database, Version 4.4. February. Available at: <http://www.epa.gov/ttnchie1/software/speciate/>. Accessed June 12, 2017.

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APPENDIX I: ENERGY AND GREENHOUSE GAS TECHNICAL TABLES

- I.1 Energy Detail Tables**
- I.2 Energy and Greenhouse Gas Calculations**

I.1 Energy and Greenhouse Gas Technical Tables – Energy Detail Tables

APPENDIX I.1 ENERGY DETAIL TABLES

Tables 1 through 20 below provide detailed estimates for change in energy use from the operation of the Proposed Project and Build Alternatives in 2025 and 2040 under Project Conditions, followed by 2025 and 2040 under Cumulative Conditions. Information is provided in kilowatt-hours (kWh) of electricity, gallons of diesel, gallons of gasoline, and total energy in million British thermal units (MMBTU).

TABLE 1 2025 CONVENTIONAL BART PROJECT – CHANGE IN ANNUAL ENERGY USE DETAILS

Energy Use Component	Electricity (kWh)	Diesel (Gallons)	Gasoline (Gallons)	Total Energy Use (MMBTU)
Sources				
<i>Transit Operations</i>				
BART operations	13,060,256	-	-	44,588
Bus operations	-	120,505	-	16,689
<i>Station and Maintenance Operations</i>				
BART car maintenance	1,977,431	-	-	6,751
DMU/EMU car maintenance	-	-	-	-
Station electricity	2,847,609	-	-	9,722
Emergency generators	-	5,821	-	806
Water and wastewater	29,696	-	-	101
Employee Shuttle Vans	-	401	-	56
Maintenance trucks	-	442	-	61
Electric forklifts	65,650	-	-	224
<i>Subtotal Sources</i>	17,980,642	127,169	0	78,998
Reductions				
Passenger vehicles (reduced VMT)	-699,054	-8,038	-1,152,834	-146,843
Solar photovoltaic electricity generation	-1,557,588	-	-	-5,318
<i>Subtotal Reductions</i>	-2,256,642	-8,038	-1,152,834	-152,161
Total	15,724,000	119,131	-1,152,834	-73,163

Notes: Energy use is shown as the change between the 2025 No Project Conditions and the 2025 Project Conditions. Positive values represent an increase in energy use and negative values represent a decrease in energy use.

“-” = not applicable; VMT = vehicle miles traveled; kWh = kilowatt hours; MMBTU = 1 million British thermal units.

TABLE 2 2025 DMU ALTERNATIVE – CHANGE IN ANNUAL ENERGY USE DETAILS

Energy Use Component	Electricity (kWh)	Diesel (Gallons)	Gasoline (Gallons)	Total Energy Use (MMBTU)
Sources				
<i>Transit Operations</i>				
BART operations	2,520,059	-	-	8,603
DMU operations	757,935	281,445	-	41,565
EMU operations	-	-	-	-
Bus operations	-	120,505	-	16,689
<i>Station and Maintenance Operations</i>				
BART car maintenance	381,558	-	-	1,303
DMU/EMU car maintenance	530,166	-	-	1,810
Station electricity	2,847,609	-	-	9,722
Emergency generator	-	5,821	-	806
Water and wastewater	19,678	-	-	67
Maintenance trucks	-	442	-	61
Electric forklifts	65,650	-	-	224
Subtotal Sources	7,122,654	408,213	0	80,850
Reductions				
Passenger vehicles (reduced VMT)	-522,286	-6,005	-861,318	-109,711
Solar photovoltaic electricity generation	-1,557,588	-	-	-5,318
Subtotal Reductions	-2,079,874	-6,005	-861,318	-115,029
Total	5,042,781	402,207	-861,318	-34,179

Notes: Energy use is shown as the change between the 2025 No Project Conditions and the 2025 Project Conditions. Positive values represent an increase in energy use and negative values represent a decrease in energy use.
“-” = not applicable; VMT = vehicle miles traveled; kWh = kilowatt hours; MMBTU = 1 million British thermal units.

TABLE 3 2025 EMU OPTION CHANGE IN ANNUAL ENERGY USE DETAILS

Energy Use Component	Electricity (kWh)	Diesel (Gallons)	Gasoline (Gallons)	Total Energy Use (MMBTU)
Sources				
<i>Transit Operations</i>				
BART operations	2,520,059	-	-	8,603
EMU operations	3,872,106	-	-	13,219
Bus operations	-	120,505	-	16,689
<i>Station and Maintenance Operations</i>				
BART car maintenance	381,558	-	-	1,303
DMU/EMU car maintenance	530,166	-	-	1,810
Station electricity	2,847,609	-	-	9,722
Emergency generator	-	5,821	-	806
Water and wastewater	19,678	-	-	67
Maintenance trucks	-	442	-	61
Electric forklifts	65,650	-	-	224
Subtotal Sources	10,236,825	126,768	0	52,504
Reductions				
Passenger vehicles (reduced VMT)	-522,286	-6,005	-861,318	-109,711
Solar photovoltaic electricity generation	-1,557,588	-	-	-5,318
Subtotal Reductions	-2,079,874	-6,005	-861,318	-115,029
Total	8,156,952	120,762	-861,318	-62,524

Notes: Energy use is shown as the change between the 2025 No Project Conditions and the 2025 Project Conditions. Positive values represent an increase in energy use and negative values represent a decrease in energy use.

"-" = not applicable; VMT = vehicle miles traveled; kWh = kilowatt hours; MMBTU = 1 million British thermal units.

TABLE 4 2025 EXPRESS BUS/BRT ALTERNATIVE – CHANGE IN ANNUAL ENERGY USE DETAILS

Energy Use Component	Electricity (kWh)	Diesel (Gallons)	Gasoline (Gallons)	Total Energy Use (MMBTU)
Sources				
<i>Transit Operations</i>				
BART operations	504,396	-	-	1,722
EMU operations	-	-	-	-
Bus operations	-	147,684	-	20,453
<i>Station and Maintenance Operations</i>				
BART car maintenance	76,370	-	-	261
Water and wastewater	7,177	-	-	25
Subtotal Sources	587,942	147,684	0	22,461
Reductions				
Passenger vehicles (reduced VMT)	-244,108	-2,807	-402,567	-51,277
Subtotal Reductions	-244,108	-2,807	-402,567	-51,277
Total	343,834	144,877	-402,567	-28,817

Notes: Energy use is shown as the change between the 2025 No Project Conditions and the 2025 Project Conditions. Positive values represent an increase in energy use and negative values represent a decrease in energy use.
“-” = not applicable; VMT = vehicle miles traveled; kWh = kilowatt hours; MMBTU = 1 million British thermal units.

TABLE 5 2025 ENHANCED BUS ALTERNATIVE – CHANGE IN ANNUAL ENERGY USE DETAILS

Energy Use Component	Electricity (kWh)	Diesel (Gallons)	Gasoline (Gallons)	Total Energy Use (MMBTU)
Sources				
<i>Transit Operations</i>				
Bus operations	-	132,202	-	18,309
<i>Station and Maintenance Operations</i>				
Water and wastewater	3,727	-	-	13
Subtotal Sources	3,727	132,202	0	18,322
Reductions				
Passenger vehicles (reduced VMT)	-1,383	-16	-2,281	-291
Subtotal Reductions	-1,383	-16	-2,281	-291
Total	2,344	132,186	-2,281	18,031

Notes: Energy use is shown as the change between the 2025 No Project Conditions and the 2025 Project Conditions. Positive values represent an increase in energy use and negative values represent a decrease in energy use.
“-” = not applicable; VMT = vehicle miles traveled; kWh = kilowatt hours; MMBTU = 1 million British thermal units.

TABLE 6 2040 CONVENTIONAL BART PROJECT – CHANGE IN ANNUAL ENERGY USE DETAILS

Energy Use Component	Electricity (kWh)	Diesel (Gallons)	Gasoline (Gallons)	Total Energy Use (MMBTU)
Sources				
<i>Transit Operations</i>				
BART operations	16,064,227	-	-	54,843
Bus operations	-	105,934	-	14,671
<i>Station and Maintenance Operations</i>				
BART car maintenance	2,432,257	-	-	8,304
Station electricity	2,847,609	-	-	9,722
Emergency generator	-	5,821	-	806
Water and wastewater	29,696	-	-	101
Employee Shuttle Vans	-	378	-	52
Maintenance trucks	-	416	-	58
Electric forklifts	65,650	-	-	224
<i>Subtotal Sources</i>	21,439,439	112,549	0	88,781
Reductions				
Passenger vehicles (reduced VMT)	-2,621,456	-12,537	-1,643,157	-214,996
Solar photovoltaic electricity generation	-1,339,617	-	-	-4,573
<i>Subtotal Reductions</i>	-3,961,072	-12,537	-1,643,157	-219,569
Total	17,478,366	100,011	-1,643,157	-130,788

Notes: Energy use is shown as the change between the 2040 No Project Conditions and the 2040 Project Conditions. Positive values represent an increase in energy use and negative values represent a decrease in energy use.

"-" = not applicable; VMT = vehicle miles traveled; kWh = kilowatt hours; MMBTU = 1 million British thermal units.

TABLE 7 2040 DMU ALTERNATIVE – CHANGE IN ANNUAL ENERGY USE DETAILS

Energy Use Component	Electricity (kWh)	Diesel (Gallons)	Gasoline (Gallons)	Total Energy Use (MMBTU)
Sources				
<i>Transit Operations</i>				
BART operations	5,186,786	-	-	17,708
DMU operations	823,155	313,236	-	46,190
Bus operations	-	105,934	-	14,671
<i>Station and Maintenance Operations</i>				
BART car maintenance	785,322	-	-	2,681
DMU/EMU car maintenance	590,052	-	-	2,014
Station electricity	2,847,609	-	-	9,722
Emergency generator	-	5,821	-	806
Water and wastewater	19,678	-	-	67
Maintenance trucks	-	416	-	58
Electric forklifts	65,650	-	-	224
Subtotal Sources	10,318,252	425,407	0	94,141
Reductions				
Passenger vehicles (reduced VMT)	-1,518,992	-7,265	-952,121	-124,579
Solar photovoltaic electricity generation	-1,339,617	-	-	-4,573
Subtotal Reductions	-2,858,609	-7,265	-952,121	-129,152
Total	7,459,644	418,142	-952,121	-35,011

Notes: Energy use is shown as the change between the 2040 No Project Conditions and the 2040 Project Conditions. Positive values represent an increase in energy use and negative values represent a decrease in energy use.

"-" = not applicable; VMT = vehicle miles traveled; kWh = kilowatt hours; MMBTU = 1 million British thermal units.

TABLE 8 2040 EMU OPTION – CHANGE IN ANNUAL ENERGY USE DETAILS

Energy Use Component	Electricity (kWh)	Diesel (Gallons)	Gasoline (Gallons)	Total Energy Use (MMBTU)
Sources				
<i>Transit Operations</i>				
BART operations	5,186,786	-	-	17,708
DMU operations	-	-	-	-
EMU operations	4,295,131	-	-	14,664
Bus operations	-	105,934	-	14,671
<i>Station and Maintenance Operations</i>				
BART car maintenance	785,322	-	-	2,681
DMU/EMU car maintenance	590,052	-	-	2,014
Station electricity	2,847,609	-	-	9,722
Emergency generator	-	5,821	-	806
Water and wastewater	19,678	-	-	67
Maintenance trucks	-	416	-	58
Electric forklifts	65,650	-	-	224
<i>Subtotal Sources</i>	13,790,228	112,171	0	62,615
Reductions				
Passenger vehicles (reduced VMT)	-1,518,992	-7,265	-952,121	-124,579
Solar photovoltaic electricity generation	-1,339,617	-	-	-4,573
<i>Subtotal Reductions</i>	-2,858,609	-7,265	-952,121	-129,152
Total	10,931,620	104,906	-952,121	-66,538

Notes: Energy use is shown as the change between the 2040 No Project Conditions and the 2040 Project Conditions. Positive values represent an increase in energy use and negative values represent a decrease in energy use.

"-" = not applicable; VMT = vehicle miles traveled; kWh = kilowatt hours; MMBTU = 1 million British thermal units.

TABLE 9 2040 EXPRESS BUS/BRT ALTERNATIVE – CHANGE IN ANNUAL ENERGY USE DETAILS

Energy Use Component	Electricity (kWh)	Diesel (Gallons)	Gasoline (Gallons)	Total Energy Use (MMBTU)
Sources				
<i>Transit Operations</i>				
BART operations	2,163,762	-	-	7,387
Bus operations	-	129,827	-	17,980
<i>Station and Maintenance Operations</i>				
BART car maintenance	327,612	-	-	1,118
Water and wastewater	7,177	-	-	25
Subtotal Sources	2,498,551	129,827	0	26,510
Reductions				
Passenger vehicles (reduced VMT)	-1,015,838	-4,858	-636,738	-83,313
Subtotal Reductions	-1,015,838	-4,858	-636,738	-83,313
Total	1,482,713	124,968	-636,738	-56,803

Notes: Energy use is shown as the change between the 2040 No Project Conditions and the 2040 Project Conditions. Positive values represent an increase in energy use and negative values represent a decrease in energy use.

“-” = not applicable; VMT = vehicle miles traveled; kWh = kilowatt hours; MMBTU = 1 million British thermal units.

TABLE 10 2040 ENHANCED BUS ALTERNATIVE – CHANGE IN ANNUAL ENERGY USE DETAILS

Energy Use Component	Electricity (kWh)	Diesel (Gallons)	Gasoline (Gallons)	Total Energy Use (MMBTU)
Sources				
<i>Transit Operations</i>				
Bus operations	-	116,216	-	16,095
<i>Station and Maintenance Operations</i>				
Water and wastewater	3,727	-	-	13
Subtotal Sources	3,727	116,216	0	16,108
Reductions				
Passenger vehicles (reduced VMT)	-96,741	-463	-60,638	-7,934
Solar photovoltaic electricity generation	-	-	-	-
Subtotal Reductions	-96,741	-463	-60,638	-7,934
Total	-93,014	115,754	-60,638	8,173

Notes: Energy use is shown as the change between the 2040 No Project Conditions and the 2040 Project Conditions. Positive values represent an increase in energy use and negative values represent a decrease in energy use.

“-” = not applicable; VMT = vehicle miles traveled; kWh = kilowatt hours; MMBTU = 1 million British thermal units.

TABLE 11 2025 CUMULATIVE CONDITIONS – CONVENTIONAL BART PROJECT – CHANGE IN ANNUAL ENERGY USE DETAILS

Energy Use Component	Electricity (kWh)	Diesel (Gallons)	Gasoline (Gallons)	Total Energy Use (MMBTU)
Sources				
<i>Transit Operations</i>				
BART operations	13,060,256	-	-	44,588
Bus operations	-	120,505	-	16,689
<i>Station and Maintenance Operations</i>				
BART car maintenance	1,977,431	-	-	6,751
Station electricity	2,847,609	-	-	9,722
Emergency generator	-	5,821	-	806
Water and wastewater	29,696	-	-	101
Employee Shuttle Vans	-	401	-	56
Maintenance trucks	-	442	-	61
Electric forklifts	65,650	-	-	224
<i>Subtotal Sources</i>	17,980,642	127,169	0	78,998
Reductions				
Passenger vehicles (reduced VMT)	-596,686	-6,861	-984,015	-125,339
Solar photovoltaic electricity generation	-1,557,588	-	-	-5,318
<i>Subtotal Reductions</i>	-2,154,274	-6,861	-984,015	-130,657
Total	15,826,368	120,308	-984,015	-51,660

Notes: Energy use is shown as the change between the 2025 No Project Conditions and the 2025 Cumulative Project Conditions. Positive values represent an increase in energy use and negative values represent a decrease in energy use.

"-" = not applicable; VMT = vehicle miles traveled; kWh = kilowatt hours; MMBTU = 1 million British thermal units.

TABLE 12 2025 CUMULATIVE CONDITIONS – DMU ALTERNATIVE – CHANGE IN ANNUAL ENERGY USE DETAILS

Energy Use Component	Electricity (kWh)	Diesel (Gallons)	Gasoline (Gallons)	Total Energy Use (MMBTU)
Sources				
<i>Transit Operations</i>				
BART operations	2,520,059	-	-	8,603
DMU operations	757,935	281,445	-	41,565
Bus operations	-	120,505	-	16,689
<i>Station and Maintenance Operations</i>				
BART car maintenance	381,558	-	-	1,303
DMU/EMU car maintenance	530,166	-	-	1,810
Station electricity	2,847,609	-	-	9,722
Emergency generator	-	5,821	-	806
Water and wastewater	19,678	-	-	67
Maintenance trucks	-	442	-	61
Electric forklifts	65,650	-	-	224
Subtotal Sources	7,122,654	408,213	0	80,850
Reductions				
Passenger vehicles (reduced VMT)	-399,471	-4,593	-658,780	-83,913
Solar photovoltaic electricity generation	-1,557,588	-	-	-5,318
Subtotal Reductions	-1,957,059	-4,593	-658,780	-89,231
Total	5,165,596	403,619	-658,780	-8,380

Notes: Energy use is shown as the change between the 2025 No Project Conditions and the 2025 Cumulative Project Conditions. Positive values represent an increase in energy use and negative values represent a decrease in energy use.

"-" = not applicable; VMT = vehicle miles traveled; kWh = kilowatt hours; MMBTU = 1 million British thermal units.

**TABLE 13 2025 CUMULATIVE CONDITIONS – EMU OPTION – CHANGE IN ANNUAL ENERGY USE
 DETAILS**

Energy Use Component	Electricity (kWh)	Diesel (Gallons)	Gasoline (Gallons)	Total Energy Use (MMBTU)
Sources				
<i>Transit Operations</i>				
BART operations	2,520,059	-	-	8,603
EMU operations	3,872,106	-	-	13,219
Bus operations	-	120,505	-	16,689
<i>Station and Maintenance Operations</i>				
BART car maintenance	381,558	-	-	1,303
DMU/EMU car maintenance	530,166	-	-	1,810
Station electricity	2,847,609	-	-	9,722
Emergency generator	-	5,821	-	806
Water and wastewater	19,678	-	-	67
Maintenance trucks	-	442	-	61
Electric forklifts	65,650	-	-	224
Subtotal Sources	10,236,825	126,768	0	52,504
Reductions				
Passenger vehicles (reduced VMT)	-399,471	-4,593	-658,780	-83,913
Solar photovoltaic electricity generation	-1,557,588	-	-	-5,318
Subtotal Reductions	-1,957,059	-4,593	-658,780	-89,231
Total	8,279,767	122,174	-658,780	-36,726

Notes: Energy use is shown as the change between the 2025 No Project Conditions and the 2025 Cumulative Project Conditions. Positive values represent an increase in energy use and negative values represent a decrease in energy use.

"-" = not applicable; VMT = vehicle miles traveled; kWh = kilowatt hours; MMBTU = 1 million British thermal units.

TABLE 14 2025 CUMULATIVE CONDITIONS – EXPRESS BUS/BRT ALTERNATIVE – CHANGE IN ANNUAL ENERGY USE DETAILS

Energy Use Component	Electricity (kWh)	Diesel (Gallons)	Gasoline (Gallons)	Total Energy Use (MMBTU)
Sources				
<i>Transit Operations</i>				
BART operations	504,396	-	-	1,722
Bus operations	-	147,684	-	20,453
<i>Station and Maintenance Operations</i>				
BART car maintenance	76,370	-	-	261
Water and wastewater	7,177	-	-	25
Subtotal Sources	587,942	147,684	0	22,461
Reductions				
Passenger vehicles (reduced VMT)	-356,551	-4,100	-588,000	-74,897
Solar photovoltaic electricity generation	-	-	-	-
Subtotal Reductions	-356,551	-4,100	-588,000	-74,897
Total	231,392	143,584	-588,000	-52,437

Notes: Energy use is shown as the change between the 2025 No Project Conditions and the 2025 Cumulative Project Conditions. Positive values represent an increase in energy use and negative values represent a decrease in energy use.

"-" = not applicable; VMT = vehicle miles traveled; kWh = kilowatt hours; MMBTU = 1 million British thermal units.

TABLE 15 2025 CUMULATIVE CONDITIONS – ENHANCED BUS ALTERNATIVE – CHANGE IN ANNUAL ENERGY USE DETAILS

Energy Use Component	Electricity (kWh)	Diesel (Gallons)	Gasoline (Gallons)	Total Energy Use (MMBTU)
Sources				
<i>Transit Operations</i>				
Bus operations	-	132,202	-	18,309
<i>Station and Maintenance Operations</i>				
	0	0	0	
Water and wastewater	3,727	-	-	13
Subtotal Sources	3,727	132,202	0	18,322
Reductions				
Passenger vehicles (reduced VMT)	-159,107	-1,829	-262,388	-33,421
Subtotal Reductions	-159,107	-1,829	-262,388	-33,421
Total	-155,380	130,373	-262,388	-15,101

Notes: Energy use is shown as the change between the 2025 No Project Conditions and the 2025 Cumulative Project Conditions. Positive values represent an increase in energy use and negative values represent a decrease in energy use.

"-" = not applicable; VMT = vehicle miles traveled; kWh = kilowatt hours; MMBTU = 1 million British thermal units.

TABLE 16 2040 CUMULATIVE CONDITIONS – CONVENTIONAL BART PROJECT – CHANGE IN ANNUAL ENERGY USE DETAILS

Energy Use Component	Electricity (kWh)	Diesel (Gallons)	Gasoline (Gallons)	Total Energy Use (MMBTU)
Sources				
<i>Transit Operations</i>				
BART operations	16,064,227	-	-	54,843
Bus operations	-	122,587	-	14,671
<i>Station and Maintenance Operations</i>				
BART car maintenance	2,432,257	-	-	8,304
Station electricity	2,847,609	-	-	9,722
Emergency generator	-	4,109	-	806
Water and wastewater	17,278	-	-	101
Employee Shuttle Vans	-	378	-	52
Maintenance trucks	-	416	-	58
Electric forklifts	65,650	-	-	224
Subtotal Sources	21,439,439	127,490	0	88,781
Reductions				
Passenger vehicles (reduced VMT)	-2,927,763	-14,002	-1,835,154	-240,117
Solar photovoltaic electricity generation	-1,339,617	-	-	-4,573
Subtotal Reductions	-4,267,380	-14,002	-1,835,154	-244,690
Total	17,172,059	133,487	-1,835,154	-155,910

Notes: Energy use is shown as the change between the 2040 No Project Conditions and the 2040 Cumulative Project Conditions. Positive values represent an increase in energy use and negative values represent a decrease in energy use.

"-" = not applicable; VMT = vehicle miles traveled; kWh = kilowatt hours; MMBTU = 1 million British thermal units.

TABLE 17 2040 CUMULATIVE CONDITIONS – DMU ALTERNATIVE – CHANGE IN ANNUAL ENERGY USE DETAILS

Energy Use Component	Electricity (kWh)	Diesel (Gallons)	Gasoline (Gallons)	Total Energy Use (MMBTU)
Sources				
<i>Transit Operations</i>				
BART operations	5,186,786	-	-	17,708
DMU operations	823,155	313,236	-	46,190
Bus operations	-	105,934	-	14,671
<i>Station and Maintenance Operations</i>				
BART car maintenance	785,322	-	-	2,681
DMU/EMU car maintenance	590,052	-	-	2,014
Station electricity	2,847,609	-	-	9,722
Emergency generator	-	5,821	-	806
Water and wastewater	19,678	-	-	67
Maintenance trucks	-	416	-	58
Electric forklifts	65,650	-	-	224
<i>Subtotal Sources</i>	<i>10,318,252</i>	<i>425,407</i>	<i>0</i>	<i>94,141</i>
Reductions				
Passenger vehicles (reduced VMT)	-1,774,098	-8,485	-1,112,024	-145,501
Solar photovoltaic electricity generation	-1,339,617	-	-	-4,573
<i>Subtotal Reductions</i>	<i>-3,113,714</i>	<i>-8,485</i>	<i>-1,112,024</i>	<i>-150,074</i>
Total	7,204,539	416,922	-1,112,024	-55,933

Notes: Energy use is shown as the change between the 2040 No Project Conditions and the 2040 Cumulative Project Conditions. Positive values represent an increase in energy use and negative values represent a decrease in energy use.

"-" = not applicable; VMT = vehicle miles traveled; kWh = kilowatt hours; MMBTU = 1 million British thermal units.

**TABLE 18 2040 CUMULATIVE CONDITIONS – EMU OPTION – CHANGE IN ANNUAL ENERGY USE
DETAILS**

Energy Use Component	Electricity (kWh)	Diesel (Gallons)	Gasoline (Gallons)	Total Energy Use (MMBTU)
Sources				
<i>Transit Operations</i>				
BART operations	5,186,786	-	-	17,708
DMU operations	-	-	-	-
EMU operations	4,295,131	-	-	14,664
Bus operations	-	105,934	-	14,671
<i>Station and Maintenance Operations</i>				
BART car maintenance	785,322	-	-	2,681
DMU/EMU car maintenance	590,052	-	-	2,014
Station electricity	2,847,609	-	-	9,722
Emergency generator	-	5,821	-	806
Water and wastewater	19,678	-	-	67
Maintenance trucks	-	416	-	58
Electric forklifts	65,650	-	-	224
Subtotal Sources	13,790,228	112,171	0	62,615
Reductions				
Passenger vehicles (reduced VMT)	-1,774,098	-8,485	-1,112,024	-145,501
Solar photovoltaic electricity generation	-1,339,617	-	-	-4,573
Subtotal Reductions	-3,113,714	-8,485	-1,112,024	-150,074
Total	10,676,515	103,686	-1,112,024	-87,460

Notes: Energy use is shown as the change between the 2040 No Project Conditions and the 2040 Cumulative Project Conditions. Positive values represent an increase in energy use and negative values represent a decrease in energy use.

"-" = not applicable; VMT = vehicle miles traveled; kWh = kilowatt hours; MMBTU = 1 million British thermal units.

TABLE 19 2040 CUMULATIVE CONDITIONS – EXPRESS BUS/BRT ALTERNATIVE – CHANGE IN ANNUAL ENERGY USE DETAILS

Energy Use Component	Electricity (kWh)	Diesel (Gallons)	Gasoline (Gallons)	Total Energy Use (MMBTU)
Sources				
<i>Transit Operations</i>				
BART operations	2,163,762	-	-	7,387
Bus operations	-	129,827	-	17,980
<i>Station and Maintenance Operations</i>				
BART car maintenance	327,612	-	-	1,118
Water and wastewater	7,177	-	-	25
Subtotal Sources	2,498,551	129,827	0	26,510
Reductions				
Passenger vehicles (reduced VMT)	-1,232,786	-5,896	-772,724	-101,106
Subtotal Reductions	-1,232,786	-5,896	-772,724	-101,106
Total	1,265,765	123,931	-772,724	-74,596

Notes: Energy use is shown as the change between the 2040 No Project Conditions and the 2040 Cumulative Project Conditions. Positive values represent an increase in energy use and negative values represent a decrease in energy use.
 "-" = not applicable; VMT = vehicle miles traveled; kWh = kilowatt hours; MMBTU = 1 million British thermal units.

TABLE 20 2040 CUMULATIVE CONDITIONS – ENHANCED BUS ALTERNATIVE – CHANGE IN ANNUAL ENERGY USE DETAILS

Energy Use Component	Electricity (kWh)	Diesel (Gallons)	Gasoline (Gallons)	Total Energy Use (MMBTU)
Sources				
<i>Transit Operations</i>				
Bus operations	-	116,216	-	16,095
<i>Station and Maintenance Operations</i>				
Water and wastewater	3,727	-	-	13
Subtotal Sources	3,727	116,216	0	16,108
Reductions				
Passenger vehicles (reduced VMT)	-313,929	-1,501	-196,774	-25,747
Subtotal Reductions	-313,929	-1,501	-196,774	-25,747
Total	-310,202	114,715	-196,774	-9,639

Notes: Energy use is shown as the change between the 2040 No Project Conditions and the 2040 Cumulative Project Conditions. Positive values represent an increase in energy use and negative values represent a decrease in energy use.
 "-" = not applicable; VMT = vehicle miles traveled; kWh = kilowatt hours; MMBTU = 1 million British thermal units.

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I.2 Energy and Greenhouse Gas Technical Tables – Energy and Greenhouse Gas Calculations

APPENDIX I.2 ENERGY AND GREENHOUSE GAS CALCULATIONS

**Table E-1a
Energy Use from Project Construction
BART to Livermore Extension Project
Livermore, California**

Source		Energy Use			
		BART	DMU/EMU	Express Bus/BRT	Enhanced Bus
Diesel (gal)	On-Road Vehicles	482,395	572,498	145,425	15,652
	Off-Road Equipment	568,454	304,547	75,726	9,811
Gasoline (gal)	On-Road Vehicles	107,641	109,991	102,552	3,979
Electricity (kWh)	On-Road Vehicles	10,293	10,293	10,913	383

Notes

On-road mobile source fuel use based on vehicle miles traveled (VMT) for all years of construction and fleet-average fuel consumption in gallons per mile from EMFAC2014 for 2020 in Alameda County. Electricity demand based on VMT and calculated average electric vehicle fuel economy for 2015 models (in kWh per mile) from the DOE Fuel Economy Guide.

Off-road mobile source fuel usage based on a fuel usage rate of 0.05 gallons of diesel per horsepower (hp)-hour, consistent with diesel conversion factors given in USEPA AP-42 Table 3.4.1.

Abbreviations

BART: Bay Area Rapid Transit	gal: gallon
BRT: Bus Rapid Transit	hp: horsepower
DMU: Diesel Multiple Unit	kWh: kilowatt-hour
DOE: United States Department of Energy	USEPA: United States Environmental Protection Agency
EMFAC2014: California Air Resources Board Emission Factor mod VMT: vehicle miles traveled	
EMU: Electric Multiple Unit	

References:

DOE. 2016. Fuel Economy Guide, Model Year 2015. Electric Vehicles. Available online at: <http://www.fueleconomy.gov/feg/printGuides.shtml>. Accessed January 2016.

USEPA. 1996. AP 42. Compilation of Air Pollutant Emission Factors, Volume 1. Fifth Edition. Chapter 3.4, Large Stationary Diesel and All Stationary Dual-fuel Engines. Available online at: <http://www.epa.gov/ttn/chief/ap42/ch03/final/c03s04.pdf>. Accessed January 2016

Table E-1b
Energy Use from Project Construction (MMBtu)
BART to Livermore Extension Project
Livermore, California

Source		Energy Use (MMBtu)			
		BART	DMU/EMU	Express Bus/BRT	Enhanced Bus
Diesel	On-Road Vehicles	66,807	79,285	20,140	2,168
	Off-Road Equipment	78,725	42,177	10,487	1,359
Gasoline	On-Road Vehicles	13,384	13,676	12,751	495
Electricity	On-Road Vehicles	106.4	106.4	112.8	4.0
Total		159,023	135,245	43,491	4,025

Notes

¹ Energy use from Table E-1a was converted to units of MMBtu based on energy content to allow for the comparison of total energy use across Alternatives.

Abbreviations

BART: Bay Area Rapid Transit
 BRT: Bus Rapid Transit
 DMU: Diesel Multiple Unit
 EMU: Electric Multiple Unit
 MMBtu: million British thermal units

References:

DOE. 2014. Fuel Properties Comparison. Available online at:
http://www.afdc.energy.gov/fuels/fuel_comparison_chart.pdf. Accessed October 2016.

Table E-2a
Energy Use from Project Operations
BART to Livermore Extension Project
Livermore, California

Energy Source		Scenario ¹	Year	Conventional BART	DMU Alternative	EMU Alternative	Express Bus/BRT Alternative	Enhanced Bus Alternative
Electricity (kWh/yr)	Passenger Vehicles ²	Project	2025	-699,054	-522,286	-522,286	-244,108	-1,383
			2040	-2,621,456	-1,518,992	-1,518,992	-1,015,838	-96,741
	BART Traction ³	Project and Cumulative	2025	-596,686	-399,471	-399,471	-356,551	-159,107
			2040	-2,927,763	-1,774,098	-1,774,098	-1,232,786	-313,929
	DMU Idling ⁴	Project and Cumulative	2025	13,060,256	2,520,059	2,520,059	504,396	-
			2040	16,064,227	5,186,786	5,186,786	2,163,762	-
	EMU Traction and Idling ⁵	Project and Cumulative	2025	-	757,935	-	-	-
			2040	-	823,155	-	-	-
	Building and Parking Electricity at Isabel	Project and Cumulative	2025	-	-	3,872,106	-	-
			2040	-	-	4,295,131	-	-
	Maintenance of BART Cars ⁷	Project and Cumulative	2025 and	2,847,609	2,847,609	2,847,609	-	-
			2025	1,977,431	381,558	381,558	76,370	-
	Maintenance of DMU/EMU Cars ⁷	Project and Cumulative	2025	2,432,257	785,322	785,322	327,612	-
			2040	-	530,166	530,166	-	-
	Water and Wastewater ⁸	Project and Cumulative	2025	-	590,052	590,052	-	-
			2040	-	590,052	590,052	-	-
Forklifts ⁹	Project and Cumulative	2025 and	29,696	19,678	19,678	7,177	3,727	
		2025 and	65,650	65,650	65,650	-	-	
Solar PV at Isabel Station ¹⁰	Project and Cumulative	2025	-1,557,588	-1,557,588	-1,557,588	-	-	
		2040	-1,339,617	-1,339,617	-1,339,617	-	-	
Total	Project	2025	15,724,000	5,042,781	8,156,952	343,834	2,344	
		2040	17,478,366	7,459,644	10,931,620	1,482,713	-93,014	
	Cumulative	2025	15,826,368	5,165,596	8,279,767	231,392	-155,380	
		2040	17,172,059	7,204,539	10,676,515	1,265,765	-310,202	
Diesel (gal/yr)	Passenger Vehicles ²	Project	2025	-8,038	-6,005	-6,005	-2,807	-16
			2040	-12,537	-7,265	-7,265	-4,858	-463
	Buses ²	Project and Cumulative	2025	-6,861	-4,593	-4,593	-4,100	-1,829
			2040	-14,002	-8,485	-8,485	-5,896	-1,501
	DMU Engine ¹¹	Project and Cumulative	2025	120,505	120,505	120,505	147,684	132,202
			2040	105,934	105,934	105,934	129,827	116,216
	Emergency Generator (Isabel Station) ¹²	Project and Cumulative	2025	-	281,445	-	-	-
			2040	-	313,236	-	-	-
	Emergency Generator (Maintenance Facility) ¹²	Project and Cumulative	2025 and	4,109	4,109	4,109	-	-
			2025 and	1,712	1,712	1,712	-	-
	Maintenance Facility Shuttle Vans ^{2,13}	Project and Cumulative	2025	401	-	-	-	-
			2040	378	-	-	-	-
	Off-Road Trucks ^{2,14}	Project and Cumulative	2025	442	442	442	-	-
			2040	416	416	416	-	-
	Total	Project	2025	119,131	402,207	120,762	144,877	132,186
			2040	100,011	418,142	104,906	124,968	115,754
Cumulative		2025	120,308	403,619	122,174	143,584	130,373	
		2040	98,546	416,922	103,686	123,931	114,715	

Energy Source		Scenario ¹	Year	Conventional BART	DMU Alternative	EMU Alternative	Express Bus/BRT Alternative	Enhanced Bus Alternative
Gasoline (gal/yr)	Passenger Vehicles ²	Project	2025	-1,152,834	-861,318	-861,318	-402,567	-2,281
			2040	-1,643,157	-952,121	-952,121	-636,738	-60,638
		Cumulative	2025	-984,015	-658,780	-658,780	-588,000	-262,388
			2040	-1,835,154	-1,112,024	-1,112,024	-772,724	-196,774
	Total	Project	2025	-1,152,834	-861,318	-861,318	-402,567	-2,281
			2040	-1,643,157	-952,121	-952,121	-636,738	-60,638
		Cumulative	2025	-984,015	-658,780	-658,780	-588,000	-262,388
			2040	-1,835,154	-1,112,024	-1,112,024	-772,724	-196,774

Notes

- ¹ Project and cumulative scenarios for each alternative only differ in the level of on-road passenger traffic.
- ² Vehicle gasoline and diesel demand for passenger vehicles, off-road trucks, and buses is derived from EMFAC2014 daily fuel use in Alameda County for operational years 2025 and 2040.
- ³ BART traction electricity demand calculated from annual total car-miles traveled and an electricity demand factor of 4.51 kWh/car-mile (based on 2006 system-wide traction electricity demand).
- ⁴ DMU idling electricity calculated based on an assumption of 12 min of idling per roundtrip. An electricity demand factor of 0.88 kWh/idle-minute (2008 eBART Phase I Project to Hillcrest Terminal DMU and LRV Comparison) was modified to account for the Project-specific number of cars per train.
- ⁵ EMU traction electricity calculated from annual revenue DMU car-miles and roundtrips. EMU idling electricity calculated based on an assumption of 12 min of idling per roundtrip.
- ⁶ Building electricity consumption at the new Isabel Station was assumed to be similar to the electricity use at the East Dublin/Pleasanton Station and Station Parking Lot. The value shown here represents a three-year annual average from 2012-2014. Electricity with losses were conservatively included.
- ⁷ Additional electricity use is anticipated from the maintenance of BART and DMU/EMU cars. A maintenance factor of 7,060 BTU/mile was obtained from Caltrans Energy and Transportation Systems, Table E-13 (1983) and applied to annual car-miles.
- ⁸ Water consumption includes use at the Dublin/Pleasanton and Isabel stations, the Maintenance Facility, and wayside facilities. Estimates of consumption are primarily based on historical usage at existing and comparable BART facilities, scaled for anticipated level of activity. Energy use consists of upstream electricity to supply, treat, and distribute water and downstream electricity to treat wastewater.
- ⁹ Two electric forklifts will be used at the maintenance yard for the Conventional BART and DMU/EMU alternatives. Horsepower and load factor are industrial averages and CalEEMod defaults, respectively. It is assumed that the forklifts will operate 365 days a year for 8 hours a day.
- ¹⁰ A solar PV capacity of 1,000 kW is assumed for the Isabel Station in 2025, with a 1% annual degradation in performance for every year thereafter. Electricity generation was estimated using the National Renewable Energy Laboratory's PVWatts calculator, available online at: <http://pvwatts.nrel.gov/pvwatts.php>. Electricity generation shown is for a roof-array with default assumptions and weather conditions typical of Livermore, California.
- ¹¹ DMU diesel demand is calculated from annual revenue DMU car-miles. A fuel use rate of 0.725 gallons diesel/mile (2008 East Contra Costa BART Extension Draft EIR) was modified to account for the Project-specific number of cars per train.
- ¹² One 2,500-kW emergency generator will be located at Isabel Station and one 500-kW emergency generator will be located at the Maintenance Facility. It is assumed that operation for routine maintenance and testing will not exceed 24 hours per year for the Isabel Station generator and 50 hours per year for the Maintenance Facility generator.
- ¹³ One shuttle van will be used at the maintenance yard for the Conventional BART and DMU/EMU alternatives. It is assumed that the vans will travel 20 miles per day (7,300 annual VMT) and idle for 40 minutes per day.
- ¹⁴ Two off-road trucks will be used at the maintenance yard for the Conventional BART and DMU/EMU alternatives. It is assumed that the trucks will travel 11 miles per day (8,030 annual VMT) and idle for 10 minutes per day, per vehicle.

Abbreviations

BART: Bay Area Rapid Transit	gal: gallon
BRT: Bus Rapid Transit	kWh: kilowatt-hour
CalEEMod®: California Emissions Estimator Model	PV: photovoltaic
DMU: Diesel Multiple Unit	USEPA: United States Environmental Protection Agency
DOE: United States Department of Energy	VMT: vehicle miles traveled
EMFAC2014: California Air Resources Board Emission FACTor model	yr: year
EMU: Electric Multiple Unit	

Table E-2b
Energy Use from Project Operations (MMBtu)
BART to Livermore Extension Project
Livermore, California

Energy Source		Scenario ¹	Year	Energy Use (MMBtu)				
				Conventional BART	DMU Alternative	EMU Alternative	Express Bus/BRT Alternative	Enhanced Bus Alternative
Electricity	Passenger Vehicles	Project	2025	-2,387	-1,783	-1,783	-833	-5
			2040	-8,950	-5,186	-5,186	-3,468	-330
		Cumulative	2025	-2,037	-1,364	-1,364	-1,217	-543
			2040	-9,995	-6,057	-6,057	-4,209	-1,072
	BART Traction	Project and Cumulative	2025	44,588	8,603	8,603	1,722	-
			2040	54,843	17,708	17,708	7,387	-
	DMU Idling Electricity Use	Project and Cumulative	2025	-	2,588	-	-	-
			2040	-	2,810	-	-	-
	EMU Traction	Project and Cumulative	2025	-	-	13,219	-	-
			2040	-	-	14,664	-	-
	Building and Parking Electricity at Isabel Station	Project and Cumulative	2025 and 2040	9,722	9,722	9,722	-	-
	Maintenance of BART Cars	Project and Cumulative	2025	6,751	1,303	1,303	261	-
			2040	8,304	2,681	2,681	1,118	-
	Maintenance of DMU/EMU Cars	Project and Cumulative	2025	-	1,810	1,810	-	-
			2040	-	2,014	2,014	-	-
	Water and Wastewater	Project and Cumulative	2025 and 2040	101	67	67	25	13
	Forklifts	Project and Cumulative	2025 and 2040	224	224	224	-	-
	Solar PV at Isabel Station	Project and Cumulative	2025	-5,318	-5,318	-5,318	-	-
			2040	-4,573	-4,573	-4,573	-	-
	Total	Project	2025	53,682	17,216	27,848	1,174	8
2040			59,671	25,467	37,321	5,062	-318	
Cumulative		2025	54,031	17,635	28,267	790	-530	
		2040	58,625	24,596	36,450	4,321	-1,059	

Table E-2b
Energy Use from Project Operations (MMBtu)
BART to Livermore Extension Project
Livermore, California

Energy Source		Scenario ¹	Year	Energy Use (MMBtu)				
				Conventional BART	DMU Alternative	EMU Alternative	Express Bus/BRT Alternative	Enhanced Bus Alternative
Diesel	Passenger Vehicles	Project	2025	-1,113	-832	-832	-389	-2
			2040	-1,736	-1,006	-1,006	-673	-64
		Cumulative	2025	-950	-636	-636	-568	-253
			2040	-1,939	-1,175	-1,175	-817	-208
	Buses	Project and Cumulative	2025	16,689	16,689	16,689	20,453	18,309
			2040	14,671	14,671	14,671	17,980	16,095
	DMU Engine	Project and Cumulative	2025	-	38,977	-	-	-
			2040	-	43,380	-	-	-
	Emergency Generator (Isabel Station)	Project and Cumulative	2025 and 2040	569	569	569	-	-
	Emergency Generator (Maintenance Facility)	Project and Cumulative	2025 and 2040	237	237	237	-	-
	Maintenance Facility Shuttle Vans	Project and Cumulative	2025	56	-	-	-	-
			2040	52	-	-	-	-
	Off-Road Maintenance Trucks	Project and Cumulative	2025	61	61	61	-	-
			2040	58	58	58	-	-
	Total	Project	2025	16,498	55,702	16,724	20,064	18,306
			2040	13,851	57,909	14,528	17,307	16,031
		Cumulative	2025	16,661	55,897	16,920	19,885	18,055
2040			13,648	57,740	14,359	17,163	15,887	

Table E-2b
Energy Use from Project Operations (MMBtu)
BART to Livermore Extension Project
Livermore, California

Energy Source		Scenario ¹	Year	Energy Use (MMBtu)				
				Conventional BART	DMU Alternative	EMU Alternative	Express Bus/BRT Alternative	Enhanced Bus Alternative
Gasoline	Passenger Vehicles	Project	2025	-143,343	-107,096	-107,096	-50,055	-284
			2040	-204,310	-118,387	-118,387	-79,172	-7,540
		Cumulative	2025	-122,352	-81,913	-81,913	-73,112	-32,625
			2040	-228,183	-138,269	-138,269	-96,080	-24,467
	Total	Project	2025	-143,343	-107,096	-107,096	-50,055	-284
			2040	-204,310	-118,387	-118,387	-79,172	-7,540
		Cumulative	2025	-122,352	-81,913	-81,913	-73,112	-32,625
			2040	-228,183	-138,269	-138,269	-96,080	-24,467
Total	Project	2025	-73,163	-34,179	-62,524	-28,817	18,031	
		2040	-130,788	-35,011	-66,538	-56,803	8,173	
	Cumulative	2025	-51,660	-8,380	-36,726	-52,437	-15,101	
		2040	-155,910	-55,933	-87,460	-74,596	-9,639	

Notes

¹ Energy use from Table E-2a was converted to units of MMBtu based on energy content to allow for the comparison of total energy use across Alternatives. Conversion factors from fuel or electricity to BTU are from the U.S. Department of Energy "Fuel Properties Comparison" (2014). Conversion factors of 3,414 Btu/kWh of electricity, 124,240 BTU/gal of gasoline, and 138,490 BTU/gal of diesel were used for this purpose.

Abbreviations

BART: Bay Area Rapid Transit	gal - gallon
BRT: Bus Rapid Transit	EMU: Electric Multiple Unit
Btu - British thermal units	kWh - kilowatt-hour
DMU: Diesel Multiple Unit	MMBtu: million British thermal units
DOE: United States Department of Energy	yr: year

References:

DOE. 2014. Fuel Properties Comparison. Available online at: http://www.afdc.energy.gov/fuels/fuel_comparison_chart.pdf. Accessed October 2016.

Table GHG-1
One-Time GHG Emissions from Project Construction
BART to Livermore Extension Project
Livermore, California

Emissions Type	GHG Emissions (MT CO ₂ e)			
	BART	DMU/EMU	Express Bus/BRT	Enhanced Bus
Off-Road Vehicles	5,337	2,867	706	92
On-Road Vehicles	5,682	6,591	2,118	189
Total One-Time GHG Emissions	11,019	9,458	2,824	281

Notes:

- ¹ Total construction GHG emissions include contributions from off-road equipment activity and on-road traffic. Off-road construction emissions were calculated based on Project-specific equipment list and usage hours and CalEEMod® (version 2013.2.2) default equipment factors (see AQ Technical Appendix Tables 2 and 3). On-road construction emissions calculated based on the total trips and vehicle miles and the EMFAC2014-based emission factors (see AQ Technical Appendix Tables 3 through 6).
- ² Enhanced bus improvements are included for all alternatives. The bus improvements were conservatively approximated by scaling BART emissions, excluding the Maintenance Facility/Yard, by the relative construction durations (i.e., total BART construction emissions*2 months/48 months). For each alternative, the total emissions is equal to the original scenario-specific emissions, plus the additional approximate emissions from bus improvements.
- ³ Global warming potentials are based on Intergovernmental Panel on Climate Change (IPCC) Fourth Assessment Report.

Abbreviations:

BART: Bay Area Rapid Transit	EMU: Electric Multiple Unit
BRT: Bus Rapid Transit	GHG: greenhouse gas
CO ₂ e: Carbon Dioxide Equivalent	MT: metric ton
DMU: Diesel Multiple Unit	

**Table GHG-2
 Annual Greenhouse Gas Emissions from Project Operations
 BART to Livermore Extension Project
 Livermore, California**

Alternative	Emission Source	Scenario ¹	CO ₂ e (MT/yr) ²		
			2025	2040	
Conventional BART	Passenger Vehicles	Project	-9,616	-13,669	
		Cumulative	-8,232	-15,275	
	Buses	Project and Cumulative	1,251	1,103	
	BART Traction		576	709	
	Station Electricity		126	126	
	BART Car Maintenance		87	107	
	Waste		447	447	
	Emergency Generator (Isabel Station)		42	42	
	Emergency Generator (Maintenance Facility)		18	18	
	Maintenance Facility Shuttle Vans		5	5	
	Off-Road Maintenance Trucks		5	5	
	Electric Forklifts		4	4	
	Water and Wastewater		9	9	
	Solar PV		-69	-59	
	Total		Project	-7,114	-11,154
	Cumulative		-5,730	-12,760	
DMU/EMU Scenario	Passenger Vehicles	Project	-7,191	-7,922	
		Cumulative	-5,521	-9,255	
	BART Traction (to Dublin/Pleasanton)	Project and Cumulative	111	229	
	DMU Engine Exhaust and Idling Electricity Use		2,404	2,675	
	Buses		1,251	1,103	
	EMU Traction		171	190	
	Station Electricity		126	126	
	BART Car Maintenance		17	35	
	DMU/EMU Car Maintenance		23	26	
	Waste		231	231	
	Emergency Generator (Isabel Station)		42	42	
	Emergency Generator (Maintenance Facility)		18	18	
	Off-Road Maintenance Trucks		5	5	
	Electric Forklifts		4	4	
	Water and Wastewater		7	7	
	Solar PV		-69	-59	
	Total DMU		Project	-3,020	-3,482
			Cumulative	-1,350	-4,814
	Total EMU		Project	-5,254	-5,967
	Cumulative	-3,584	-7,300		

Table GHG-2
Annual Greenhouse Gas Emissions from Project Operations
BART to Livermore Extension Project
Livermore, California

Alternative	Emission Source	Scenario ¹	CO ₂ e (MT/yr) ²	
			2025	2040
Express Bus/BRT Scenario	Passenger Vehicles	Project	-3,355	-5,302
		Cumulative	-4,901	-6,425
	Buses	Project and Cumulative	1,528	1,347
	BART Traction (to Dublin/Pleasanton)		22	95
	BART Car Maintenance		3	14
	Waste		103	103
	Water and Wastewater		3	3
	Total	Project	-1,695	-3,739
	Cumulative	-3,241	-4,862	
Enhanced Bus Scenario	Passenger Vehicles	Project	-24	-614
		Cumulative	-2,187	-1,634
	Buses	Project and Cumulative	1,369	1,207
	Waste		52	52
	Water and Wastewater		1	1
	Total	Project	1,399	646
	Cumulative	-764	-374	

Notes

- ¹ Project and cumulative scenarios for each alternative only differ in the level of on-road passenger traffic.
- ² The CO₂e emission factor for electricity (97 lb/MWh) was based on BART 2017 electricity portfolio projections, which is assumed to serve as a conservative assumption of electricity intensity for Project years 2025 and 2040. This factor was used in all cases except water treatment electricity, which is presumed to use grid electricity. The grid electricity emission factor (293 lb/MWh) is based on PG&E CO₂ projections for 2020 and CalEEMod® (version 2013.2.2) defaults for CH₄ and N₂O. Global warming potentials from the Intergovernmental Panel on Climate Change (IPCC) Second Assessment Report was used in the development of the BART emissions factor, while all other GHG emissions are calculated using the global warming potentials from the Fourth Assessment Report.

Abbreviations

- | | |
|--|---|
| BART: Bay Area Rapid Transit | IPCC: Intergovernmental Panel on Climate Change |
| BRT: Bus Rapid Transit | lb - pound |
| CH ₄ : methane | MT - metric tons |
| CO ₂ : carbon dioxide | MWh - megawatt-hours |
| CO ₂ e: carbon dioxide equivalent | N ₂ O: nitrous oxide |
| DMU: Diesel Multiple Unit | PV - photovoltaic |
| EMU: Electric Multiple Unit | yr: year |
| GHG: greenhouse gas | |