Train Control Modenization Program

Phase 5b South Alameda Corridor

TCMP South Alameda

Submitted By:

San Francisco
Bay Area Rapid Transit District

FY 2022 National Infrastructure Investments
DTOS59-22-RA-RAISE

Application Date:
April 14, 2022

SAN FRANCISCO BAY AREA RAPID TRANSIT DISTRICT
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April 14, 2022

Honorable Pete Buttigieg
Secretary of Transportation
U.S. Department of Transportation
1200 New Jersey Avenue, SE
Washington, DC 20590

RE: RAISE 2022 – Train Control Modernization Program Phase 5b

Dear Secretary Buttigieg,

The San Francisco Bay Area Rapid Transit District (BART) requests your consideration of our Train Control Modernization Program Phase 5b (TCMP South Alameda) project for a $25 million grant award through the Rebuilding American Infrastructure with Sustainability and Equity (RAISE) discretionary grant program.

The TCMP South Alameda Project will replace the existing train control system with a new, best in class communications-based train control (CBTC) system, allowing BART to achieve:

- Shorter headways and additional capacity
- Improved system reliability
- Increased train frequency
- Reduced greenhouse gas emissions
- Continued focus on system safety
- Increased access to jobs, thus stimulating the economy
- Improved mobility for all users, including those in disadvantaged communities

This specific CBTC system is a proven technology, having been implemented in rail systems around the world, including New York, London, Paris, and other locations.

The TCMP South Alameda Project will reduce congestion along the Interstate 880 (I-880) corridor, which is the fifth most congested freeway corridor in the Bay Area. The TCMP South Alameda corridor runs parallel to I-880 and encompasses five BART stations from the southern edge of the Bay Fair station to Warm Springs/South Fremont, including Hayward, South Hayward, Union City, and Fremont.

As the Bay Area's transit backbone, BART carries more than 50% of the Bay Area's and 25% of the State of California's passenger miles traveled on transit. More than half of BART riders live in households earning less than $50,000 and 50% of riders do not have a vehicle. The TCMP South Alameda Project will increase BART's capacity to serve low income and transit-dependent riders, enabling them to access jobs, services and amenities. The project will also support workforce development goals by creating hundreds of good-paying, local trade and union jobs.

While the TCMP South Alameda Project will ultimately be implemented throughout the BART system with 10 phases of project delivery, 2022 RAISE funds would specifically be used to fully fund the TCMP Project implementation through South Alameda County. Further, an award for this project will leverage $102.6 million of non-federal funds, including $52.6 million of BART operating funds allocated to this project and $50 million of State Transit and Intercity Rail Capital Program funds.

Thank you for your consideration. We look forward to partnering with U.S. Department of Transportation to ensure successful implementation of this innovative and critical project.

Sincerely,

Robert M. Powers
General Manager

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1. PROJECT DESCRIPTION

1.1. Project Overview

The San Francisco Bay Area Rapid Transit District (BART) is submitting this application to the United States Department of Transportation (USDOT) for the Rebuilding American Infrastructure with Sustainability and Equity (RAISE) 2022 grant cycle for BART's Train Control Modernization Program (TCMP) Phase 5b implementation in southern Alameda County (*TCMP South Alameda*).

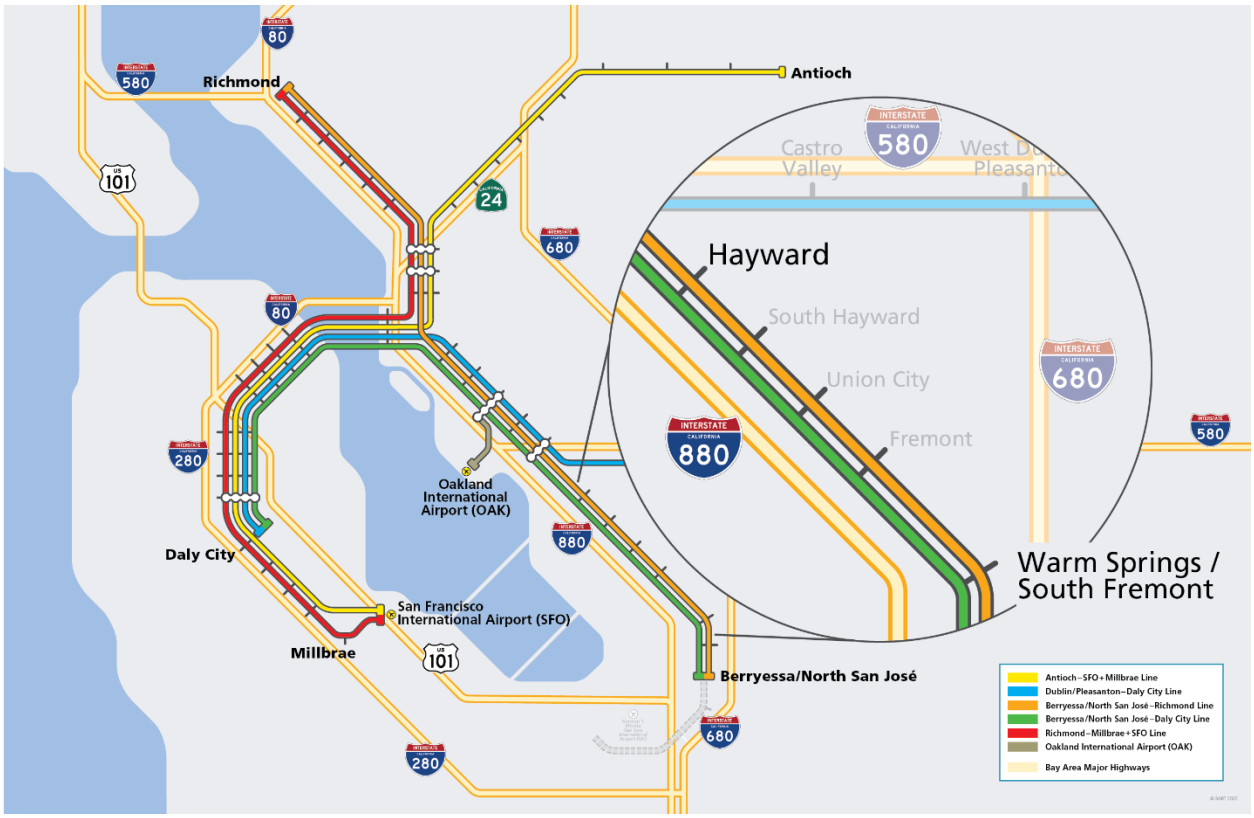
This grant application is for $25 million in 2022 RAISE funds to fully fund BART's *TCMP South Alameda* project. The TCMP will replace the existing train control system with a new communications-based train control (CBTC) system-wide, allowing BART to achieve the shorter headways needed to operate an increased number of regularly scheduled trains per hour on the trunk line between downtown Oakland and southern Fremont. The new CBTC system is a moving block signaling system installed throughout the BART system, within or adjacent to the existing BART trackway and wayside facilities. Existing signaling equipment will be overlaid with the most current electronics, software, computer systems, and cabling.

The cost for BART's systemwide TCMP is approximately $1.6 billion. Matching funds will be provided by a variety of sources, including BART's Measure RR (a $3.5 billion general obligation measure passed by voters in November 2016), BART's capital allocations (operating funds transferred to support BART's capital program), a Federal Transit Administration (FTA) Capital Investment Grant (CIG), and other state grant funds. The current request of $25 million in RAISE funds will fully fund the *TCMP South Alameda* project and enable the benefits presented in this application. The scope that these funds will be applied to are outside the scope of the FTA CIG project eligibility.

TCMP South Alameda

While the TCMP will be implemented throughout the BART system with ten phases of project delivery, 2022 RAISE funds will be used specifically to fully fund Phase 5b implementation in southern Alameda County, referred to as *TCMP South Alameda*. Figure 1-1 shows the BART system with the specific *TCMP South Alameda* corridor identified, along with the major adjacent highways. The *TCMP South Alameda* corridor encompasses five operating BART stations: Hayward, South Hayward, Union City, Fremont, and Warm Springs/South Fremont.

Figure 1-1. BART System Map with TCMP South Alameda Corridor Segment



BART will install CBTC on other segments of the BART system following completion of *TCMP South Alameda*, but the improved capacity in southern Alameda County does not depend on the remaining TCMP segments to be completed.

1.2. Project Background

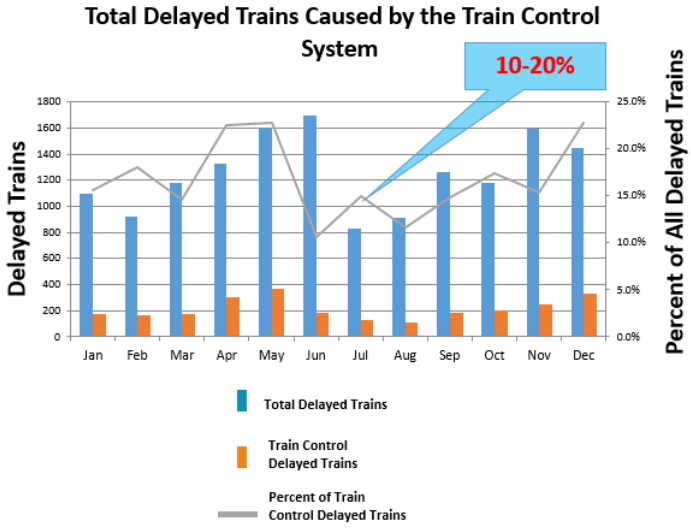
BART's Core Capacity Program (CCP) is a comprehensive program of projects that will increase capacity, relieve congestion and crowding, increase transit ridership, and decrease greenhouse gas (GHG) emissions and vehicle miles traveled (VMT) by increasing the frequency and capacity of trains operating on the entire BART system. The CCP will allow the number of trains operating through the Transbay Corridor to increase from 23 up to 30 per hour, and peak hour train lengths to be increased from an average of 8.9 cars to ten, maximizing throughput capacity in the most heavily used and most congested travel corridor in the San Francisco Bay Area. BART's CCP has four major project components:

1. Train Control Modernization Program (TCMP)
2. New rail cars
3. Additional vehicle storage at BART's Hayward Maintenance Complex (HMC)
4. Six new traction power substations

The systemwide TCMP is key to expanding capacity as well as enhancing system reliability and safety. In 2017, between ten and 20 percent of all delayed trains were caused by problems with the existing train control system, which is over 49 years old (See Figure 1-2). BART is proposing to completely replace its

aging and obsolete equipment with a communications-based system that will allow trains to safely run closer together, thereby increasing system capacity. This new system is a fully tested and operational system that is used all over the world, including New York, London, Paris, Hong Kong, and Denmark.

Figure 1-2. Total Delayed Trains Caused by the Train Control System, 2017



The four program elements of the CCP will allow BART to decrease headways on each of the five BART lines from 15 to 12 minutes, thus increasing frequency by up to 25 percent. Within TCMP South Alameda, between the Warm Springs/South Fremont Station and just south of Bay Fair Station, the average combined headways of two lines of service will be reduced from 7.5 to six minutes between successive trains. Between Bay Fair and Coliseum Stations, average combined headways will be reduced from five to four minutes between trains.

Expansion of the rail car fleet will allow for BART to put additional ten-car trains into operation, creating additional capacity in the system. Decreased headways and increased capacity is expected to result in an estimated increased average weekday ridership of 202,972 BART riders beyond current levels (starting in 2027) and will decrease GHG emissions by at least 3.3 million metric tons of carbon dioxide equivalent ($MTCO_2e$) over a 20-year period.[1]

1.3. Transportation Challenges and Project Need

Ranked by population, the Bay Area is the fourth largest metropolitan area in the United States.[2] The nine-county region is home to more than 7.8 million people and 3.9 million jobs. Some 300,000 jobs are in San Francisco's central business district alone, the fourth largest central business district in the country.[3] The Bay Area's economy is healthy and growing, driven in part by the technology sector that is vital to growing the nation's overall economy. Downtown San Francisco has several large construction projects ongoing that will increase office space and enable the city to add more jobs. By 2050, the region expects over ten million residents and five million jobs to be located here.[4]

This rapid growth is reflected in the increased levels of congestion on Bay Area freeways. In September 2017, the Metropolitan Transportation Commission (MTC) released its yearly analysis of Bay Area freeway congestion. The analysis showed that congestion-related delays during weekday commute periods climbed nine percent, from 3.2 minutes per commuter in 2015 to a record average of 3.5 minutes in 2016. MTC defines "congested delay" as the time spent in traffic moving at speeds of less than 35mph. The top two most congested freeway segments in the Bay Area feed into the highly congested Transbay Corridor

[1] Ridership projections are included in Appendix D and GHG projects are included in the benefit-cost analysis.
[2] http://www.vitalsigns.mtc.ca.gov/population
[3] http://www.vitalsigns.mtc.ca.gov
[4] Plan Bay Area 2050, Plan Bay Area 2050 Final Plan

across the Bay Bridge. Topping the list is afternoon peak period travel northbound and eastbound on US Highway 101 (US-101) and Interstate 80 (I-80) from the Interstate 280 (I-280) interchange in San Francisco to the Bay Bridge's Yerba Buena Island Tunnel. Number two on the list is westbound I-80 from State Route 4 (SR4) in Hercules to Fremont Street in San Francisco. Congested conditions on this segment span most of the day from 5:25am to 6:55pm.

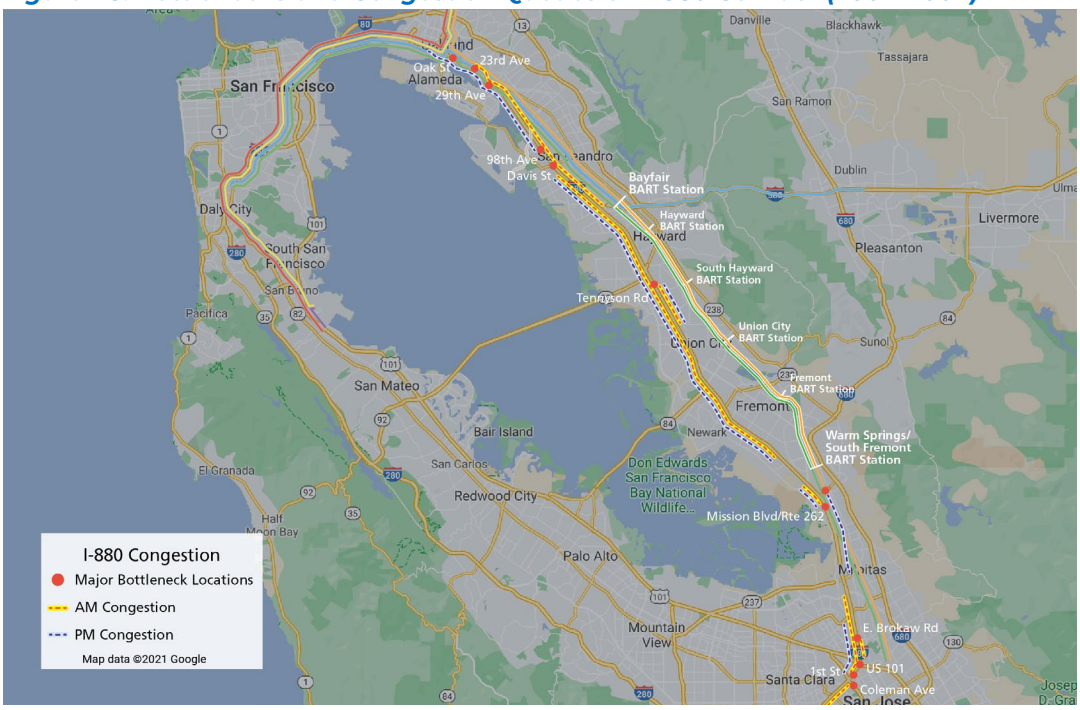
Current I-880 Corridor Congestion

As the Bay Area's second largest transit network, BART currently operates and maintains 50 stations and 131 miles of revenue track, serving over 440,000 passengers every weekday in the counties of Alameda, Contra Costa, San Francisco, San Mateo, and Santa Clara.[5] The Interstate 880 (I-880) corridor runs parallel to BART's Alameda County tracks.

I-880 is the fifth most congested freeway corridor in the Bay Area. I-880 connects the San Francisco-Oakland Bay Bridge with Silicon Valley, serving the Port of Oakland, Oakland International Airport, San Jose's Mineta International Airport, and about ten East and South Bay Area cities along the way. Most congestion in the corridor is attributed to heavy commuter and truck traffic during weekdays. I-880 is also a critical link for the international movement of goods between the Central Valley and Port of Oakland north of the Interstate 238 (I-238)/Interstate 580 (I-580) corridor interchange. The I-880 corridor carries the greatest volume of truck traffic in the region, which is among the greatest of any highway in California. The corridor is also a major commuter facility carrying motorists to and from the East Bay and Silicon Valley. To the south, the route passes through San Jose, the high-tech capital of the world. I-880 is a true urban freeway with major traffic generators corridor-wide, including retail venues and commercial, industrial, and residential centers. See Figure 1-3 for bottlenecks and congestion on the I-880 corridor, parallel to the BART system. The TCMP South Alameda Project segment is highlighted for reference.

[5] https://www.bart.gov/sites/default/files/docs/Role%20of%20BART%20in%20Region%20-%20Final%20Web%20Oct%202016_1.pdf

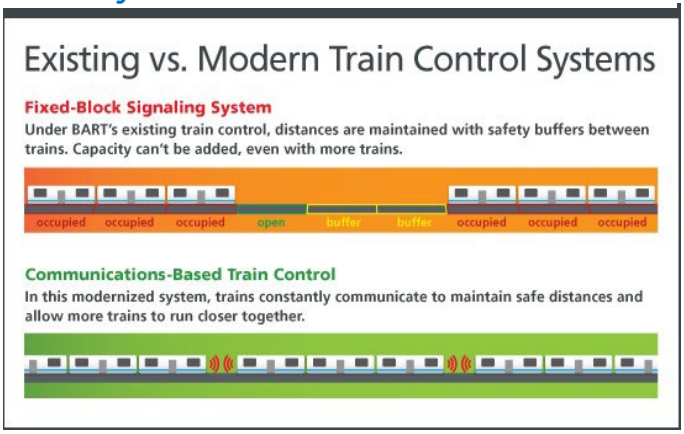
Figure 1-3. Bottlenecks and Congestion Queues on I-880 Corridor (2004-2007)



1.4. Project Scope

BART's CCP enhancements support capacity increases of greater than ten percent through fleet expansion, maintenance yard expansion, CBTC, and traction power upgrades. The Core Capacity investments will increase transit frequency by 25 percent during peak periods once BART has fully recovered from the impacts of COVID-19. BART's systemwide TCMP will replace the existing train control systems with a new CBTC system, allowing BART to achieve the shorter headways needed to provide an attractive alternative to the use of congested highways by operating more regularly scheduled trains per hour in southern Alameda County. Increased capacity to BART's southern Almeda County corridor is important to provide additional BART service to meet the demand of residents connecting to job centers in Downtown San Francisco, Downtown Oakland, and Silicon Valley. The *TCMP South Alameda* project corridor encompasses stations that are not part of BART's FTA CIG CCP. BART, regional, and state funds are covering CIG-ineligible costs.

Figure 1-4. Comparison of Existing vs. Modern Train Control Systems



The new CBTC system will be a moving block signaling approach, installed within BART right-of-way and adjacent to the existing BART trackway and wayside facilities. Existing signaling equipment will be overlaid with the most current electronics, software, computer systems, and cabling. New zone controllers, interlocking controllers, and wayside radio transponder tags will be installed throughout the trackside alignment, train control rooms, and central control facilities. BART D-Cars will be outfitted with processor-based controllers, transponders, communication equipment, and location sensors. See Appendix D for detailed scope of work.

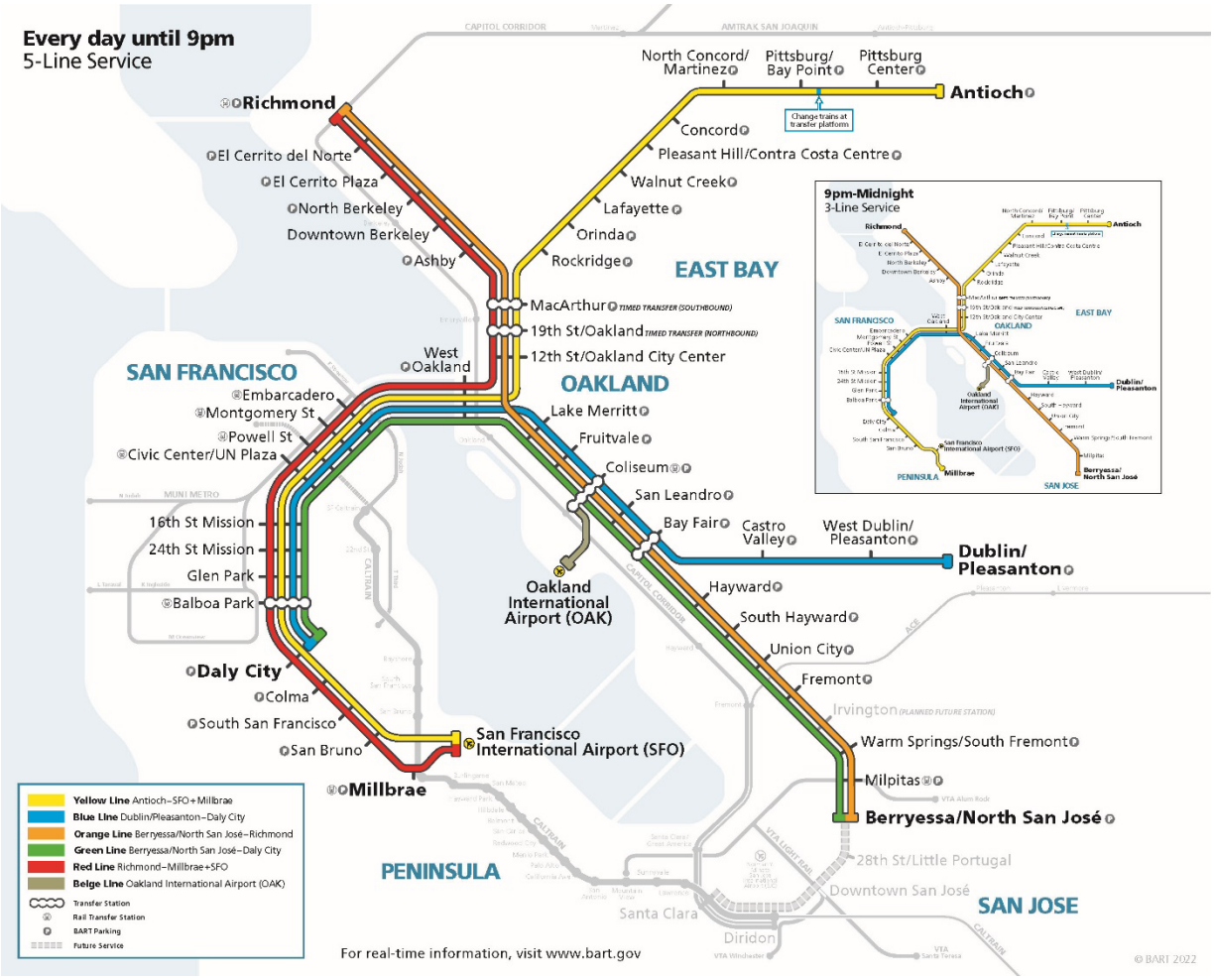
As part of the overall TCMP, BART will install new surface mounted train control raceways and associated cables to new Switch Power Supply Cabinets (SPSC) and associated interlock switches in 26 locations. This also includes installation of new conduit, power cable, and new breakers between Station House Power and Train Control rooms in 38 locations. Specifically, within *TCMP South Alameda*, BART will install at least one surface mounted train control raceway and associated cables to new SPSCs and associated interlock switches in six locations.

Installation activities for the CBTC system will take place within existing BART right-of-way and will include trenching for new cabling, concrete pads for electronic equipment and antenna along the trackway, as well as new racks, servers, computers, communication equipment, and cable trays within the wayside train control rooms, houses and central control facilities.

2. PROJECT LOCATION

This RAISE project will add much needed capacity and congestion relief to southern Alameda County and is a critical component of the full TCMP implementation for the entire Bay Area. The proceeds from RAISE funding will be used to complete *TCMP South Alameda*, which includes five operating BART stations from the Hayward BART Station to Warm Springs/South Fremont Station, including South Hayward, Union City, and Fremont (see Figure 1-1). The *TCMP South Alameda* project is entirely with the San Francisco--Oakland, CA census-designated urbanized area. The highly congested I-880 corridor, which carries car, truck, and transit traffic, and the BART system run in parallel through southern Alameda County to Santa Clara County. This corridor is used to connect to job centers in the north (San Francisco and Oakland) and south (Silicon Valley). Increasing capacity for the *TCMP South Alameda* corridor is vital for people to access the Bay Area's job centers.

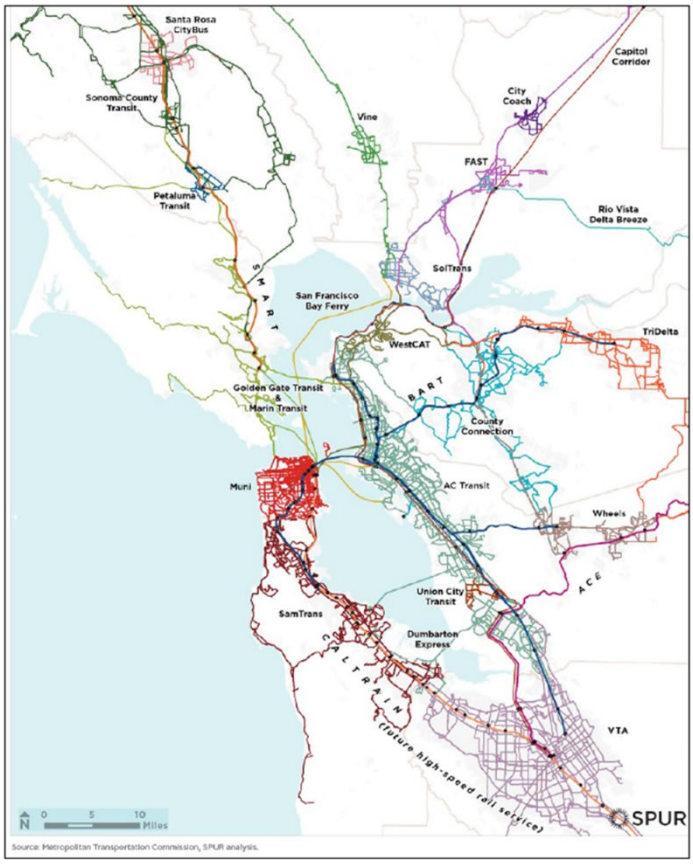
Figure 2-1. BART System Map with Connecting Transit Systems



2.1. Access to Transit Choices

BART provides the backbone transit system throughout the core of the Bay Area as shown in Figure 2-1 and Figure 2-2. Every BART station provides local bus connections with some BART stations providing major intermodal transit connections to a substantial number of other transit services such as Caltrain, Union City Transit, Livermore Amador Valley Transit Authority (LAVTA) Wheels, San Francisco Muni light rail and bus, AC Transit, SamTrans, Golden Gate Transit (bus and ferry), Altamont Corridor Express (ACE) commuter rail, San Francisco Bay Ferries, Santa Clara Valley Transportation Authority (VTA) light rail and bus, and bus services to and from Solano and Napa counties.

Figure 2-2. BART Connections in Bay Area



Capitol Corridor, which provides passenger rail service from the Sacramento Valley to San Jose, connects with BART at both the Richmond and Coliseum stations. In 2017, over 160,000 riders transferred between systems at these two stations. The Richmond BART station also provides connections to Amtrak's San Joaquins and California Zephyr services. In addition, BART provides direct service to both the San Francisco and the Oakland International Airports. Over 125 privately- and publicly-funded shuttle services – from medical, university, senior, employment, and high-tech services – provide rides to and from BART stations throughout the system, and many BART riders increasingly rely on Transportation Network Companies (TNCs) such as Uber and Lyft for "last mile" trips.

MTC manages the Clipper® fare payment system on behalf of transit systems throughout the Bay Area. BART and 22 other Bay Area transit systems use the regional the Clipper® fare payment system, facilitating transfers between systems. From August 2018 to August 2019, a monthly average of nearly 30 percent of all BART's riders transferred to another Bay Area operator from BART. Looking at Clipper® usage data from this period, BART can identify riders that used Clipper® on more than one transit system in a regular month. Of the 23 transit operators that were using Clipper® at that time, all services that connect with BART have riders that use Clipper® on both systems. For the major transit operators that connect to BART, 29 percent of AC Transit riders, 20 percent of Muni riders, 12 percent of Caltrain riders, and 22 percent of SamTrans riders transferred to BART in a regular month.

Transit agencies that are either currently connected to the BART system, or have plans for integration, will benefit from growth in BART capacity. As CBTC is implemented, BART will be able to provide its passengers with improved access and connections to destinations throughout the Bay Area.

2.2. Communities in the Corridor

The greatest percentage of BART customers on both weekdays and weekends comes from Alameda County. About 43 percent of weekday and weekend customers were from Alameda County based on BART's 2020 Customer Satisfaction Survey. Alameda County's share of ridership was nearly double that of Contra Costa County, the second greatest contributor of BART customers at 26 percent. Residents of Alameda County stand to gain significant benefits from decreased GHG emissions and decreased travel time due to the reliability and increased service levels brought upon by the implementation of *TCMP South Alameda*.

There are several communities within the southern Alameda / I-880 corridor that will specifically benefit from CBTC implementation along the identified corridor. As shown in Figure 1-3, some of the worst congestion in the region runs along I-880 in the morning and evening, resulting in considerable release of single occupancy vehicle emissions into the surrounding communities. Because of the capacity increase provided by this project, these communities, including Areas of Persistent Poverty, MTC Equity Priority Communities (formerly Communities of Concern), and federally designated community development zones will benefit from better air quality and increased transportation options. Figure 2-3 shows the number of Areas of Persistent Poverty, Figure 2-4 shows the Equity Priority Communities, and Figure 2-5 shows federally-designated community development zones (Opportunity Zones) along the *TCMP South Alameda* corridor.

Figure 2-3. Areas of Persistent Poverty: South Alameda, One-Mile Corridor

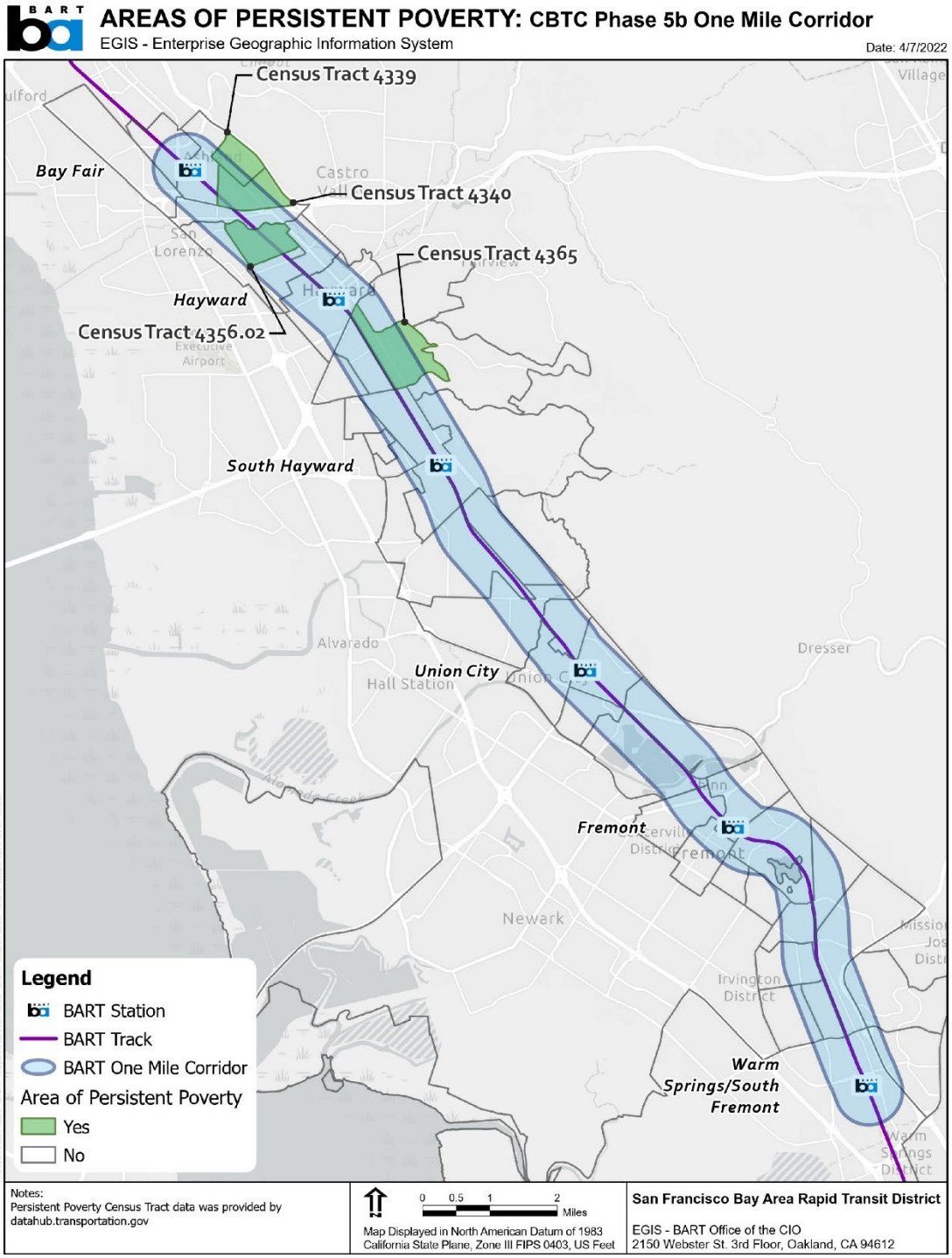


Figure 2-4. MTC Equity Priority Communities: South Alameda, One-Mile Corridor

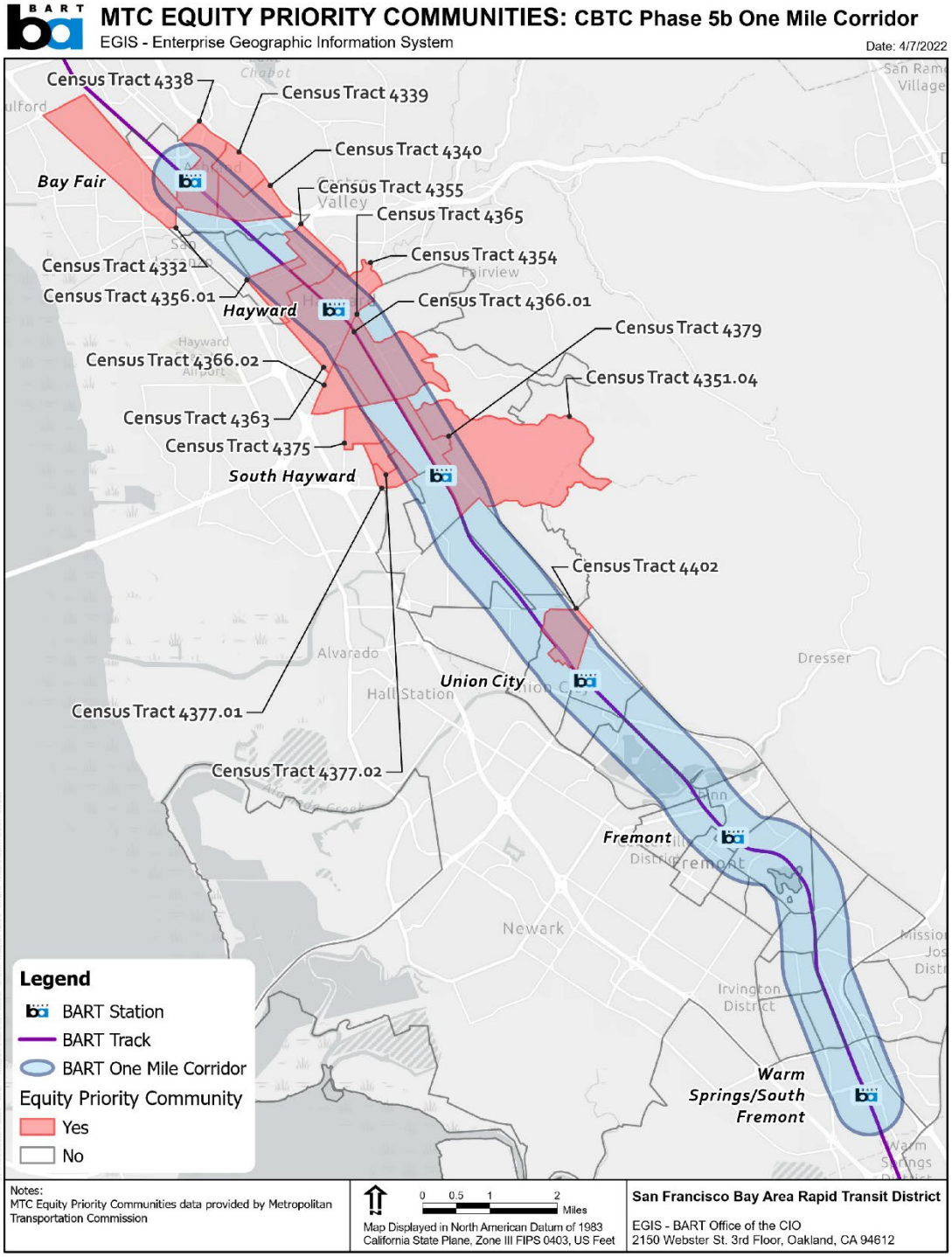
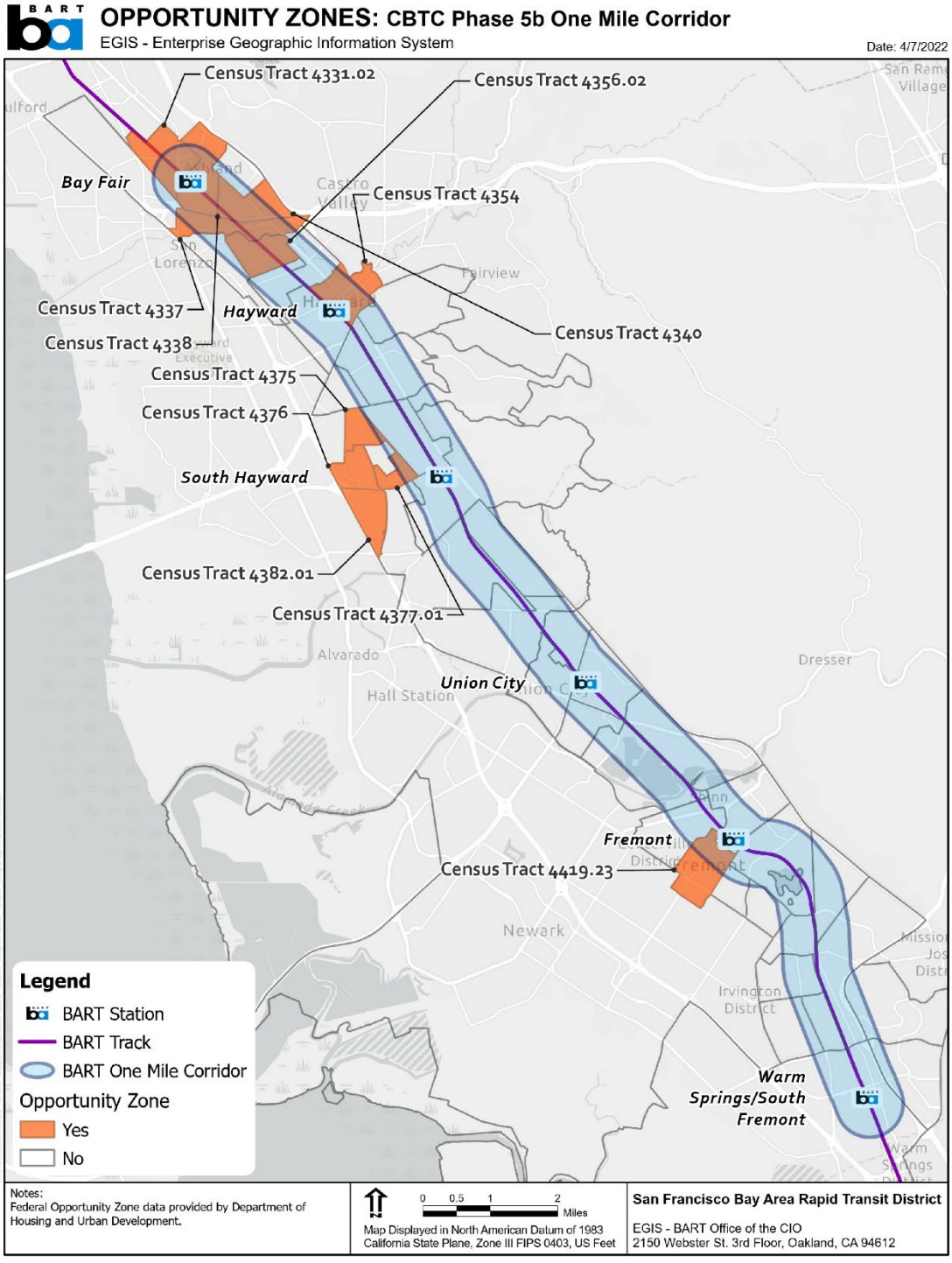


Figure 2-5. Federally Designated Opportunity Zones: South Alameda, One-Mile Corridor

Federally Designated Opportunity Zones: South Alameda, One-Mile Corridor



3. GRANT FUNDS, SOURCES AND USES OF PROJECT FUNDING

3.1. Sources and Uses of Funds

The project will be funded from a blend of local and federal sources, as shown in Table 3-1. All federal funds, including potential RAISE grant funds, will be used for construction capital costs for the project.

Non-federal fund sources include approximately $62.2 million of BART Operating to Capital Allocations (Capital Allocations) and $50 million of State Transit and Intercity Rail Capital Program (TIRCP) Funds. The BART Capital Allocations are part of a larger commitment of over $250 million to the CCP, of which this project is a component. The BART Board committed these funds via Board Resolution 5405 on June 13, 2019. The State TIRCP Funds are a portion of a larger $318 million grant award from the state of California for the overall TCMP project. These funds were awarded in 2018 and allocated by the California Transportation Commission (CTC) on May 13, 2021. Of the approximate $112.2 million non-federal sources for this project, $102.6 million will be used for construction capital, while $9.5 million will be reserved for contingency.

Table 3-1. Project Budget Summary by Source and Use ($1,000s)

	RAISE Funds	Non-Federal Funds		Total Non-Federal	Total (RAISE funds + Total Non-Federal)
		BART Capital Allocations	State TIRCP Funds		
Construction	**$25.0**	$52.6	$50.0	**$102.6**	**$127.6**
Contingency	-	$9.5		**$9.5**	**$9.5**
Total	**$25.0**	**$62.2**	**$50.0**	**$112.2**	**$137.2**

TCMP South Alameda has an estimated total cost of $137.2 million, including $127.6 million for construction and $9.5 million for contingency. The estimated project expenditures over time are included in Table 3-2 and demonstrate that all project costs are anticipated to be incurred after award and obligation of the RAISE grant, should an award be made.

Table 3-2. TCMP South Alameda Project Expenditures by Fiscal Year ($1,000s)

	2022 & Before	2023	2024	2025	2026	2027	2028	2029	2030	Total
Cashflow	$0	$2.7	$10.0	$42.5	$10.7	$7.0	$6.0	$.3	$0	**$78.9**
SCC 50 Other & SCC 80 Costs	$0	$1.7	$6.2	$26.3	$6.6	$4.4	$3.7	$.2	$0	**$48.8**
Subtotal[1]	$0	$4.4	$16.2	$68.7	$17.2	$11.3	$9.6	$.4	$0	**$127.7**
Estimated Contingency Drawdown	$0	$.4	$1.3	$5.2	$1.3	$.9	$.8	$.1	$0	**$9.6**
Total	**$0**	**$4.7**	**$17.4**	**$73.9**	**$18.5**	**$12.2**	**$10.4**	**$.4**	**$0**	**$137.2**

1: Subtotal of hard and soft costs.

4. MERIT CRITERIA

Implementing *TCMP South Alameda* will provide safety, accessibility, economic, air quality, and quality of life benefits in Alameda County and throughout the Bay Area region.

4.1. Safety

BART's existing train control system, which was installed more than 49 years ago and as shown in Figure 4-1, is reaching the end of its useful life. Many systems worldwide, such as the London Underground, the Paris Metro, portions of the New York City subway, and others, have now converted to CBTC and BART will be following this path using fully tested and certified technology. Modernizing the train control system will improve the reliability and safety of the BART system. Trains will be tracked continuously through a moving block technology rather than the "legacy" fixed block technology it is replacing.

Figure 4-1. Photo of Existing Train Control System

Reduction in Potential Safety Incidents along BART System

Due to the newer train control technology, the need for manual moves is reduced, which reduces potential for incidents. Trains will also run more efficiently and carry more passengers by safely operating under shorter headways and controlled speeds throughout the system. This approach falls in line with the Safe Systems approach to help eliminate human error and eliminate death and serious injury.

Implementation of the overall TCMP will also improve safety on BART platforms. During evening peak periods, the platforms at stations in downtown San Francisco and Oakland often become extremely crowded, particularly when there is a service disruption. Extreme crowding on the platforms can lead to unsafe conditions when people are too close to the platform edge. The TCMP will enable more frequent trains, which will help to relieve crowding and improve safety on all BART platforms, including in the project corridor.

Reduction in Safety Incidents in along Adjacent Highway Corridors

In 2018 alone, 747 traffic crashes resulting in fatalities, injuries, or property damage were reported in Alameda County. It is estimated that the implementation of *TCMP South Alameda* will lead to a reduction of 152.2 million VMTs by 2048. This reduction in VMT is due to increased ridership (discussed in the section on Economic Competitiveness and Opportunity), which will decrease the number of cars on I-880, thus reducing the number and frequency of vehicle crashes. Table 4-1 details the reduction in safety incidents over the 20-year analysis, discussed further in the benefit-cost analysis (BCA) completed for this application.

Table 4-1. Safety Incidents Reduction from Project Implementation

Incident Category	No Build	Build	Change
Fatalities	210	207	(3)
Injuries	14,672	14,509	(163)
Property Damage Only (PDO)	16,432	16,250	(182)

The BCA completed as part of this application shows that this reduction in safety incidents will yield an itemized benefit of $47.9 million in 2020 undiscounted dollars, and $14.5 million in 2020 dollars at a seven percent discounted rate, over the 20-year analysis.[6]

Comparative Safety

Compared to roadway conditions, BART is a significantly safer travel option. A 2013 Northwestern University study found that rail travel is about 17 times safer than traveling in a car, in terms of number of fatalities per billion-passenger mile. In 2019, BART experienced only 1.59 station incidents per million riders and 0.47 vehicle incidents per million riders.[7] Station incidents and vehicle incidents are all incidents that meet the FTA criteria as "reportable" (mostly injuries and illnesses) and occur either in BART station areas or on BART train cars.

4.2. Environmental Sustainability

Air Quality and Greenhouse Gas Reductions

Included in the BCA conducted as part of this application, a GHG analysis was conducted in conjunction with the ridership analysis discussed in the section on Economic Competitiveness and Opportunity.

The substantial GHG reductions resulting from the increased ridership that will be induced by the additional capacity made possible by implementation of *TCMP South Alameda* are shown in Table 4-2. Throughout its lifecycle, the project is expected to reduce an amount of traffic-related emissions valued at $4.0 million (2020 dollars), equal to $2.2 million (2020 dollars) at seven percent discount.

Table 4-2. GHG Reduction BCA Model Results

Emission Reductions	Total over 20 Years (tons)	Average Annual (tons)	Value over 20 years ($ million)	Value over 20 years (discounted $ million)
CO_2 Emissions Saved	50,507	2,525	3.64	2.07
NO_X Emissions Saved	5	0.25	0.09	0.03
$PM_{2.5}$ Emissions Saved	0.3	0.014	0.25	0.09
SO_X Emissions Saved	0.3	0.013	0.01	0.00
Total	-	-	**4.00**	**2.20**

[6] Seven percent discount rate is required by USDOT to compare future investment to today's.
[7] https://www.bart.gov/sites/default/files/docs/QPRFY2019Q4.pdf

Based on the total GHG reductions over 20 years, the following equivalencies are shown for the emissions reductions from implementation of *TCMP South Alameda* :[8]

- Over 5 million gallons of gasoline
- Over 50 million pounds of coal
- Over 6 thousand homes' energy use for one year
- Over 116 thousand barrels of oil

Additionally, GHG reductions from *TCMP South Alameda* implementation is equivalent to carbon sequestered by:

- Over 800 thousand seedlings grown for ten years
- Almost 60 thousand acres of U.S. forests in one year

BART's Commitment to Environmental Justice

BART, as a recipient of federal funds, is required by the FTA to comply with Title VI of the Civil Rights Act of 1964 and its amendments (Act). Title VI of the Civil Rights Act of 1964 requires that no person in the United States, on the grounds of race, color, or national original be excluded from, be denied the benefits of, or be subjected to discrimination, under any program or activity receiving federal financial assistance. Presidential Executive Order 12898 "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations" addresses environmental justice in minority and low-income populations. Presidential Executive Order 13166 "Improving Access to Services for Persons with Limited English Proficiency" addresses services to those individuals with Limited English Proficiency (LEP).

FTA Circular 4702.1B, dated October 1, 2012, titled *Title VI Requirements and Guidelines for Federal Transit Administration Recipients* (Title VI Circular) and FTA Circular 4703.1, dated August 15, 2012, titled *Environmental Justice Policy Guidance for Federal Transit Administration Recipients* (EJ Circular), require that federal funding recipients such as BART review its transportation decisions to ensure equity in the transportation decision making process and to ensure that decisions are not made on the basis of race, color, national origin, or socioeconomic status.

The existing BART system covers large portions of the Bay Area and bisects several communities, including those with designated minority and low-income populations. The TCMP equipment in operation will not make any noise, and it will be largely invisible to the public. The TCMP equipment will be installed entirely in existing transportation rights-of-way and existing structures. No impacts from the installation or operation of TCMP equipment are anticipated; therefore, no disproportionately high and adverse effects are anticipated for any surrounding communities, including any Title VI/EJ communities.

Per page 11 of the final categorical exclusion for the entire CCP, TCMP has no physical features that will lead to environmental impacts. TCMP has a categorical exclusion (CE) for the National Environmental Policy Act (NEPA) and negative declaration (ND) for California Environmental Quality Act (CEQA). These documents are available on BART's CCP website, further detailed in the Project Readiness section of this application, and included in Appendix D.

[8] These equivalencies were calculated based on the EPA Greenhouse gas equivalencies calculator: https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator

Consistency with Regional Planning Efforts

As stated previously, MTC adopted an update to its Regional Transportation Plan/Sustainable Communities Strategy (RTP/SCS), Plan Bay Area 2050, released October 2021. The update includes the capital projects and service assumptions that make up the CCP. Hence, the CCP is consistent with the Bay Area's Sustainable Communities Strategy RTP/SCS.

The TCMP meets the guiding principles of Plan Bay Area 2050 in specific and measurable ways, including:

- Reduce vehicle O&M costs due to pavement conditions (Affordable)
- Increase non-auto mode share (Connected)
- Reduction of CO2 emissions (Healthy)
- Reduction of adverse health impacts (Healthy)
- Increase share of jobs accessible in congested conditions (Vibrant)

Figure 4-2. Plan Bay Area 2050 Guiding Principles

GUIDING PRINCIPLE	DESCRIPTION
AFFORDABLE	All Bay Area residents and workers have sufficient housing options they can afford – households are economically secure.
CONNECTED	An expanded, well-functioning, **safe and multimodal** transportation system connects the Bay Area – fast, frequent, and efficient intercity trips are complemented by a suite of local transportation options, connecting communities and creating a cohesive region.
DIVERSE	The Bay Area is an inclusive region where people from all backgrounds, abilities, and ages can remain in place – with **full** access to the region's assets and resources.
HEALTHY	The region's natural resources, open space, clean water, and clean air are conserved – the region actively reduces its environmental footprint and protects residents from environmental impacts.
VIBRANT	The Bay Area is an innovation leader, creating quality job opportunities for all and ample fiscal resources for communities.

Beyond these connections to the CCP and TCMP, BART is also committed to the following goals through their Transit Oriented Development (TOD) Guidelines, as discussed more in this application:

- House the region's population (Adequate Housing)
- Direct development within urban footprint (Open Space and Agricultural Preservation)
- Increase share of affordable housing (Equitable Access)

The Bay Area Air Quality Management District's 2017 Clean Air Plan provides a regional strategy to protect public health and the climate. To protect public health, the plan describes how the Air District will continue progress toward attaining all state and federal air quality standards and eliminating health risk disparities from exposure to air pollution among Bay Area communities. To protect the climate, the plan defines a vision for transitioning the region to a post-carbon economy needed to achieve ambitious GHG reduction targets for 2030 and 2050, and provides a regional climate protection strategy that will put the Bay Area on a pathway to achieve those GHG reduction targets. The TCMP will directly support this goal by shifting single occupancy vehicle car trips to increased transit ridership, thus reducing harmful emissions.

4.3. Quality of Life

The primary quality of life benefit for users of the *TCMP South Alameda* corridor are increased service frequencies resulting in reduced automobile dependence and congestion on both the BART system and the I-880 corridor.

Supporting the Shift to Transit Ridership

Waiting for a train is more onerous than riding on a train – waiting causes anxiety and typically occurs outdoors on the BART system.[9] As such, in the ridership and BCA analysis conducted as part of this grant application, BART assumed that one minute in time saved waiting is equivalent to 1.8 minutes of riding. The travel time equivalent savings is, therefore, the wait time savings multiplied by 1.8. The estimated time savings is summarized in Table 4-4 on page 22.

The total estimated time savings due to *TCMP South Alameda* improvements in 2050 is 4,901 hours for an average week peak period (eight hours). Using an annualization rate of 260, **this results in annual benefits of 1.27 million hours of time savings annually.** Aside from time savings, the BCA accounts for roadway noise reduction from reduced VMT. Total benefit amounts to $0.26 million ($0.08 discounted).

Equity and Inclusion

Overall, the *TCMP South Alameda* project will contribute to addressing equity and inclusion concerns in the Bay Area region. According to a City and County of San Francisco Planning Department document, "new housing options […] were not nearly enough to meet the needs of communities of color, low-income workers, and at times further exacerbated their displacement; many were forced out of the city given the increase in rents. This displacement has also been impacting the environment by imposing longer commutes and led to the loss of local businesses, art and entertainment activities."[10] This was echoed in UC Berkeley's Urban Displacement Project and the California Housing Partnership, which stated "the primary destinations for low-income people of color who moved in 2015 included Oakland and Hayward in Alameda County and parts of San Mateo County."[11] BART's 2018 and 2020 ridership survey results show that over 83 percent of riders to/from the southern Alameda County stations are non-white. Low-income populations accounted for 46 percent of the 2020 ridership compared to 20 percent in 2018. Moreover, riders without cars accounted for 55 percent in 2020 as compared to 28 percent in 2018. Such results highlight the importance of providing reliable transit services to those of lower incomes and with limited to no other mobility options. Specifically, the economic competitiveness benefits generated by the project that will **directly benefit low-income and/or minority riders amount to $69.1-$126.2 million** (discounted).[12]

Jobs created from the systemwide TCMP include goals to address equity and inclusion as well. Per the CBTC System Contract No. 49GH-110, covered by the BART Project Stabilization Agreement, the overall project hiring goals meet or exceed the hiring goals of Federal Targeted Workers.[13] For the San Francisco-Oakland Standard Metropolitan Statistical Area, this goal has been set at 25.6% of work hours for minorities, and 6.9% for women.

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[9] USDOT Revised Departmental Guidance on Valuation of Travel Time in Economic Analysis. https://www.transportation.gov/sites/dot.gov/files/docs/2016%20Revised%20Value%20of%20Travel%20Time%20Guidance.pdf. Accessed July 8, 2021.

[10] "Context: Dismantling San Francisco's Housing Inequities," City and County of San Francisco Planning Department, April 2021.

[11] "Rising Housing Costs and Re-Segregation in San Francisco," UC Berkeley's Urban Displacement Project and the California Housing Partnership, August 2021.

[12] Estimated as 45-84% of total economic competitiveness benefits ($152.4 million, discounted) but not part of BCA as amounts would be double counted.

[13] "Federal Targeted Worker" means a female or minority worker, whom contractors on federally funded projects are required to take affirmative action to employ.

Supports Public and Private Development

The Plan Bay Area 2050, released in 2021 by the MTC and the Association for Bay Area Governments, is both a transportation plan and a housing plan, which makes the case that the Bay Area currently has a housing crisis and the need for a tremendous amount of additional affordable and other housing to support a growing population. Work is currently underway to update MTC's Transit-Oriented Development (TOD) Policy to ensure land use supports current and planned transit investments. The previous version of the Plan Bay Area document (2040) included a Sustainable Communities Strategy that called for a 33 percent increase in the share of housing units located in priority development areas (PDAs) that are well served by transit, many of which are centered around BART stations. BART's participation in priority development and TOD is evaluated further in the section on Economic Competitiveness and Opportunity.

4.4. Improves Mobility and Community Connectivity

The TCMP will increase accessibility to multimodal choices in southern Alameda County by enhancing the reliability of the BART system in this highly used corridor that connects to the regions job centers in San Francisco, Oakland, and Silicon Valley. As described previously, the BART system suffers from reliability issues because of the current train control system. Implementation of *TCMP South Alameda* will allow riders to better rely on BART to get them to their destinations with more certainty on timing, making work, education, retail, and other trips easier on the BART system.

Walking and Biking Access

BART proactively supports projects and programs that encourage and support riders accessing the BART system by walking and bicycling. BART regularly uses existing revenues and grant funds to improve pedestrian walkways, lighting, and signage, and to provide secure bicycle parking at or near its stations. In 2018, over 35 percent of BART riders accessed stations by bicycling and walking, according to the 2018 Station Profile Survey. Through increased ridership, the TCMP will likely result in a proportional increase in bicycling/walking trips to BART stations.

The number of daily riders accessing the station by bicycle has increased significantly from 2008 to 2015 at the stations included in *TCMP South Alameda* (Table 4-3). According to the 2020 BART Customer Satisfaction Study, 45 percent of respondents say that they walked, biked, or used a scooter to travel from home to BART.

Table 4-3. Change in Daily Bike Access at* TCMP South Alameda *Stations, 2008-2015

Station	2008 Number of Bike Trips	2015 Number of Bike Trips	Percent Change
Hayward	37	202	445% increase
South Hayward	42	130	206% increase
Union City	52	220	323% increase
Fremont	75	207	175% increase

To encourage alternative access modes, BART revised its Station Access Policy in 2016 to prioritize investments to improve active transportation mode share and safety. With a clear focus on improved access, BART anticipates that the percentage of riders who use active transportation to reach BART will be even greater in the future, especially in southern Alameda County. In 2022, a new pedestrian bridge

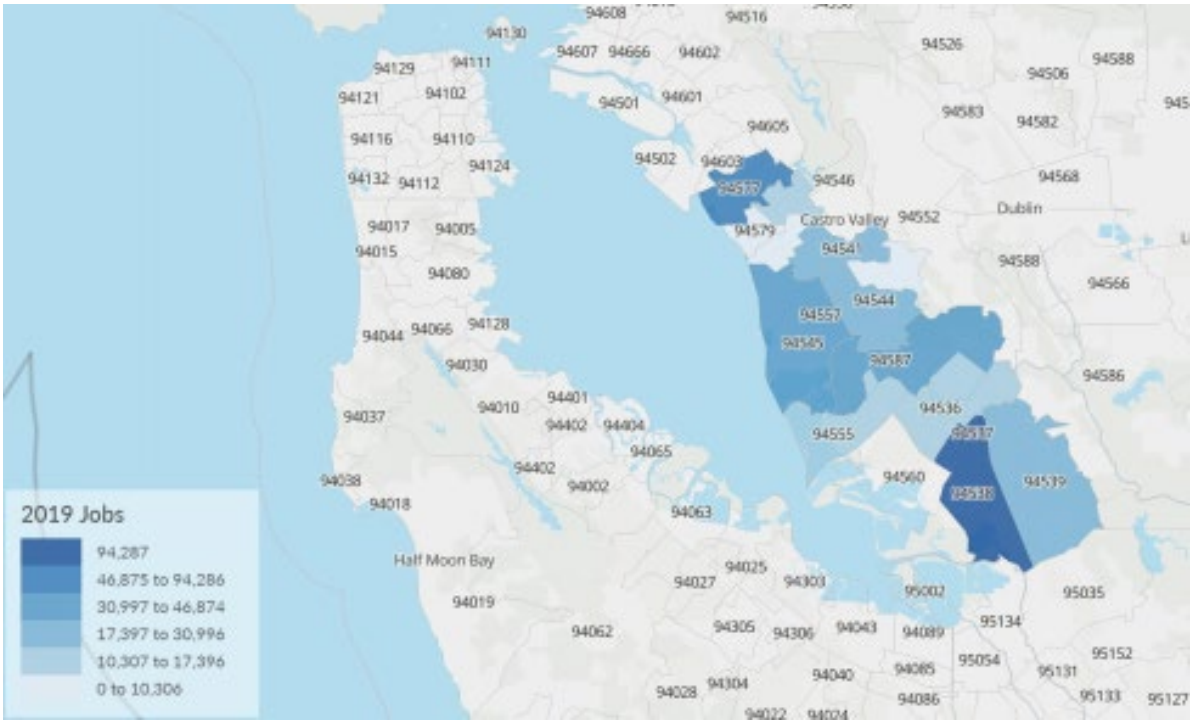
opened that connects the Warm Springs/South Fremont BART Station across the Union Pacific Railroad freight tracks to the "Innovation District" in Fremont. This transit-oriented "Innovation District" is in an industrial area that is home to the Tesla Motors factory and includes mixed-use housing and retail development.

Connectivity to Opportunities

As the Bay Area has recovered from the Great Recession, professional and business service sectors have driven rapid and significant growth, with a peak of 3.9 million wage and salary jobs in 2017.[14] Service sector jobs have grown significantly since 1990 in the region as demand for education, healthcare, hospitality and information services grew as well. Further, about a quarter of all workers in downtown San Francisco and Oakland use BART for their daily commute. As a major connection mode to job centers throughout the Bay Area, investments in BART's capacity will serve the thousands of workers using the system to access employment, recreational, and housing centers throughout the region. See the Economic Competitiveness and Opportunity section for information on how the project will continue to support connection to jobs, major destinations, and residential areas throughout the Bay Area.

Figure 4-3 reflects the number of jobs throughout the project corridor, which are substantial in southern Alameda County. The *TCMP South Alameda* project will support the growth of Bay Area jobs, specifically through this corridor, by increasing headways and making the BART system and line more reliable.

Figure 4-3. Job Frequency in Project Corridor, 2019 by Zip Code



[14] https://www.vitalsigns.mtc.ca.gov/jobs-industry#chart-3

Mobility for Freight Movements

According to the San Francisco Bay Area Goods Movement Plan, traffic congestion is a prominent issue to the movement of goods in the Bay Area. Truck delays increase the cost of goods movement, as well as truck emissions. Most of these freight corridors, shown in Figure 4-4, carry between 5,000 and 15,000 trucks per day on average, performing both long-haul and short-haul truck moves. Specifically, key segments of I-880 and I-580 connect the Port of Oakland to the San Joaquin Valley carrying between 15,000 and 37,000 trucks per day on average. The continued relocation of distribution facilities out of the Bay Area to places further east in the San Joaquin Valley and the flows of products to the region from these distribution facilities by truck are going to continue to put greater pressure on this already congested corridor, increasing conflicts between trucks and automobiles.

Figure 4-4. Bay Area Annual Average Daily Traffic (AADT) Truck Volumes, 2014

As described in this application, the TCMP will result in significant VMT reductions that correspond to fewer drivers utilizing the Bay Area's highways, allowing for better movement of trucks throughout the region.

4.5. Economic Competitiveness and Opportunity

Residents in southern Alameda County have less income, on average, than the typical Bay Area resident. For the five BART stations along the *TCMP South Alameda* project corridor, median household incomes vary. Connecting the residents of southern Alameda County to the entire Bay Area is key to the economic vitality of this section of the region. BART plays a key role in connecting residents of southern Alameda County to the downtown job centers in San Francisco and Oakland, including Silicon Valley in Santa Clara County. Below is a summary of the economic competitiveness and opportunities that residents of southern Alameda County will benefit from with increased capacity due to the implementation of *TCMP South Almeda*.

BART System & Regional Competitiveness

BART supports the Bay Area's growing economy. Hundreds of thousands of commute trips are made on BART every weekday, saving commuters time and money, and connecting businesses with a larger pool

of workers. Commuters traveling into San Francisco save, on average, 30 minutes each direction compared to driving. Commuters traveling to downtown Oakland save seven minutes on average compared to driving and those traveling to Pleasant Hill save 30 minutes on average.[15] These travel time benefits help support the region's major economic centers by connecting businesses with the workers they need. About a quarter of all workers in downtown San Francisco and Oakland use BART for their daily commute. BART makes 12 percent more workers available within an hour commute of Downtown San Francisco and 28 percent more within an hour commute of the West Dublin/Pleasanton station than if BART were not an option.[16] Without investments in BART capacity to serve these important travel markets, the Bay Area's economic competitiveness would suffer. Many new jobs would go to regions that enjoy shorter travel times and less crowding.

Ridership Increase & VMT Reduction

As train service improves from the implementation of *TCMP South Alameda*, some number of travelers in the corridor will switch from other travel modes to BART. To estimate the ridership increase from reduced headways, BART assumed ridership to frequency elasticity of 0.35 percent, i.e., a one percent increase in train frequency results in a 0.35 percent increase in ridership. For the improvements associated with this RAISE application (*TCMP South Alameda*), train frequency is expected to increase 25 percent. The elasticity would, therefore, estimate an increase in ridership of 8.8 percent.

Given the distance of travel and the subject corridor, BART expects that most of the new riders will be switching from automobile without any induced demand.

To estimate the VMT saved by *TCMP South Alameda* improvements, BART multiplied the distance between the corridor station pairs by the number of riders that previously traveled in an automobile. The average weekly peak period VMT reduction in 2047 is expected to be 30,024 vehicle miles. The annual figure, using an annualization rate of 260, is over 7.8 million vehicle miles, as shown below in Table 4-4. The project anticipates $401.2 million worth of travel time benefits in undiscounted 2020 dollars and $129.8 million in discounted 2020 dollars from time savings due to improved throughput and travel time reliability. Additionally, the project anticipates realizing fuel and out-of-pocket cost saving of $67.6 million in undiscounted 2020 dollars and $20.2 in discounted 2020 dollars.

Table 4-4. TCMP South Alameda Corridor Ridership, Travel Time Savings, and VMT Reduction (Build Versus No Build)

Year	No Build Ridership	Build Ridership	Travel Time Savings	VMT Reduction
2029 Opening	14,422	18,027	228,331	3,903,119
2047 Total	14,422	18,027	926,302	7,806,237

[15] 2014 BART Customer Satisfaction Study, https://www.bart.gov/sites/default/files/docs/CustSat2014Report_Final.pdf

[16] Economic Impacts of BART Operations, ALH Urban & Regional Economics, September 2015

Efficient and Reliable Freight Movements

As stated in the Improves Mobility and Community Connectivity section, the systemwide TCMP, in which *TCMP South Alameda* plays a critical role, will result in significant VMT reductions allowing for better movement of trucks in the region.

Job Creation

BART's TCMP will result in direct jobs creation at both BART and for contracted staff. Based on staffing plans for TCMP, from 2021 through 2029 over 500 new positions will be created to build the overall system, with the jobs being located at BART headquarters in Oakland, CA, a vehicle manufacturing facility in Pittsburg, CA, and other locations internationally.

The CBTC System Contract No. 49GH-110, covered by the BART Project Stabilization Agreement, is the systemwide TCMP Design-Build contract and includes several project hiring goals to ensure long-term job creation. As part of its Disadvantaged Business Enterprise (DBE) and Small Business Enterprise (SBE) programs, the participation goals are set at four percent of the total pre-bid construction cost estimate, respectively. As of November 2021, the DBE goal is tracking at 5.1 percent participation. These programs also include a provision that there shall be full Union access at all times to the persons performing work and a Mentor-Protégé Program to assist DBEs and SBEs broaden their technical capacity and long-term stability.

Contracts that support the CBTC System Contract are a Construction Management on-call contract and a Design Support During Construction (DSDC) on-call contract, each with their own DBE participation goals. As of November 2021, the DBE goal for each of these contracts is tracking at approximately 30 percent participation.

Additional hiring goals in the CBTC System Contract include a Local Hire Program, and goals for Federal Targeted Workers (as described in the Equity and Inclusion section), National Targeted Workers[17], and Disadvantaged Workers[18] goals. Local hiring goals, require thatt 50 percent of all workers on the project on a craft basis will be Local Area Residents[19] and 25 percent will be residents of the Project Local Impact Area, if available. Local Area Residents shall also be utilized for 50 percent of apprenticeship hours. National Targeted Workers shall be utilized for 25 percent of the apprenticeship hours. Disadvantaged Workers shall work ten percent of all National Targeted Worker hours.

Land Use in Southern Alameda County

Because of the value BART provides, the land around BART stations sells and leases at a substantial premium, increasing property tax revenue to local government. At the same time, the money that the region invests in building and maintaining BART is reinvested in the Bay Area economy, further contributing to growth. Over the next 25 years, BART is expected to take on an even larger role in the Bay Area's economy by helping to accommodate the region's growth.

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[17] National Targeted Worker is an individual residing in an Economically Disadvantaged Area (household annual income of $32k-$40k) or Extremely Economically Disadvantaged Area (household annual income of less than $32k) or a Disadvantaged Worker.

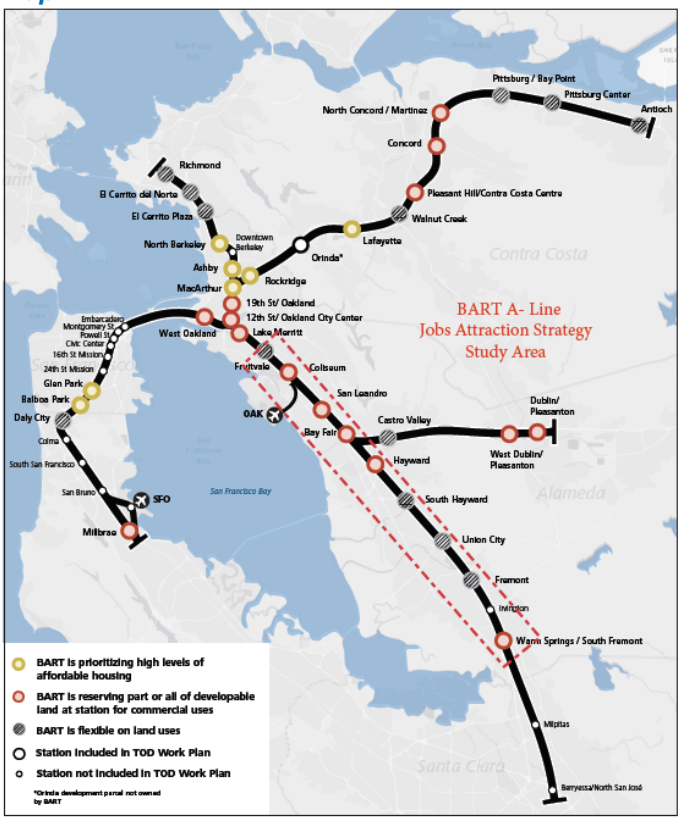
[18] Disadvantaged Worker is an individual residing in an Economically Disadvantaged Area or Extremely Economically Disadvantaged Area and faces at least one barrier to employment.

[19] Local Area Residents include residents of Alameda, Contra Costa, San Francisco, San Mateo, and Santa Clara counties.

In the Fall of 2020, FTA awarded BART a TOD Planning grant in partnership with six jurisdictions along the corridor between Oakland and Silicon Valley in Alameda County to develop a Jobs Attraction Strategy. The TOD award area includes *TCMP South Alameda*, and includes nine BART stations, five of which are included in *TCMP South Alameda*: Fruitvale, Coliseum, San Leandro, Bay Fair, Hayward, South Hayward, Union City, Fremont, and Warm Springs/South Fremont.

Previous work has shown that this corridor has competitive development sites, market potential, and the local support needed to attract major employers to future TOD. But experience has shown that attracting employers is difficult when the region's economic focus is to the west and south. This affects low-income workers too. A recent UC Berkeley study found that low-income residents living near BART do not take BART because their jobs are not near transit. Forty-six percent of *TCMP South Alameda* riders are low-income (2020 Customer Survey); therefore, BART's efforts with this planning study will create a strategy to boost job creation along the corridor between Oakland and Silicon Valley in Alameda County. *TCMP South Alameda* will build on robust TOD planning efforts in this corridor and will be integral to bringing jobs to the corridor. It also builds on work by the East Bay Economic Development Alliance (EDA) on COVID-19 economic recovery, outlined in the East Bay Forward document, released in September 2021.

Figure 4-5. TOD Jobs Attraction Strategy Study Area Map



The work outcomes will lead to an increase in jobs near transit and address the six aspects of the general authority of the Moving Ahead for Progress in the 21st Century Act (MAP-21), the surface transportation authorization signed into law in 2012:

1. Reduce the region's jobs-housing imbalance and address BART's core capacity constraints by offering transit as a viable choice for non-San Francisco jobs.
2. BART's TOD projects are required to enhance multi-modal connections. Short, convenient walking distances are key to transit trip generation from jobs.
3. New TOD projects will leverage grant funds to close gaps in the walking and biking network, which BART identified in a recent Network Gap study for six of the nine stations.
4. Specifically focuses on advancing mixed-use TOD projects on the A-Line.[20]
5. Identifies infrastructure needs that may be required to attract job generating uses.

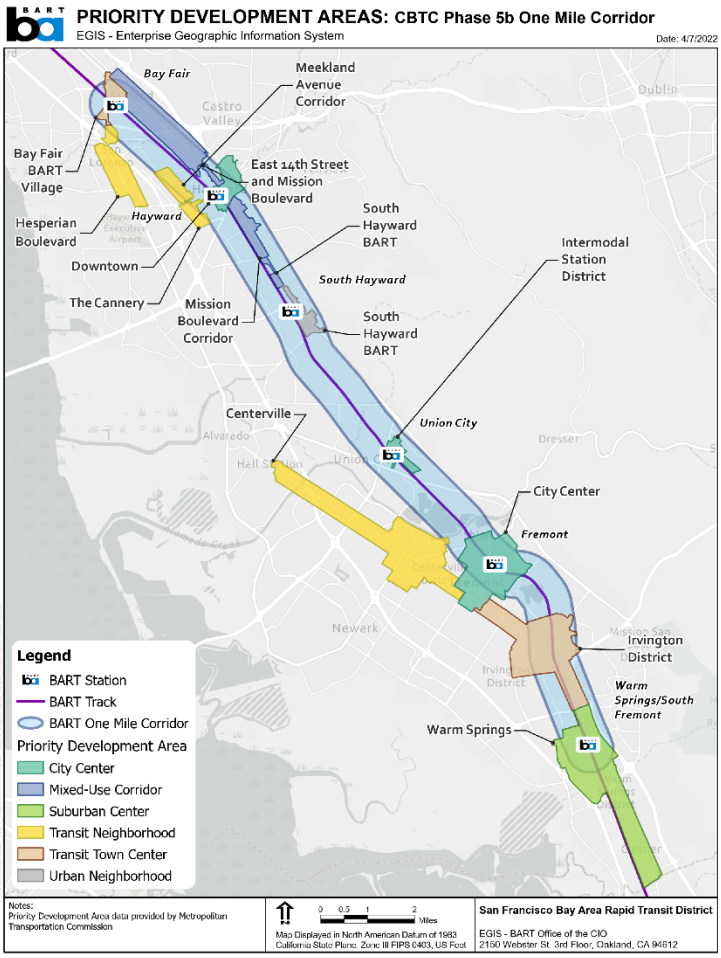
[20] A-Line refers to the BART corridor from Fremont to Lake Merritt.

6. Includes private sector participation through interviews of commercial brokers and industry experts, and East Bay EDA (a private entity) is a grant partner.

Priority Development and Transit Oriented Development

As stated earlier, the TOD Policy is currently being updated by the MTC. Plan Bay Area 2040 includes the existing TOD Policy, which contains the Bay Area's strategy for reducing GHG emissionsby concentrating new housing and jobs in designated Priority Development Areas (PDAs)[21] that are served by BART and other transit operators (Figure 4-6). These areas typically are accessible by one or more transit services; and they are often located near established job centers, shopping districts and other services.

Figure 4-6. Priority Development Areas in Corridor



While BART is not directly responsible for building housing, sustaining high-quality transit service is essential to supporting the Regional Plan for concentrating housing in places best served by transit. BART proactively supports TOD on its property and around its stations. Twenty-four TOD projects are currently under construction, planned, or completed on BART-owned property near stations, representing over $3 billion in private investment. These projects will add over 5,600 new housing units within walking distance of BART stations.[22] In general, BART's TOD Policy encourages and supports high-quality TOD, including new housing within walking distance of BART stations.

In 2016, the BART Board of Directors adopted an affordable housing policy and performance targets setting a goal of 35 percent affordable housing on its station sites, which could result in an additional 7,000 affordable units over the next ten years. In addition, the BART Board also adopted TOD land use strategies, which ensure that TOD opportunities are explicitly accounted for in the acquisition of new properties, the location of new station sites, and the design and construction of station facilities. It is estimated that the TOD Policy will offset GHG emissions by 24 percent versus conventional development. This means that if BART produces 20,000 units on its property versus elsewhere in Alameda and Contra Costa counties, households will drive approximately 24 percent less. Additionally, by supporting TOD in these areas, BART is contributing to the

[21] PDAs are areas within existing communities that local city or county governments have identified and approved for future growth.

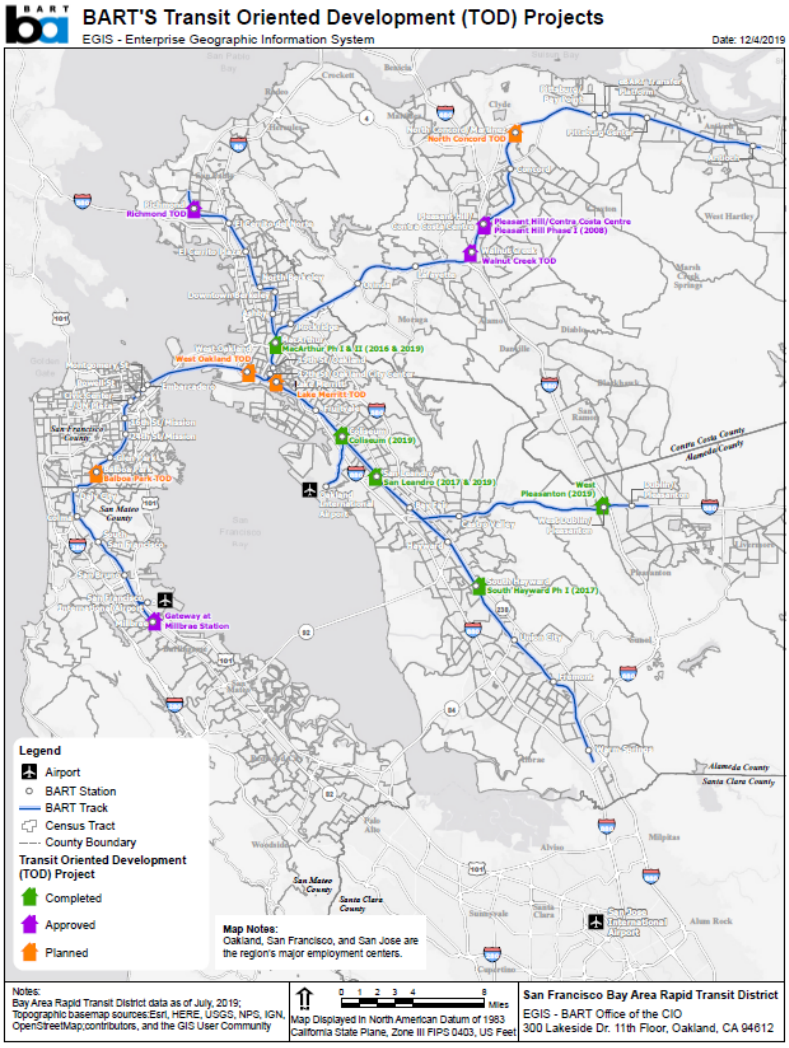
[22] https://www.bart.gov/about/business/tod

region's Sustainable Communities Strategy goal of reducing per capita GHG emissions in 2035 by 19 percent.

BART has played a strong leadership role as a transit agency with an interest in housing, as evidenced by BART's role on the technical and steering committees of CASA – the committee to house the Bay Area, convened by MTC in 2017 and 2018 – and BART's leadership role in partnership with the Nonprofit Housing Association of Northern California to draft the CASA public lands strategy. In 2018, then-Governor Brown signed Assembly Bill (AB) 2923 (Chiu/Grayson), which was authored in response to BART's strong Board-adopted commitments to constructing housing on BART property. This bill establishes a process by which developable BART-owned property in Alameda, Contra Costa, and San Francisco counties will be rezoned to support TOD and establishes development streamlining provisions similar to Senate Bill (SB) 35 (Wiener, 2017), intended to facilitate and expedite the construction of housing. BART is in the process of implementing this historic bill and has engaged the 22 jurisdictions affected by BART's TOD program.

It is assumed that many riders from these TODs on the BART system will drive BART ridership increases, once the TCMP allows greater capacity.

Figure 4-7. Station Modernization Program: TOD Projects



4.6. State of Good Repair

The original legacy fixed-block train control system is nearing the end of its useful life and experiences frequent failures in false occupancies, train program stops, door openings, track block shunts, routing, and system resets. These repeating failures have a detrimental impact on automatic train operation, resulting in immediate impacts to revenue service, system safety, and reliability. **The current system is obsolete with limited access to spare parts and requires extensive preventative maintenance to remain operable.**

A new CBTC system will replace all legacy infrastructure with modern moving block technology that will increase reliability, decrease current maintenance procedures, and allow for higher train frequency with decreased travel times. The new system will also include significant efficiency upgrades including wireless

remote management to improve failure response times and increase system resilience through additional redundancies. The current train control system is supported by various supplier equipment, which increases the complexity of maintenance. Consolidation to a single vendor with the new TCMP will create a unified servicing platform with direct access to spare parts and significantly improve maintenance efficiency. In addition, it will also allow BART to meet future ridership demands. A technologically modern system will allow greater focus on a Reliability Centered Maintenance (RCM) approach, creating a more robust system of planned maintenance activities and maintaining a state of good repair.

Asset Management

Given BART's limited resources, the ability to gather data, evaluate information, and develop the most cost-effective strategies for maintenance and capital replacement is of increasing importance to the aging BART system. BART's asset management approach utilizes a broad risk framework to systematically assess the likelihood of near-term failure for each asset and the consequent impact on the BART system, rather than merely looking at the asset's age or condition. By doing this, the agency can prioritize and allocate limited resources to high value investments to achieve and maintain a state of good repair. This framework is implemented through BART's Risk Register and informs BART's Capital Needs Inventory (CNI), which applies several factors when determining which capital projects are allocated funding, given limited resources. These factors include whether a project will:

- Maximize value for the money spent
- Help manage and address risk
- Close an identified need
- Minimize lifecycle cost
- Yield operational cost savings through increased efficiency or reduced risk
- Align with the agency's strategy for long-term financial sustainability

In compliance with the FTA Transit Asset Management (TAM) Rule, BART recently updated their TAM Plan in 2021. The TCMP continues to be included in the TAM Prioritized Project List and a Key Activity for the four-year TAM horizon.

Investment in State of Good Repair

BART's FY 2022 Capital Budget allocates $684 million for system reinvestment, or approximately 48 percent of the total FY 2022 Capital Budget. This level of system reinvestment spending reflects BART's emphasis on and prioritization of several reinvestment projects in operational areas of high-risk exposure (i.e., track condition, traction power transformers and substations, rail tie/switch replacement, wayside equipment, and existing train control rehabilitation). BART's system reinvestment budget includes modernization of its obsolete train control system and passenger and worker safety related projects (e.g., life safety systems, access control, structure fail protection, etc.).

Overall, the TCMP's benefit to the region's state of good repair is quantified as the investment's residual value and the reduced pavement maintenance from fewer roadway users. In particular, the BCA assumes the investment will have 30 years of useful life with ten remaining after 20 years of operations. The total project residual value as well as pavement maintenance cost savings amounts to $35.4 million ($5.3 discounted). Additionally, this project is expected to reduce operations and maintenance (O&M) and periodic rehabilitation and replacement (R&R) costs due to operating efficiency gains. However, such impacts are not modeled at the time of this application. Instead of the efficiency, the BCA quantified the additional O&M costs resulting from additional peak services. The resulting additional O&M cost in 2020 dollars is $80.2 million ($24.2 million discounted).

4.7. Partnership and Collaboration

BART has partnered with multiple regional and state agencies to implement the TCMP through the entire BART system and specifically the *TCMP South Alameda* corridor project. Significant project partners include California Department of Transportation (Caltrans), MTC, and Alameda County Transportation Commission (ACTC).

TCMP South Almada has received significant local and elected official support, as evidenced by the letters of support included in this application package:

- Alameda County Transportation Commission
- California Department of Transportation
- California State University East Bay
- City of Fremont
- City of Hayward
- East Bay Leadership Council
- Fremont Chamber of Commerce
- Hayward Chamber of Commerce
- Hayward South Alameda County NAACP
- The Metropolitan Transportation Commission (MTC)
- Silicon Valley Leadership Group
- SPUR nonprofit public policy organization
- Union City
- Union City Chamber of Commerce

Equity-Focused Community Outreach & Public Engagement

BART has a long and successful history of interacting and working with social justice, environmental, community-based, faith-based, disability rights, and other groups in the BART service area. BART has solicited input and sought ideas on a wide variety of programs and projects – from the design of new rail cars to station area improvements or development to changes in fares and their potential impact. BART has successfully implemented several community-based grants such as Caltrans' Environmental Justice grants, MTC's Community-based Transportation Planning grants, and the successful Better BART outreach campaign in 2016.

BART's Public Participation Plan (PPP) was developed in 2011, with an update in 2015, following extensive outreach throughout the BART service area and guides the organization's ongoing public participation endeavors. The PPP ensures that BART utilizes effective means of providing information and receiving public input on transportation decisions from low-income, minority, and LEP populations.

As recommended in the PPP, BART has implemented a variety of outreach techniques for projects related to the overall Core Capacity Project. In 2014, BART launched its "Fleet of the Future" outreach campaign to obtain public feedback on the design of BART's new vehicles. A series of ten events were held at BART stations and in local communities throughout the Bay Area. Approximately 17,500 people attended the events and a total of 7,666 surveys were collected. BART staff consulted regularly with members of the disability community, including the BART Accessibility Task Force (BATF), on the design and functionality of the new BART trains. The BATF provided hands-on feedback on all aspects of the car design.

Outreach related to the 2014 BART Vision Plan engaged over 2,000 people in exploring the tradeoffs involved in considering how BART can meet its future needs. The public helped BART staff narrow down future projects and investments BART should focus on by determining which ones are most important to the public and fit best into BART's goals of serving the Bay Area for years to come. A total of ten in-station events were held and a total of 2,551 surveys were collected.

BART's Title VI/EJ Advisory and LEP Advisory committees meet regularly to assist BART on all issues of policy with a focus on meeting the needs of minority and disadvantaged communities and riders. In November 2017, both committees received a presentation on the CCP.

In 2017, BART also partnered with MTC to conduct outreach on its Core Capacity Transit Study, a collaborative effort to improve public transportation to and from the San Francisco core. Outreach activities consisted of two public meetings to identify investments and improvements to increase transit capacity to the San Francisco core. Approximately 80 people participated in the public meetings.

Outreach strategies to Disadvantaged or Low-Income Communities outlined in the PPP include:

- Translation of flyers and other meeting materials and interpretation services
- Outreach to Community-based Organizations (CBOs)
- Providing notification using Ethnic Media Sources
- Hosting meetings in accessible locations

Additional outreach activities were included as part of the following relevant efforts:

- Fleet of the Future New Train Car Model
- BART Vision – Future BART
- Embarcadero-Montgomery Capacity Implementation and Modernization Study
- Better BART
- MTC Plan Bay Area 2040
- MTC Core Capacity Transit Study
- Hayward Maintenance Complex Noise Study

Federal Coordination

Most of the coordination with federal agencies for *TCMP South Alameda* has occurred through the environmental clearance process, as described in the Required Approvals section. The CBTC System Contract will require FTA coordination to ensure compliance to meet the Buy America requirements, included in the TCMP Design-Build contract.

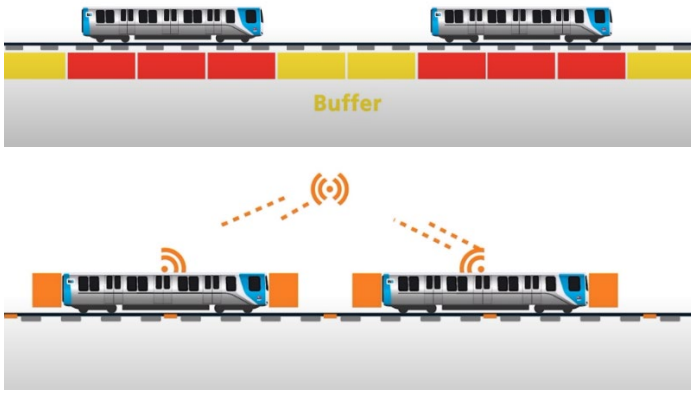
4.8. Innovation

Innovative Technology

As detailed in the scope description, TCMP will replace the existing train control systems with a state-of-the art CBTC system, allowing BART to achieve the shorter headways needed to operate an increased number of regularly scheduled trains per hour on the portion of the system included in this RAISE application.

CBTC is a proven railway signaling system that makes use of telecommunications between the train and trackside equipment for the traffic management and infrastructure control. By means of the CBTC system, the exact position of a train is known more accurately than with the traditional fixed block signaling systems. CBTC allows for real-time adjustments of speed and braking to allow for safe train separation while allowing trains to get closer to each other. This equates to increased capacity and thus reduced wait times between trains. A modernized train control system will enable BART to increase projected capacity to 30 trains per hour per direction from the current limitation of 23 trains per hour per direction in the Transbay Tube.

Figure 4-8. Existing Fixed Block System versus CBTC (Moving Block Signaling)



The overall TCMP will install new raceway, power and communication cables, SPSCs, conduit, and breakers at various locations throughout the BART system. New zone controllers, interlocking controllers, and wayside radio transponder tags will be installed throughout the trackside alignment, train control rooms, and central control facilities. Bart D-Cars will be outfitted with processor-based controllers, transponders, communication equipment, and location sensors. For more details on this innovative CBTC technology, see BART's video here.

Innovative Project Delivery

TCMP South Alameda will bring continuous change to BART and the riding public. By implementing the CBTC technology throughout the BART system in phases through the TCMP Design-Build contract, BART is ensuring the best design and implementation strategies possible for this necessary and innovative project. BART executed the Design-Build contract with Hitachi Rail STS USA, Inc. in September 2020. The TCMP Design-Build contract will allow expedited project delivery, as detailed in the Economic Competitiveness and Opportunity section. The innovative CBTC technology will first be proven on a test track and then will roll out for BART mainline deployment in eight geographical phases, with the ability to run 28 trains per hour in each direction through the Transbay Tube in 2030 and up to 30 trains in 2032. BART and Hitachi worked together closely on the Conceptual Design Phase work products, which set the foundation for Preliminary Design work that began in the Spring of 2021. The team has recently conducted early surveys of field conditions and is developing plans for equipping the test tracks with CBTC components. A detailed project schedule is discussed further in the next section.

5. PROJECT READINESS

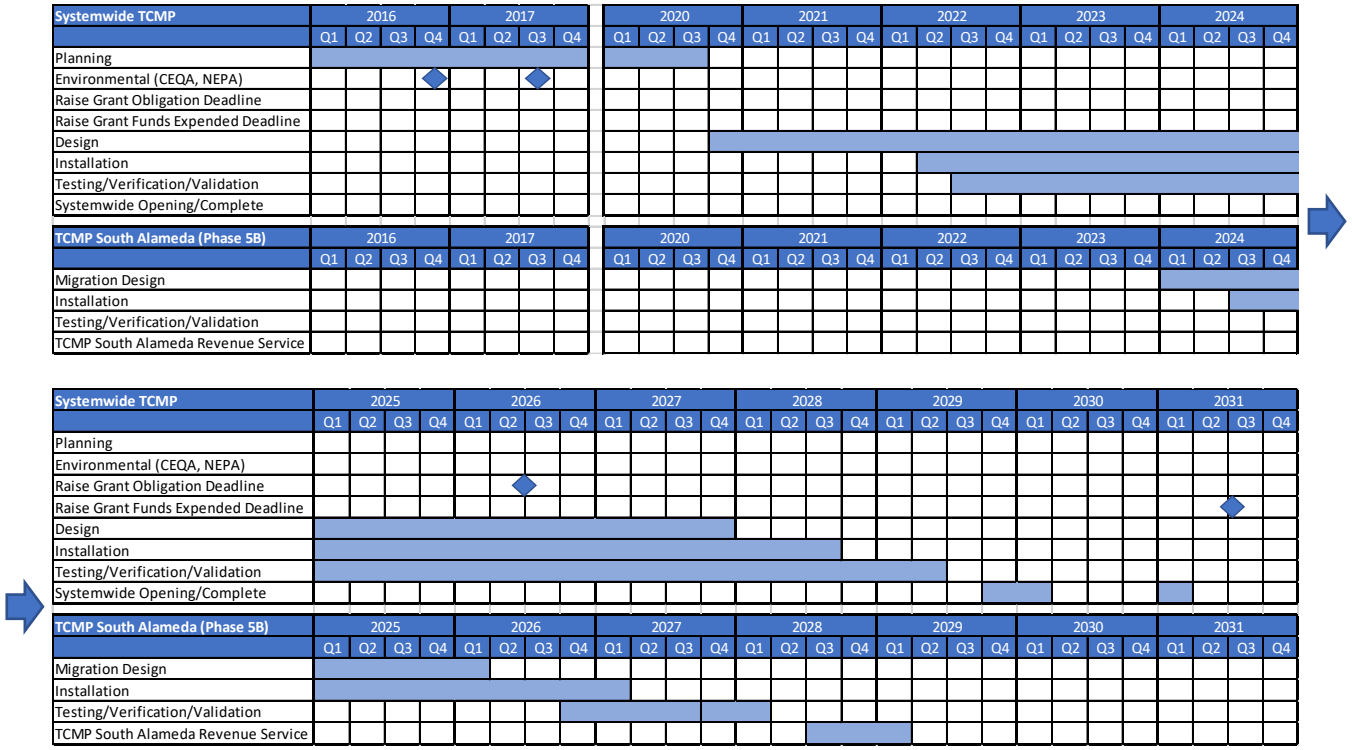
5.1. Environmental Risk

TCMP South Alameda is covered under the Transbay Core Capacity NEPA CE, approved in 2017, and specifically meets 23 CFR Part 771.118 subsection (c)(5) criteria for "installation and improvement of safety and communication equipment within or adjacent to existing right-of-way." The project is also covered under the Transbay Core Capacity CEQA ND, approved in 2016.

5.2. Project Schedule

Notice to proceed for the systemwide TCMP Design-Build contract was granted on November 2, 2020, as shown in Figure 5-1. Conceptual Design of *TCMP South Alameda* was completed May 2021 and Preliminary Design in December 2021. Final Design for *TCMP South Alameda* is scheduled for completion in December 2022. With this RAISE grant fully funding *TCMP South Alameda*, construction of this will begin in mid-2024 with revenue service starting mid-2028.

Figure 5-1. Schedule for Systemwide TCMP, Showing TCMP South Alameda



5.3. Required Approvals

NEPA / CEQA Process

- NEPA CE [September 14, 2017] (See Appendix D)
- CEQA ND [November 7, 2016] (See Appendix D)

State and Local Planning Approvals

- All work is in BART right-of-way
- BART's Measure RR Oversight Committee has been engaged in the process
- CCP Transportation Improvement Program (TIP) ID: REG170017

Federal Transportation Requirements Affecting Planning

The MTC adopted an update to its Regional Transportation Plan/Sustainable Communities Strategy (RTP/SCS), Plan Bay Area 2050, which was released in October 2021. The update includes the capital projects and service assumptions that make up the CCP, which includes *TCMP South Alameda*. Hence, the project is consistent with the Bay Area's Sustainable Communities Strategy RTP/SCS.

5.4. Assessment of Project Risks and Mitigation Strategies

Risk management is an integral part of the CBTC project's success. BART has implemented a robust risk approach that engages all disciplines in the identification and treatment of project risks. The approach ensures that risk management is an ongoing process of maintaining control of risks through project execution. This approach is captured in the Project Management Plan and Risk Management Plan, which document the methodology, criteria, roles, responsibilities, processes, tools, and techniques for identifying, assessing, analyzing, managing, monitoring, and mitigating risks. Listed below are three key risks and their coordinated mitigation strategy.

Potential Risk: Project Delivery Delays

Project delivery delays need to be accounted for in any infrastructure project. Addressing potential delivery delays is critical for TCMP as a key risk factor involves obtaining track access windows. Because other major projects involving track access will be occurring at the same time as CBTC development, there is a risk of schedule and cost impacts if the CBTC Contractor cannot perform its scheduled work on the trackway. Mitigations for this risk include identifying interface milestones across projects at BART, ensuring the interface points are included in the respective project schedules, and continuing to explore opportunities for access to the trackway in coordination with other projects. These access commitments will need to be monitored and met through well-defined and careful planning, coordination, and scheduling.

Potential Risk: Product Substitutions Impacting System Performance

BART's contract with the Contractor calls for all products used in the CBTC system to have been service proven for at least two years. Because there is a tendency in the transit industry for contractors to introduce different products as part of their innovation and evolution, there is a risk of lost time during development and testing, and in ultimately receiving Safety Certification. To mitigate this risk, there is a process for review of product substitutions that must be followed in every case. It is understood that some product substitutions may not be a bad choice for BART because even though it may not have been in proven service for two years, it could still represent an advantage in terms of overall reliability, performance, and innovation.

Potential Risk: Difficult Software and Hardware Adaptation of Contractor's CBTC Products on the New Fleet of Vehicles

An additional challenge to the implementation of TCMP is the fact that BART is renewing its aging fleet of vehicles. Because of difficult software and hardware adaptation of the Contractor's CBTC products to new BART car interfaces, there is a risk of cost impact and delay to the project including the CBTC Contractor

potentially being unable to meet the contract requirements. To mitigate this risk, BART is engaging early on the interfaces with both the CBTC Contractor and Vehicles manufacturer. Other mitigations include deploying BART staff at the CBTC Contractor's development centers to participate in the design and development. Equipment will be lab tested, followed by actual testing on a BART vehicle to confirm its functionality before incorporating into the CBTC design.

6. BENEFIT COST ANALYSIS

A USDOT-compliant BCA was completed for this RAISE application and is in Appendix A. *TCMP South Alameda* has an estimated total cost of $137.2 million (in FY2022 dollars), including $127.6 million for construction and $9.5 million for contingency. The discounted project cost in 2020 dollars is $88.4 million. All project costs are anticipated to be incurred after award and obligation of the RAISE grant should an award be made.

In 2020 dollars, the project is expected to generate $148.1 million in discounted benefits using a seven percent discount rate. These monetizable benefits are derived from safety benefits of avoided collisions, travel time savings, vehicle operating cost savings (including fuel consumption), reduced emissions, reduced rehabilitation and replacement costs, health benefit improvements, and residual value from the roadway improvements associated with the project. **This leads to an overall project Net Present Value of $59.7 million in 2020 discounted dollars and a Benefit Cost Ratio (BCR) of 1.67.**

The non-monetarized impacts to which the benefits correspond are reported in Table 6-1. In particular, *TCMP South Alameda* will reduce automobile travel by 152.2 million miles over 20 years of analysis and increase rail passenger miles by over 254.2 million. Over 17.6 million of travel hours will be saved with six million fewer gallons of fuel consumed.

Table 6-1. Quantified Project Impacts

Category	Unit	No Build	Build	Change
Vehicle-Miles Traveled - Auto	VMT	13,722,799,769	13,570,578,144	(152,221,625)
Passenger-Miles Traveled - Rail	VMT	1,016,840,455	1,271,050,569	254,210,114
Person-Hours Traveled - Auto	PHT	997,051,316	979,386,035	(17,665,281)
Person-Hours Traveled - Rail	PHT	63,324,690	55,503,583	(7,821,107)
Fuel Consumed	gallons	541,815,804	535,833,654	(5,982,150)
Fatalities	#	210	207	(2)
Injuries	#	14,672	14,509	(163)
Property Damage Only (PDO)	#	16,432	16,250	(182)
CO_2 Emissions	tons	4,815,117	4,764,611	(50,507)
NO_X Emissions	tons	390	385	(5)
PM2.5 Emissions	tons	11.4	11.1	(0.3)
SO_X Emissions	tons	20.6	20.3	(0.3)

7. APPENDICES

A. BCA Technical Memorandum
B. BCA Spreadsheets
C. Letters of Support
D. Technical Documents
E. Financial Documents