



# BART Perks Phase II Evaluation Report

San Francisco Bay Area Rapid Transit District

September 2019



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# Acknowledgements

Funding for BART Perks Phase II was generously provided through the Federal Transit Administration's Pilot Program for Transit Oriented Development, which encourages economic and ridership development in major transit corridors. The grant (CA-2016-066-00) funded two sub-projects (BART Perks and the Downtown Oakland Specific Plan), both focused on BART's Transbay Corridor connecting downtown Oakland and San Francisco.

A team of dedicated consultants supported the Perks II project. Metropia developed the incentives software platform, incentives algorithm, and crowding predictive model under the direction of Drs. Yi-Chang Chiu and Ali Arian. The Behaviouralist, led by Dr. Rob Metcalfe, developed the experimental design and program evaluation. TransSight, under the direction of Satinder Bhalla, led the front-end software development and engineering.

Multiple staff from several BART departments led or supported components of the work. BART's Office of the Chief Information Officer, under Angie West, oversaw the software development and systems integration. BART's Marketing Department, under Aaron Weinstein, supported the experimental design, project evaluation, user experience research, and user surveys. Ryan Greene-Roesel in BART's Strategic Planning Department managed the project under the guidance of Val Menotti and Ellen Smith. BART's Communications, Fare Collection Engineering, Operations Planning, Legal, Customer Service, and Treasury Departments also made key contributions.

Several forthcoming academic papers are expected from the project, including:

- Robert Hahn, Robert Metcalfe, Eddy Tam (2019). Estimating the Welfare Impacts for Public Transit: New Experimental Evidence and Theory. Working Paper.
- Ali Arian, Chih-Wei Hsieh, Yi-Chang Chiu, Ryan Greene-Roesel (2019). Developing A Crowding Prediction Model using A Machine Learning Approach for a Fare Card-Based Transit System. Working Paper.
- Ali Arian, Raymond Huang, Yi-Chang Chiu, Ryan Greene-Roesel (2019). The Development and Field Validation of a System Optimal Individualized Incentive Scheme for a Metro Transit System. Working Paper.

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# Executive Summary

This report summarizes the results of BART Perks Phase II, a pilot program aimed at reducing train crowding with incentives. One of very few international examples of projects to reduce crowding on mass transit with incentives, Perks Phase II ran from December 2018 to June 2019, and built on the lessons learned of a similar pilot (Perks Phase I) completed in 2017. A grant from the Federal Transit Administration funded the project as part of a program of efforts to encourage ridership development and more efficient capacity utilization in the BART Transbay Corridor that connects San Francisco and Oakland via the underwater Transbay Tube.

## Program Overview

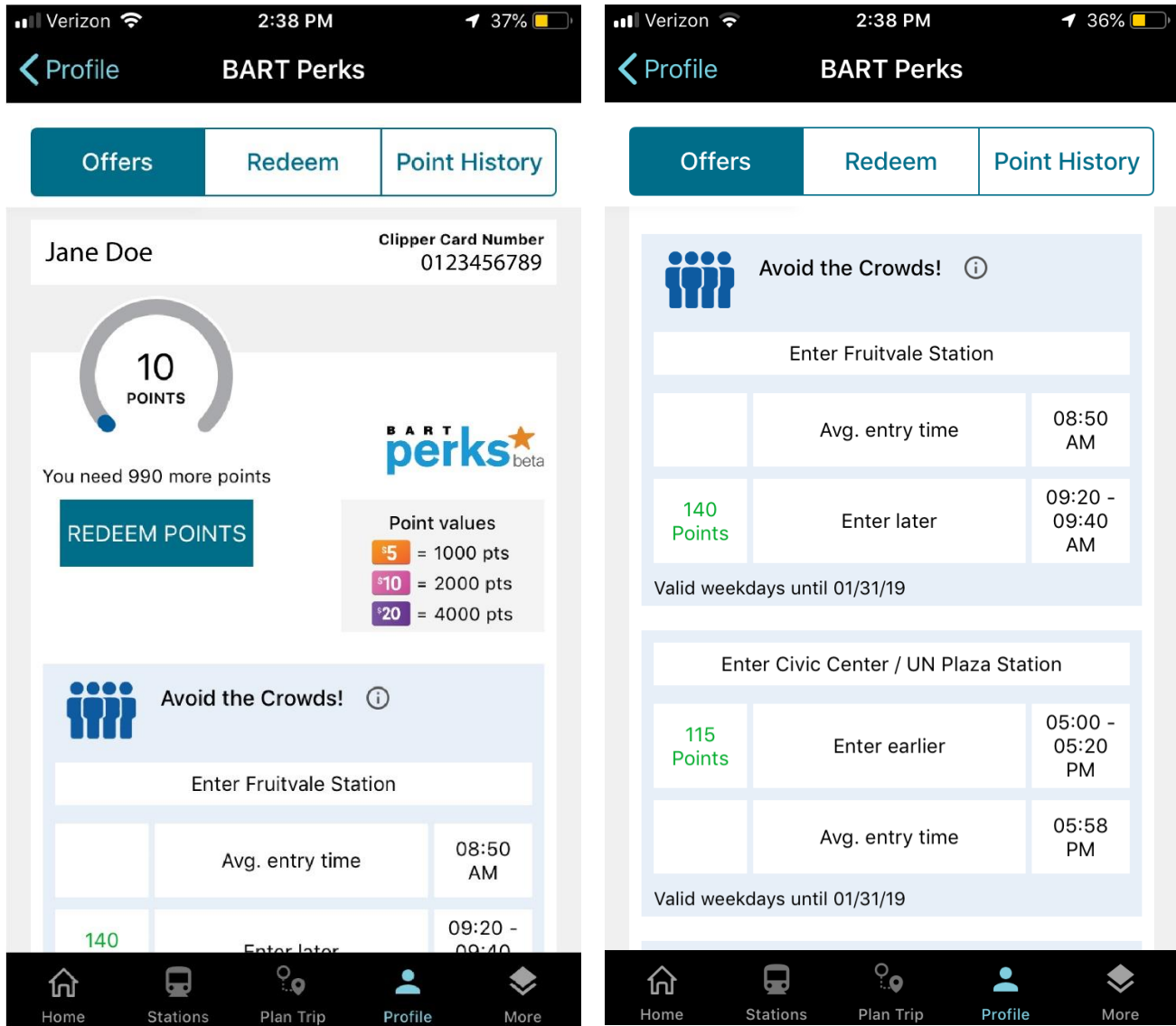
Perks Phase II offered personalized incentives to a pilot group of 1,900 BART riders with the objective of achieving a modest (approximately 5 percent) reduction in the share of travel made in congested periods. Participants were recruited from prior Perks Phase I participants and on select station platforms and were predominantly frequent commuters to downtown San Francisco stations. After registering with their Clipper smart cards, participants accessed the program via BART's website and Official Mobile Application. Participants received limited time offers to earn points by changing their typical departure time and cashed out their rewards by selecting from a variety of gift cards. To support a robust program evaluation, half the participants randomly did not receive offers to shift their commute in the first three months of the program, so their behavior could be compared to those that did receive offers.

## Incentive Offers

Participants received point offers of about \$1 per trip on average for starting their journey at a specific station (based on their most frequent entry and exit stations) and during a specific 20-minute time window (customized for the individual rider) in the morning and/or evening commute period. The incentivized time window was determined by algorithms, including a crowding predictive model, that identified whether less-crowded options were available up to forty minutes before or after the typical departure time. If a less crowded window was not identified within 40 minutes of the typical departure time, no offer was shown, based on focus group findings that users do not like being asked to make large shifts. Four types of offers were possible: morning-shift early, morning-shift late, afternoon-shift early, and afternoon-shift late.

Only regular BART riders (defined as having made at least four one-way trips on BART per week on average over the last four weeks) were eligible to receive this type of offer. **Figure ES. 1** illustrates an example shift commute offer within the BART app. Participants also received point offers designed to encourage additional trip making on evenings and weekends, or to the airport.

**Figure ES. 1: Shift Commute Offer Example**



The Perks Phase II incentive approach improved upon Phase I by providing participants with customized and dynamic, rather than static, incentive offers. Perks Phase II incentive offers were unique to the participant and tailored to their travel history, including their station origin, average departure time, and history of traveling during congested periods. Offers were updated monthly based on changes in predicted congestion patterns. In comparison, Perks Phase I provided essentially the same static incentive offering to all users regardless of whether they were already travelling at the desired times, and without taking into account whether users would be shifted to less crowded trains.

## Results

**Table ES. 1,** summarizes the program results in terms of the percentage increase in the share of participant travel made during incentivized periods, for those who received offers to shift compared

to participants who did not receive offers to shift their commute. Participants with offers increased the share of their travel during incentivized periods by between 6 and 20 percent, depending on the type of offer. Looking just at trips in the Transbay corridor, the range was 8-18%.

**Table ES. 1: Change in Share of Participant Trips During Incentivized Periods - Average Shift**

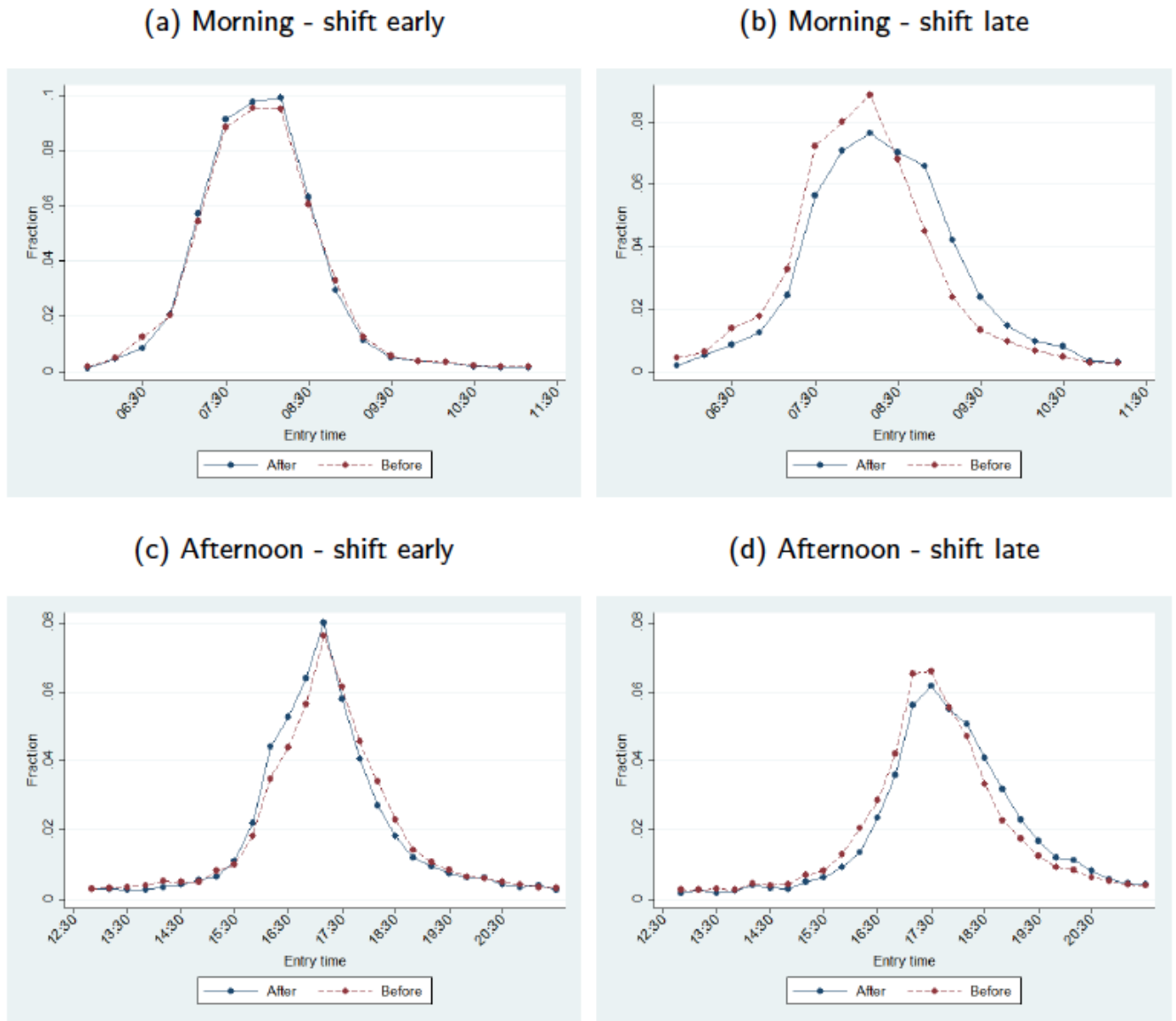
Change in Share of Travel During Incentivized Periods		
Type of Offer	All Participant Trips	Trips in the Transbay Market
Morning – shift earlier	6%	8%
Morning – shift later	19%	14%
Afternoon/evening – shift earlier	13%	15%
Afternoon/evening – shift later	20%	18%

**Note:** These percentages reflect the increase in the share of travel made during incentivized periods for those receiving the incentive compared to those who did not, from mid-December 2018 to the end of March 2019. Differences significant at the 95% confidence level.

**Figure ES.2** looks at the results another way by comparing participant travel (fraction of system entries by time period) during the program to the 3 months prior to the program, for participants who received each of the four types of offers. The shift late offers demonstrate a more visually noticeable effect in causing participants to enter the system later, compared to the shift-early offers.



**Figure ES. 2: Share of Participant Travel by Time of Day, Before and During the Perks Program, by Type of Offer**



**Note:** The “before” period refers to the three months prior to the program and the “after” period refers to the first three months of the program. The sample sizes for panels a, b, c, and d are 661, 642, 610, and 659 respectively. Participants may have received more than one type of offer.

The travel shift results indicate a strong response to the incentives overall and in comparison, to Perks Phase I, which showed about a 10% reduction in travel during the dis-incentivized peak hour. Moreover, the definition of “shift” in Perks Phase II was more robust, because it entailed shifting from a more to a less congested time window and making time shifts of 20 to 40 minutes, as opposed to shifting from one time period to another by any number of minutes (even one). Some of the strength of the response can be attributed to the participation of prior Perks Phase I users. These individuals made up about a third of Perks II program enrollment and exhibited much stronger shift results than the new recruits. Travel behavior shifts just among new recruits ranged from 5 to 16%.

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In addition to receiving offers to shift their commute time, participants received offers of between 200-500 points (\$1 - \$2.50) per trip for making additional BART trips on selected evenings and weekends and to the airport. Among eleven such offers evaluated, five resulted in statistically significant and positive increases of between 13 to more than 100% in the incentivized type of trip.<sup>1</sup>

## Participant Characteristics and Feedback

More than half of participants (about a thousand) responded to a survey administered in mid-April 2019 to gauge their feedback about the program, barriers to shifting commute behavior, and their demographic characteristics. The results indicated that most participants (about 70%) were satisfied with the program, a similar share as Perks Phase I. Overall, satisfaction was strongly related to the amount of rewards received. Top areas of feedback included requests for expanded ways to earn points, better notification of new offers through in-app push notifications, and different types of rewards (besides gift cards, and especially Clipper value) and a desire to be rewarded on an ongoing basis for riding BART, rather than just receiving limited time offers. Regarding demographic characteristics, the survey showed that the following groups were underrepresented compared to all BART riders: those identifying as non-white and non-Asian, low-income households, non-English language speakers and those without a smartphone. As expected based on the recruitment approach, Perks participants more closely reflected the demographic makeup of BART ridership to downtown San Francisco, which tends to be more affluent than BART's overall ridership.

## Cost Effectiveness and Cost to Scale

In Perks Phase II, the incentive cost per shifted trip varied over the course of the program but was approximately \$1 overall, a significant improvement over the incentive cost of \$10 per shifted trip in Perks Phase I.<sup>2</sup> The greater degree of efficiency was achieved primarily by rewarding only behavior change (e.g. change from baseline travel behavior) rather than rewarding pre-existing behavior as was done in Perks Phase I, and by expanding the eligible windows for time shift.

The study team undertook a simulation of the cost to scale the Perks program to achieve an approximately 5 percent reduction in a measure of system crowding called the total crowding score (TCS), which represents the aggregate amount of crowding (people per train car) occurring on BART, with higher weight given to more severely crowded conditions. Achieving this reduction would require a program enrollment of between 30,000 and 75,000 users (assuming a range of 10 to 20% uptake of the incentive offers), and would cost about \$1.9 million per year including \$1.2 million annually in incentives, plus an additional \$650,000 to cover program staffing, customer service,

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<sup>1</sup> The percent change was calculated by comparing the share of participant trips that were of the incentivized type among those who received the offer compared to those who did not. For example, if 3% of trips made by those who received a given offer were of the incentivized type, and 1% of trips made by those who did not receive the offer were of the incentivized type, then the total percent change in trip making attributable to the incentivize would be calculated as  $(3\% - 1\%) / 1\%$ , or a 200% increase.

<sup>2</sup> Note that this figure relates only to points earned for shift commute offers, and not to "extra reward" or survey offers.

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marketing and research, and information technology support. This analysis assumes that all enrolled users would behave similarly to the 1,900 users enrolled in the Perks pilot.

A full cost-benefit analysis was outside the scope of the study, but the following simple comparisons suggest the program is likely to be cost effective if scaled up:

- **Train car comparison:** A scaled up program that would reduce crowding (TCS) by 5% would free up an equivalent of approximately 30 train cars for an annual program cost of approximately \$1.9 million. Purchasing an equivalent amount of train car capacity (about 30 cars) would cost approximately \$6m annually (a new train car costs about \$200,000 annually, with a \$5 million up-front purchase cost over a useful life of 25 years).
- **Backfilling comparison:** Assuming each shifted trip frees up space for another fare paying passenger during peak times, the \$1 per shifted trip figure compares favorably with the approximately \$4 average fare paid by the typical commuter who might backfill the space.

## Summary Findings and Recommendations

BART Perks Phase II was one of very few international examples involving the use of personalized incentives to reduce crowding on mass transit. Perks II was unique in that incentive offers were customized to the individual and based on predicted congestion levels, as determined by a crowding predictive model. Perks II also featured a robust case-control evaluation approach that measured changes in the travel behavior of participants receiving offers and compared them to similar participants who did not receive offers at the same time. Recommendations are as follows:

**Strong results justify continued exploration of incentive programs to manage congestion.** Perks Phase II re-affirmed the core finding of Perks Phase I that meaningful travel behavior changes can be accomplished through incentive programs. The program also appears to be cost effective based on a high-level analysis, suggesting that continued investment in incentive programs is worthwhile. Some uncertainty remains regarding whether the strong results would translate to the much larger population (35,000 – 70,000) of BART riders necessary to scale up the program. Some Perks participants may have self-selected into the program based on an interest in incentives and willingness to shift. Whether enough such individuals could be found for a scaled-up program is unknown.

**The Perks platform can be leveraged to meet a range of agency goals in addition to reducing train crowding.** Once established, a program like Perks could support multiple agency goals beyond managing train congestion. Promising future uses include:

- Encouragement of additional weekend, evening, and airport travel: Perks II showed that incentives to encourage more evening and weekend transit trips can result in statistically significant increases in trip making. Future programs could further explore this potential.
- Management of station crowding. Station crowding is a major concern at the downtown San Francisco stations, and significantly increasing capacity would be very costly. Perks II did not explore reduction of station crowding, but future programs could examine whether station crowding can be reduced through incentives to shift to adjacent stations in addition to the time of travel.

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- Improved customer communication. The travel data provided by Perks could be leveraged to support more tailored and customized communications. For example, in the event of a major station closure, BART could leverage Perks data to inform Perks customers who typically travel to the affected station at that time.

**Future programs should explore even more precise targeting of congested conditions.** Incentive offers in Perks Phase II were updated monthly based on average congestion predictions for the upcoming month. The software system had the technical capability of updating offers daily, but the study team judged that too much variation in the offers could be confusing, especially given that offer updates were communicated over email rather than through push notification. Future programs could explore whether riders will respond to offers that change based on real time congestion. This could allow even more precise targeting of congested conditions and help ensure that when riders make travel shifts that they enjoy a congestion reduction benefit. About 73% of Perks participants said they frequently or sometimes experienced less crowding when entering the station at the designated time; this figure could be increased if incentives were more closely matched to real-time congestion patterns.

Even without incentives, BART can help improve conditions for riders by providing real-time updates in expected crowding conditions. More than 90% of Perks participants said they would like BART to provide predictions of train crowding.

**Future programs should consider incorporation of app-based incentive and crowding notifications.** A top request from Perks user surveys was for in-app push notifications to alert riders of new incentive offers (these were communicated only by email during the program). Future programs should consider incorporation of such notifications to maximize rider awareness of incentive offerings and crowding conditions, especially if offers are to be updated more frequently in response to real time variations in congestion.

**Future programs should examine and consider ways to ensure fair distribution of costs and benefits among riders of different incomes.** Two-thirds of BART trips start or end on Market Street in San Francisco, the area where BART crowding is most severe. Perks participants reflected the demographic make-up of BART's ridership to these stations, which tends to be more affluent compared to BART's overall ridership for the entire system. While workers of all incomes could benefit from congestion reduction, future programs will need to carefully consider and address any issues related to the potential for focusing monetary rewards on high income populations.

**Future programs should seek to include Clipper value as a reward offering.** Most Perks participants were satisfied with choosing from a variety of electronic gift cards for their rewards, but many expressed a preference for receiving Clipper smart card value instead of cash rewards or gift cards. Future programs should seek to offer Clipper value as a reward. This will be more possible once the next generation regional Clipper technology is available.

**A dedicated source of ongoing funding is necessary to scale the program.** Scaling the Perks program to provide a system-wide crowding reduction is expected to cost about \$1.9 million annually. Grant funding or merchant partnerships could defray some of these costs, but would not remove the need for a stable, ongoing source of funding. BART's operating budget is very constrained, with many potential uses for existing and new revenue sources, so new sources of funding would need to be identified.

# Introduction

The report presents the results of BART Perks Phase II, a pilot program that tested the effectiveness of using incentives to reduce crowding on BART. It ran from mid-December 2018 to June 2019, and was preceded by a similar pilot (Perks Phase I, Sept 2016 - March 2017). The report summarizes program results, compares them to the results of the Phase I pilot, and provides recommendations for future programs.

## Background

Between 2004 and 2016, ridership on the San Francisco Bay Area Rapid Transit (BART) system increased by about 40% overall and 75% in the Transbay corridor connecting San Francisco and Oakland via the underwater Transbay Tube (Figure 1), due primarily to strong employment growth in downtown San Francisco. Beginning in 2017, ridership began to decline in the evenings and weekends, but heavy congestion during commute periods remains the norm.

Figure 1: BART System Map Highlighting the Transbay Corridor



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BART is working to alleviate train congestion by expanding its fleet of rail cars, which will allow longer trains with more standing room, and through implementation of the \$3.5 billion Transbay Corridor Core Capacity Project, which will increase peak hour train frequency in the Transbay tube by about 45% by 2028. The Transbay Corridor Core Capacity Program is currently in the Engineering phase of the Federal Transit Administration's (FTA) Capital Investments Grants (CIG) Program.

Participants in the CIG program are eligible to compete for FTA Pilot Program for Transit Oriented Development Planning Grant funds, intended to encourage economic development and ridership in corridors slated for major transit investments. BART received a \$1.1 million TOD Planning Grant Development grant in 2016 for developing ridership in the Transbay corridor.

The grant funded two sub-projects: The first involved encouraging commercial development in downtown Oakland through creation of the Downtown Oakland Specific Plan, to maximize corridor throughput by leveraging existing reverse commute capacity. This report focuses on the second sub-project funded by the grant (Perks Phase II), which aimed to reduce congestion and maximize throughput in the peak direction along the corridor by incentivizing riders to shift their travel to less crowded times.

BART Perks is one of only a few international examples of projects using incentives (tied to smart card data) to reduce crowding. One prominent example is the Singapore Land Transportation Authority's Travel Smart Rewards program), which awarded points for riding during shoulder-peak times, and also provided discounted off-peak rides and employer financial incentives to support schedule flexibility.<sup>3</sup> An early evaluation found a 7.5% reduction in the average share of trips made during the peak periods during the program compared to beforehand among participants; most of this shift seems to have been to the few minutes just before the peak hour.<sup>4</sup> BART Perks Phase I, which was modeled closely on the Singapore program and used the same underlying software platform, produced a similar result of about 10% reduction in the share of peak hour travel.<sup>5</sup>

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<sup>3</sup> Singapore Land Transportation Authority. Travel Smart. <https://www.lta.gov.sg/content/ltaweb/en/public-transport/mrt-and-lrt-trains/travel-smart.html>. Accessed July 18, 2017.

<sup>4</sup> Pluntke, C., and B. Prabhakar. INSINC: A Platform for Managing Peak Demand in Public Transit. JOURNEYS, Land Transport Authority Academy of Singapore, 2013, pp. 31–39. <https://web.stanford.edu/~balaji/papers/13INSINC.pdf>

<sup>5</sup> San Francisco County Transportation Authority and the Bay Area Rapid Transit District, 2018. Evaluation Findings from the BART Perks Test Program. <https://www.sfcta.org/sites/default/files/2019-03/Lessons%20From%20Perks%20-%20Eval%20Report.pdf>. Accessed July 25, 2019.



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## BART Perks Phase II

### Program Overview

BART Perks Phase II offered incentives to a pilot group of 1,900 BART riders with the objective of achieving a modest (approximately 5 percent) reduction in the share of travel made in congested periods. A secondary objective was to encourage travel during times when BART has low ridership or excess capacity (evenings, weekends, and airport trains). After registering with their Clipper smart cards, participants could access the program via BART’s website and BART Official Mobile Application. The program provided limited time incentive offers tailored to the participant and allowed participants to cash out their rewards by selecting from a variety of gift cards. The main program objective was to test the effectiveness of using incentives to reduce crowding on BART.

### Key Differences from Phase I

BART Perks Phase I was implemented in September 2016 with a grant from the Federal Highway Administration’s Value Pricing Program. The firm (Urban Engines) that offered the underlying software behind Perks Phase I decided to discontinue their product. To implement Perks Phase II, BART worked with a new firm (Metropia, Inc.) to modify their incentives platform, which had been developed for application to roadway travel, to suit a transit environment and to benefit from the lessons learned of Perks Phase I.<sup>6</sup>

In comparison to Perks Phase I, BART Perks Phase II:

- Enrolled 1,900 people compared to 18,000, to allow small-scale testing of the new platform, which had never been tried in a transit context, unlike Perks Phase I which had been successfully deployed at scale in Singapore.
- Enrolled by invitation only. The Perks Phase II recruitment was carefully controlled to ensure sufficient participation by the target market (peak hour commuters) within the small sample of enrollees.
- Deployed through a mobile app: Phase II was deployed through the BART.gov website and the BART Official Mobile application. Perks Phase I used a separate, custom-built website and required separate login credentials.
- Featured customized and dynamic incentive offerings. Perks Phase I offered essentially the same incentives to all participants for the duration of the pilot program<sup>7</sup>, whereas Perks Phase II incentives were customized to the individual participant, and incentive offers were updated at least monthly based on changes in congestion levels and other factors.
- Provided limited-time offers rather than ongoing rewards. All Perks Phase II offers were structured as limited-time offers targeted at specific individuals, compared to Perks Phase I which provided all participants with a minimum of one point for every mile travelled on BART. Perks Phase II participants did not receive any base rewards for general BART travel.

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<sup>6</sup> The full Perks Phase I Evaluation Report is available at <https://www.sfcta.org/projects/bart-perks-test-program>.

<sup>7</sup> An exception were the “Bonus Boxes” offered during Perks Phase I, some of which were offered only to BART Riders travelling in the crowded Transbay market. See the Perks Phase I evaluation report for details.

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- Tested occasional promotional offers for weekend and evening travel, whereas Perks Phase I was focused exclusively on reducing peak period travel.
  - Paid incentives out through gift cards, whereas Perks Phase I participants were paid exclusively by PayPal. Limitations with the current Clipper card contract prevented use of Clipper as the payment mechanism for both pilots.
  - Included a case-control approach. Half of the participants in Perks Phase II did not receive offers to shift their commute during the first three months of the program, allowing comparison with those who did receive offers, and providing a robust basis for analyzing the program effectiveness (all participants received offers for evening, weekend, and airport travel throughout the program). Because Perks Phase I did not include a case control, the results of the program could not be assessed with the same degree of confidence.

## **Remainder of this Report**

The remainder of this report is organized as follows:

- Chapter 1: Experimental Design and Recruitment
- Chapter 2: Software System and Incentive Approach
- Chapter 3: Response to Incentives
- Chapter 4: Participant Characteristics and Feedback
- Chapter 5: Cost Effectiveness and Cost to Scale



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# Chapter 1: Experimental Design and Recruitment

## Experimental Design

Perks II was designed to ensure that any participant travel shifts detected could be attributable to the incentives program and not to exogenous factors. To achieve this, program participants were randomly assigned into two groups upon enrollment: the first group received offers to shift at the beginning of the program, and the second group began receiving offers to shift after the first three months. Throughout the program, both groups received additional, ongoing offers to earn extra rewards by answering survey questions or for using BART during selected evenings or weekends, or to the airport.

This approach is more robust than Perks Phase I, which did not feature a control. Instead, behavior change was evaluated by comparing travel patterns before, during, and after the program, and to all BART riders. While the evidence from Perks I strongly suggested that the behavior shifts identified during the program were attributable to the incentives, the influence of exogenous factors could not be ruled out.

The program experimental design was also setup to test whether distribution of a \$5 sign-up bonus affected enrollment and engagement, and whether prior participation in Perks Phase I made a difference in the degree of travel behavior shift shown. These objectives were achieved by randomly providing half of participants with the \$5 sign-up bonus, and by recruiting Perks Phase I participants in addition to new participants for the experiment.

## Recruitment

### Recruitment approach

The Perks recruitment aimed to achieve the following:

- Enroll regular BART commuters who typically travel to downtown San Francisco during congested times.
- Enroll about 2,000 participants, to ensure differences in behavior among participants with offers to shift and participants without could be detected with statistical significance.
- Randomly recruit about half of participants into the early and delayed offer groups.
- Randomly assign about half of participants to receive a \$5 sign up incentive.
- Include some Perks Phase I participants in the recruitment, so their behavior could be compared to those who had not participated in the first Perks.

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Participants were recruited from two sources:

- Email recruitment from Perks Phase I participants: A subset of those who participated in Perks Phase I opted in to receiving notifications from BART about future incentive programs. The study team analyzed the travel histories of these individuals (as recorded during Perks Phase I) and identified those who made at least 50 percent of their BART trips from downtown Embarcadero, Montgomery, or Civic Center stations.<sup>8</sup> An email invitation to join the Perks Phase II program was sent to a random subset of qualifying individuals.
- Distributing flyers at downtown San Francisco stations: Twelve people distributed flyers advertising the program at the Embarcadero, Montgomery and Civic Center stations in downtown San Francisco from 8:00 – 9:30 AM on December 13th, 2018, to coincide with peak commute periods.

Those invited to participate in the program (either via email or flyer) were provided with a unique sign-up code. The codes were evenly distributed into four groups:

- \$5 sign-up incentive, immediate offers to shift
- No sign-up incentive, immediate offers to shift
- \$5 sign-up incentive, delayed offers to shift
- No sign-up incentive, delayed offers to shift

The codes in these four groupings were distributed randomly when handing out flyers and sending emails. **Figure 2** presents the flyer.

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<sup>8</sup> Downtown San Francisco BART stations were the focus for recruitment because these stations have the highest commuter ridership and trains servicing them experience the highest levels of congestion in the BART system. One of the downtown stations (Powell Street) was not included in the recruitment because it also serves a large number of trips for non-commuter purposes such as shopping, recreation, and tourism.

Figure 2: Recruitment Flyer (Front and Back)

Get a \$5 gift card instantly when you sign up!



# BART Perks

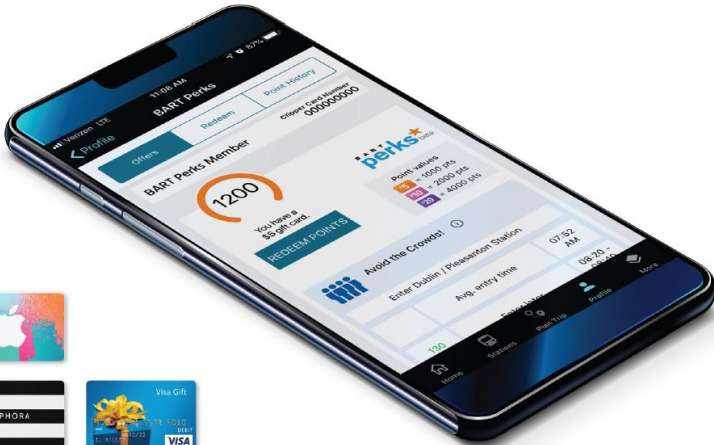
Earn gift cards just for riding

Help test BART's new Perks program and app. You'll receive special offers based on when you commute. Plus, receive bonus offers for evening, weekend and airport BART trips.

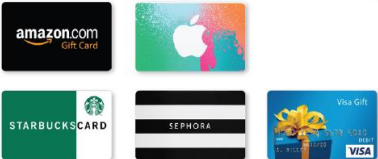
- 1 Visit [perks.bart.gov](http://perks.bart.gov) and enter code: **AX46Y**  
Then register your Clipper Card
- 2 Download the new BART app and sign in
- 3 Receive offers and earn gift cards

Participation is limited to the first 2,000 people. **Sign up now!**

Earn gift cards just for riding BART in this six-month trial program.



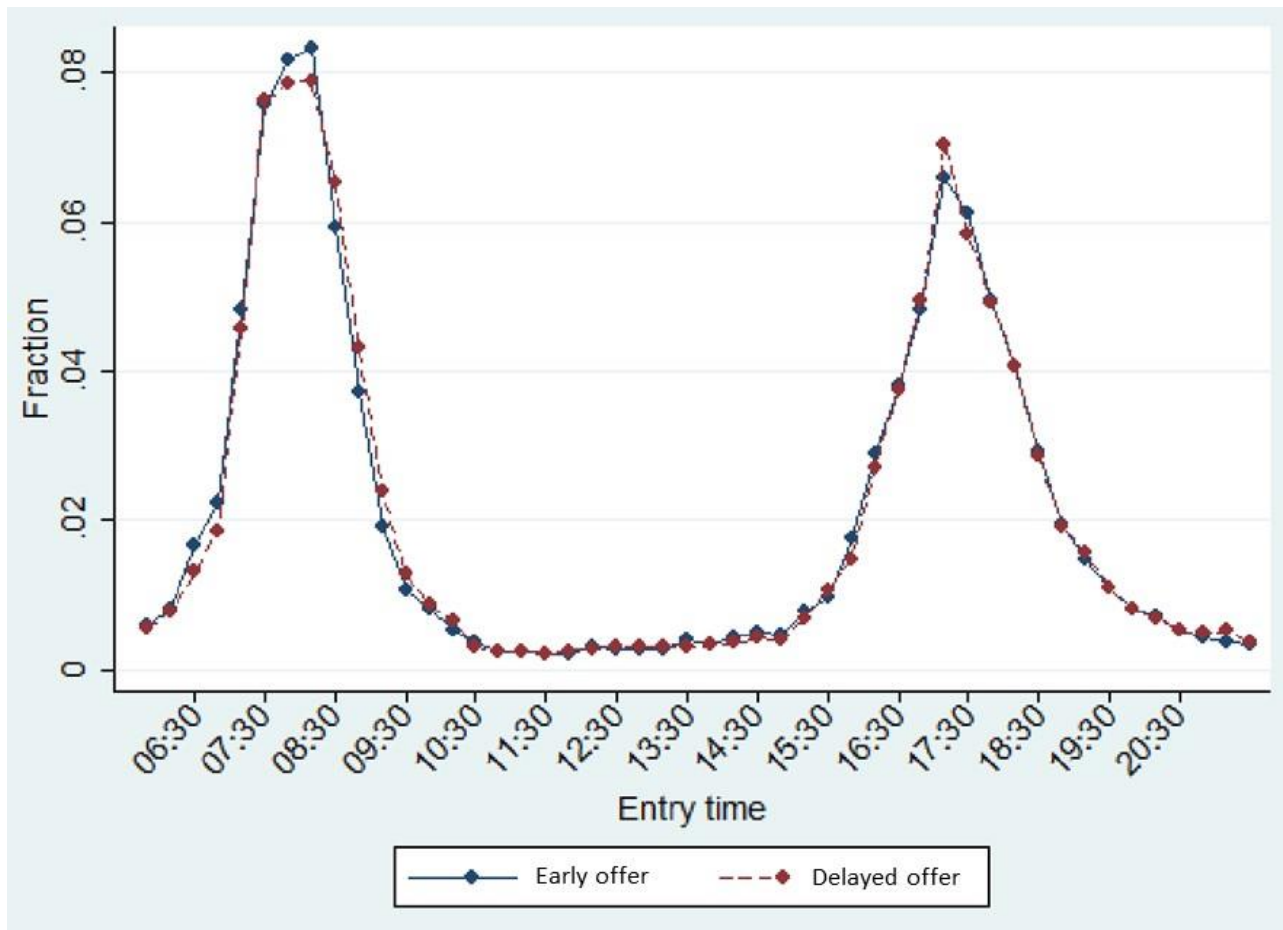
Sample gift cards:



## Recruitment results

As occurred with Perks Phase I, enrollment targets were achieved rapidly with minimal outreach. Approximately 1,900 individuals were recruited within a few days of the date of the flyering event, and the study team decided to close the enrollment at that point. Ultimately, 63% of participants were recruited through flyering and 36% through email, and 29% of those invited to participate in the program signed up. The uptake rate was essentially the same among those who received an email invitation (28%) versus a flyer (30%) and among those who received a \$5 sign up incentive (28%) versus no incentive (31%). In other words, neither the sign-up incentive nor the method of outreach had a discernable effect on the likelihood of enrollment. The recruitment also resulted in a nearly even split in enrollment within the early and delayed offer groups. Prior to the program start, these groups had nearly identical travel behavior (Figure 3), indicating that any changes in behavior during the program can be attributed to the incentives.

**Figure 3: Travel Behavior of Early and Delayed Offer Groups Prior to Program**



Note: Compares the percentage of system entries occurring in each time period in the three months prior to the program, between those who received an early offer to shift and those who did not receive offers to shift until later in the program.

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# Chapter 2: System Design and Incentive approach

## System Software Design

The Perks Phase II software system consisted of front-end systems developed by BART with consultant support (including the BART.gov website and BART official mobile applications) that communicated with several software modules provided by a vendor (Metropia) and BART databases. These systems are described below and diagrammed in **Figure 4**.

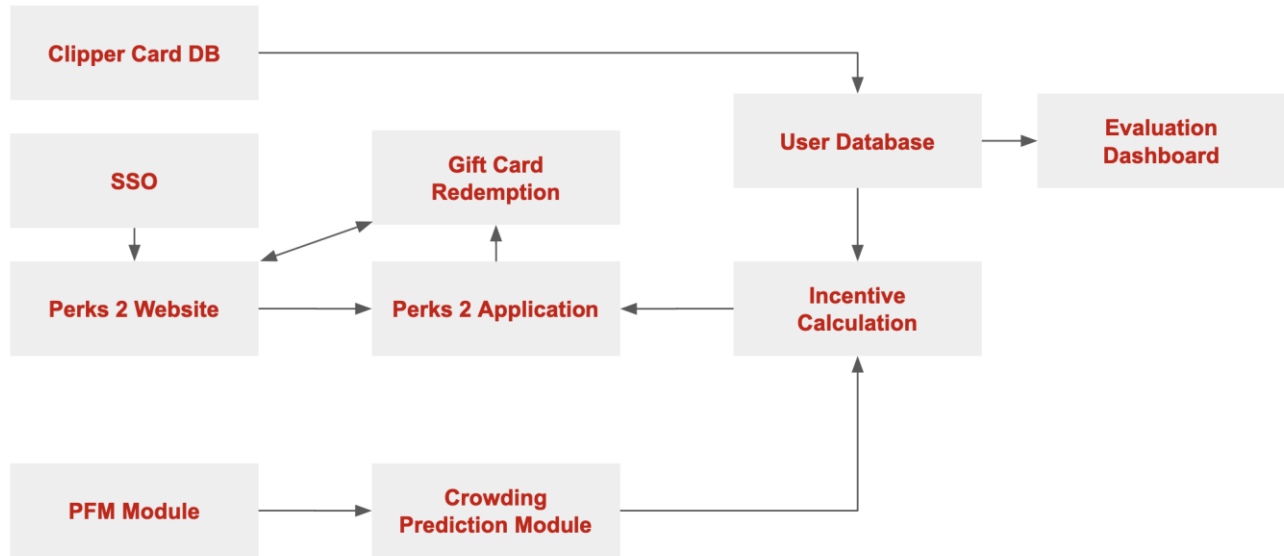
Modules provided by BART included the following:

- BART Perks web page and BART official mobile application: These are the front-end systems that interacted with the user.
- Fare gate entry and exit database: After users opted-in to the program, data from BART's fare gate entry and exit database was provided to the Metropia account management module for the purpose of calculating incentive offers and awarding points.
- Single Sign-On (SSO): This module is BART's credentialing system, which stored participants usernames and passwords, to authenticate users when they login to the Perks system.
- Passenger flow model: BART's Passenger Flow Model (PFM) calculated historic train loads based on train schedules and system entries and exits. This information was passed to Metropia's crowding prediction model, which dynamically updated its crowding predictions based on historic trends.

Modules provided by Metropia included the following:

- Perks2 Application: This module consolidated all the data needed for the Perks web page and mobile application, as well as a gift card redemption engine and administrator dashboard interface provided by third party vendors.
- User database: This included a directory of users and their trip records obtained from BART's Clipper data. This information was used to create personalized incentives and communicate with participants.
- Crowding Prediction Module: This module consisted of an algorithm that predicted train crowding levels on a pre-defined frequency, to inform the calculation of incentives.
- Incentive calculation engine: This module integrated predicted crowding levels with riders' behavior and trip data and calculated personalized incentive offers.

Figure 4: Structure of Perks Software Systems



The Perks II system design improved upon Perks Phase I in several ways. Perks II:

- Used BART’s credentialing system. Perks Phase I required users to generate a new username and password to access Perks, whereas Phase II used a standard BART user name and password that can be used for other BART purposes beyond Perks.
- Offered a package of features rather than a single-purpose website. Phase I was offered through a stand-alone, single purpose website. Perks Phase II was offered through the BART official mobile application, which also includes real-time train departures, trip planning and station information, thereby providing customers with multiple reasons to download and engage with the app.
- Provided flexibility for vendor substitution if needed. Perks Phase I was licensed from a third-party vendor, and when the vendor stopped offering the service, an entirely new software system was needed. Perks II was setup so that BART owns the front-end interfaces (website and mobile app), which communicate with vendor databases via application programming interfaces. If a change in vendor had been necessary, BART had the flexibility to maintain the same front-end user experience with back end databases provided by a new vendor.

The most significant improvement of Perks II over Perks I was the inclusion of customized and dynamic incentive offers based on the user’s travel history and predictions of expected crowding on BART based on a crowding prediction model developed as part of the project. Perks Phase I provided the same static incentive scheme to all users, and for simplification purposes, assumed that congestion patterns do not vary spatially and do not change over time.

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## Incentives and User Interface

Perks participants could receive three types of offers:

- Shift commute offers: These provided users with points for entering BART up to forty minutes before or after their typical entry time, to reduce travel during congested times.
- Extra reward offers: These offers provided users with points for making evening, weekend, and airport BART trips at specific times and for specific stations.
- Survey offers: Users received points for answering a single survey question offered through the mobile app. These were primarily designed to encourage engagement with the app. Users also received points for completing a longer survey administered in April via Qualtrics.

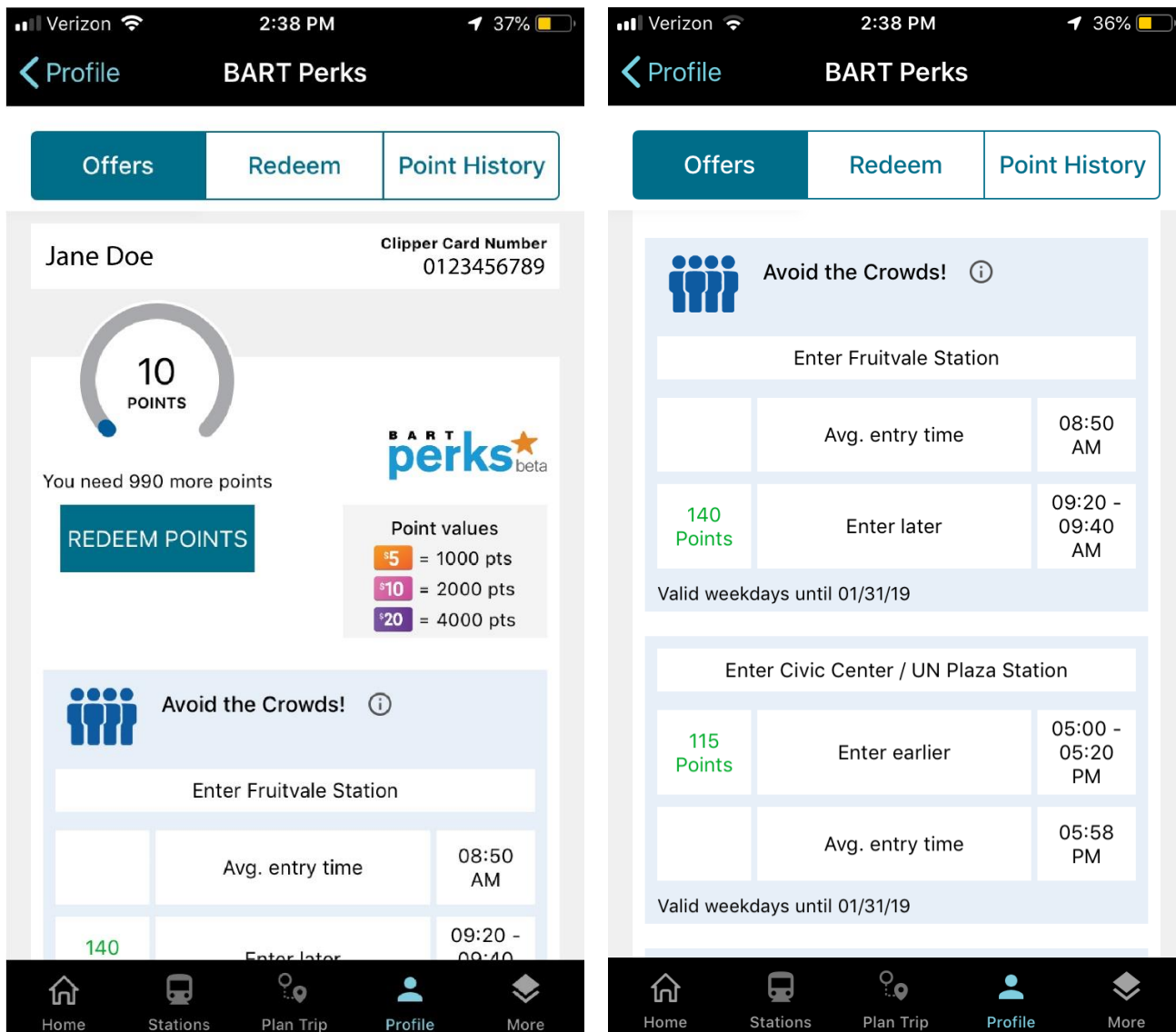
Offers were communicated to users following their enrollment in the program by email, and users could view their offers by logging into the Perks section of the BART website or mobile application. Unlike a traditional rewards program, and in contrast to Perks Phase I, these offers were provided for a limited time only, and users did not receive points for every trip taken on BART. Offer types are discussed in more detail below.

### Shift commute time offers

Shift commute offers provided users with points (ranging from 50 to 200 per trip) for entering their most frequently-visited station at a specific 20-minute time window during the morning and/or evening commute period. The time window shown was up to 40 minutes before or after their typical entry time and optimized so that if the individual entered the station at the incentivized time, net crowding on BART would be reduced. Users could receive up to four commute-related point offers (shift early AM, shift late AM, shift early PM, shift late PM). Only regular BART riders (defined as having made at least four one-way trips on BART per week on average over the last four weeks) were eligible to receive this type of offer. The offer particulars (amount, timing, and station) were determined by an algorithm that drew upon the participants travel history and the crowding predictive model. **Figure 5** illustrates an example shift commute offer.



Figure 5: Shift Commute Offer Example (Page 1 and 2)



To identify the right incentive time windows, the Perks algorithm identified the user’s typical departure time and then calculated the predicted crowding reduction benefit of shifting this user to one of the adjacent time periods. If no benefit would occur from shifting the user, then no offer would be shown. Similarly, no offer was shown if achieving crowding reduction would require the user to make larger shifts (beyond up to 40 minutes from their average departure time). This was based on feedback from user focus groups that individuals did not wish to make large shifts in their commute and perceived the program negatively if they thought that large shifts would be required. The algorithm assumed that everyone who receives a point offer shifts to the incentivized window and calculated the optimal number of people to shift to avoid over-congesting the incentivized window.



## Extra Reward Offers

All Perks participants received point offers designed to encourage additional trip making on evenings and weekends, or to the airport. **Table 1** lists the offers provided during the program. Participants were equally and randomly divided into two groups (A and B) for the purpose of evaluating the effectiveness of these offers. Each group A and B was comprised of half of the early offer and half of the delayed offer group described in the prior section. In the first two and a half months of the program, Groups A and B received the same extra reward offers. Beginning in March, 2019, different offers were provided to each group at different times so their effectiveness could be evaluated. Offers ranged between 200 to 500 points (\$1 – 2.50) per qualifying trip. Participants could make no more than 3 reward trips in a given day.

**Table 1: Extra Reward Offers**

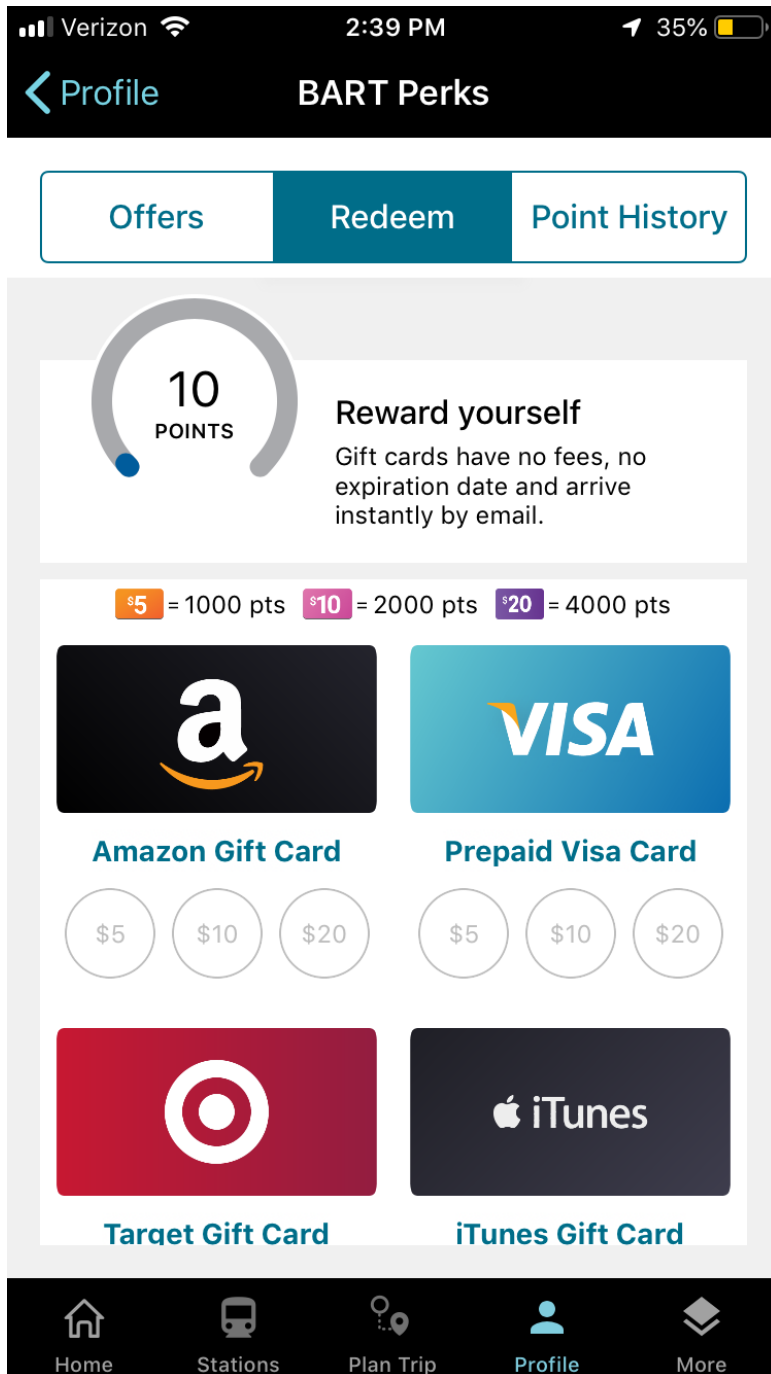
	<b>Group A</b>	<b>Group B</b>
<b>Mid-Dec 2018</b>	Take BART to the airport	Take BART to the airport
<b>January 2019</b>	Take BART to the airport	Take BART to the airport
<b>February 2019</b>	Enjoy the Bay Lights – Exit Embarcadero Station on weeknights after 7 PM	Enjoy the Bay Lights – Exit Embarcadero Station on weeknights after 7 PM
	Ride BART with your sweetheart on Valentine’s weekend	Ride BART with your sweetheart on Valentine’s weekend
<b>March 2019</b>	Enjoy the Macy’s Flower Show - Exit Powell Street Station March 30 <sup>th</sup> /31 <sup>st</sup>	Cheer the St Patrick’s Day Parade – Ride BART on March 16 <sup>th</sup>
	Oakland Art Murrum Exit 12 <sup>th</sup> or 19 <sup>th</sup> Street Oakland Stations on Friday March 1 <sup>st</sup>	
<b>April 2019</b>	Ride BART to the A’s - Exit Coliseum Station April 20 <sup>th</sup> or 21 <sup>st</sup>	Enjoy the Macy’s Flower Show - Exit Powell Street Station April 6 <sup>th</sup> & 7 <sup>th</sup>
	Explore the Bay! Ride BART on Saturdays in April	Spring getaway – ride BART to the airport
<b>May 2019</b>	Spring getaway – ride BART to the airport	Explore the Bay! Ride BART on Saturdays in May
	Oakland Art Murrum Exit 12 <sup>th</sup> or 19 <sup>th</sup> Street Oakland Stations on Friday March 1 <sup>st</sup>	Ride BART to the A’s - Exit Coliseum Station May 4 <sup>th</sup> , 5 <sup>th</sup> , 25 <sup>th</sup> & 26 <sup>th</sup>

	<b>Group A</b>	<b>Group B</b>
<b>June 2019</b>	Explore the Bay! Ride BART on Saturdays in June	Spring getaway – ride BART to the airport

**Point redemption**

Users viewed their point history and redeemed points by logging into the Perks section of the BART website or mobile application. Upon redemption, the user instantly received a gift-card code via email. Users selected from among ten gift cards including pre-paid Visa, Amazon, Target, iTunes, eBay, Starbucks, Walmart, Best Buy, Sephora, or the Tango gift card (redeemable at more than 60 additional retailers such as Google Play, Nordstrom, Pottery Barn, REI, Barnes and Noble, and CVS, and with more than fifteen charities). Gift card options were selected based on the top-ten most searched for gift cards nationally according to WalletHub.com, with some modifications to prioritize gift cards that provide the most flexibility and were readily available through an off-the-shelf provider of national gift card choices. The team did not pursue gift card options with local merchants for the pilot period, but such options could be pursued for future deployments. Figure 6 shows the point redemption page.

Figure 6: App Redemption Page



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## Chapter 3: Response to Incentives

This chapter describes the user response to incentives, including the number of points accumulated, gift cards redeemed, and travel shifts made in response to point offers.

### Point Accrual and Redemption Patterns

Perks users accumulated about \$23,000 in point value over the course of the program, or approximately \$12 per participant over a six-and-a-half-month period (\$1.80/participant/month on average). Looking just at rewards associated with commute offers, this figure drops to about \$7 per participant total. **Table 2** shows the distribution of points by user and **Table 3** shows the share of rewards by type.

**Table 2: Share of Users by Reward Value (Cumulative Over the Program)**

Dollar Value of Points Accumulated	Share of Participants
Greater than \$50	1%
\$30 - \$49	4%
\$10 - \$29	43%
\$5-\$9	32%
Less than \$5*	19%

\*Point values of less than \$5 were not redeemable, so effectively these individuals did not receive any rewards.

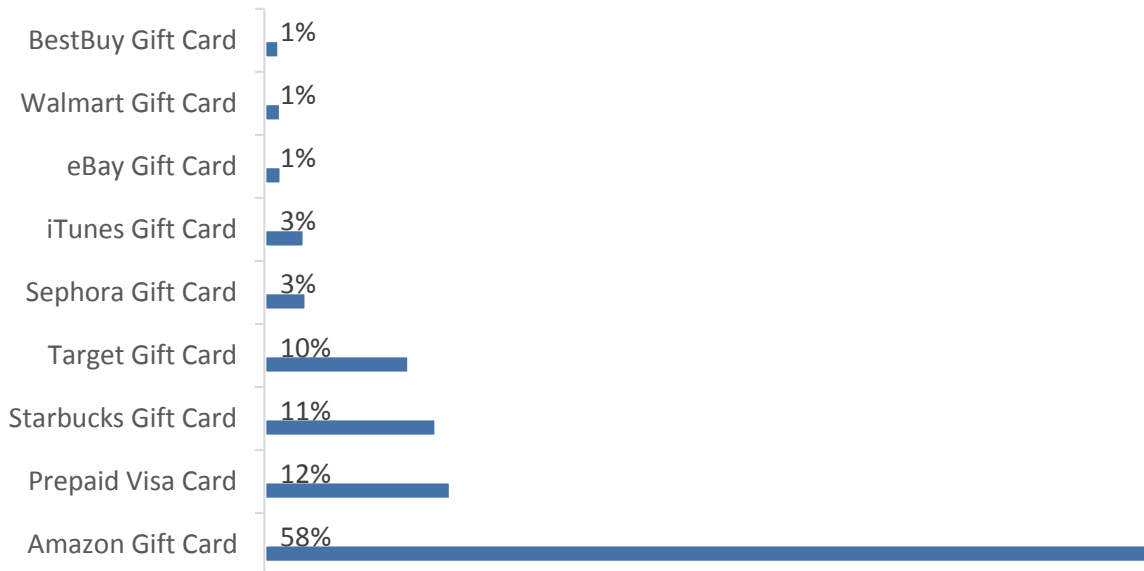
**Table 3: Share of Rewards by Reward Type**

Type of Offers	Point Value per Offer	Share of Total Rewards
Shift commute	50 – 200 points (\$0.25 - \$1.00)	56%
Extra offers	200 - 500 points (\$1.00 - \$2.50)	22%
Survey question	5 points (\$0.03)	1%
Sign up incentive	1,000 points (\$5.00)	20%

Note: Figures do not total to 100% due to rounding.

As of a month following the end of the program, \$13,400 of the total \$23,000 of rewards had been redeemed. This represents about 80% of the value that was eligible to redeem (after subtracting out points less than 1,000, the minimum threshold for redemption). Among those who redeemed rewards, Amazon was the most popular gift card choice by far. **Figure 7** shows the percentage of program rewards by type of reward.

**Figure 7: Share of Redeemed Value by Type of Card**



## Response to Shift Commute Incentives

This section summarizes the participant response to receiving offers to shift their commute time. Participant’s response to these offers was evaluated by comparing their travel times to the travel times of participants who did not receive offers to shift their commute during the same month, and by comparing participant travel behavior before and during the program. The evaluation results reflect the first half of the program (mid December 2018 through end of March 2019). For the remainder of the program (April to June 2019), offers to shift were provided to most participants, making the program results from that period more difficult to ascertain.

### Overall Shift Results

Participants increased the share of their travel during incentivized periods by between 6 and 20%, depending on the type of offer (**Table 4**). Looking just at trips in the Transbay corridor, the range was 8-18%. These percentages reflect the increase in the share of travel made during incentivized periods for those receiving the incentive compared to those who did not. These results are substantially higher than the shift figures calculated for Perks Phase I, which showed about a 10% reduction in travel during the dis-incentivized peak hour.

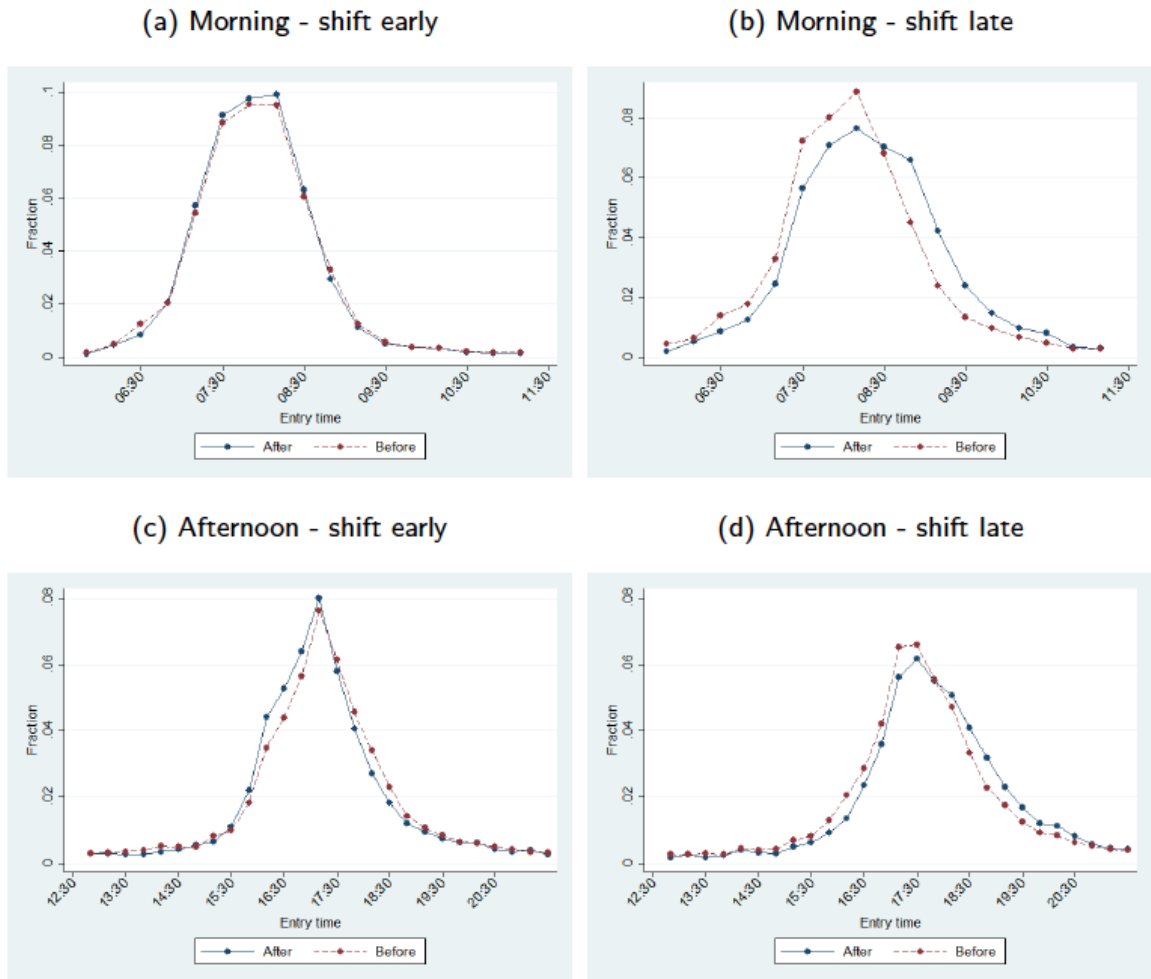
**Table 4: Change in Share of Participant Trips During Incentivized Periods - Average Shift**

Type of Offer	Change in Share of Travel During Incentivized Periods	
	All Participant Trips	Trips in the Transbay Market
Morning – shift earlier	6%	8%
Morning – shift later	19%	14%
Afternoon/evening – shift earlier	13%	15%
Afternoon/evening – shift later	20%	18%

Note: These percentages reflect the increase in the share of travel made during incentivized periods for those receiving the incentive compared to those who did not, from mid-December 2018 to the end of March, 2019. These results are statistically significant at the 95% confidence level.

**Figure 8** looks at the results another way, by comparing participant travel (fraction of system entries by time period) during the program to the 3 months prior to the program, for participants who received each of the four types of offers. The shift late offers demonstrate a more visually noticeable effect in causing participants to enter the system later, compared to the shift-early offers.

**Figure 8: Share of Participant Travel by Time of Day, Before and During the Perks Program, by Type of Offer**



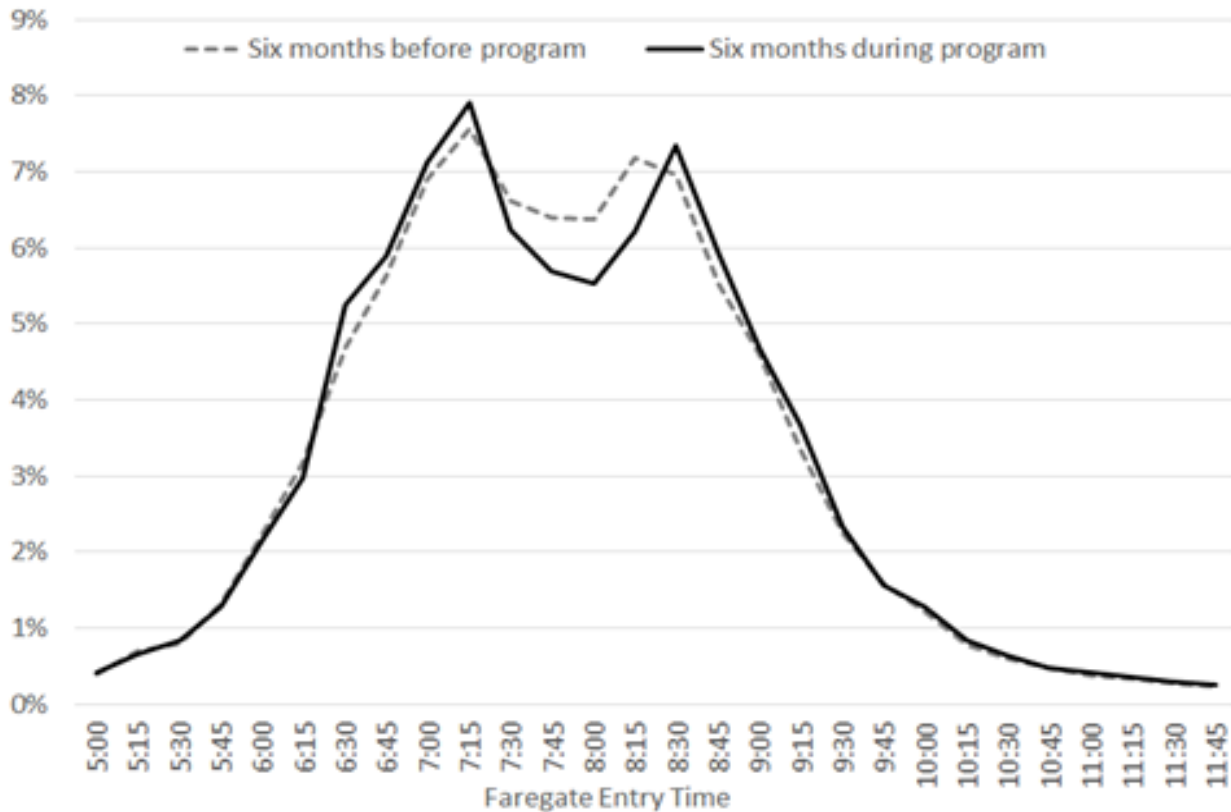
**Note:** The “before” period refers to the three months prior to the program and the “after” period refers to the first three months of the program. The sample sizes for panels a, b, c, and d are 661, 642, 610, and 659 respectively. Participants may have received more than one type of offer.

The travel shift results indicate a strong response to the incentives overall and in comparison, to Perks Phase I, which showed about a 10% reduction in travel during the dis-incentivized peak hour. Moreover, the definition of “shift” in Perks Phase II was more robust. In Perks Phase II, “shift” entailed moving from a more congested to a less congested time window, as determined by a crowding predictive model and associated algorithm, and shifts were made of between 20 and 40 minutes away from the individuals prior average departure time. The algorithm also checked to ensure that moving an additional trip to the adjacent window would not just transfer congestion from one time period to another. In Perks Phase I by contrast, “shift” was defined as moving a trip from the 7:30 – 8:30 time window to any other period in the morning, regardless of the difference in departure time (e.g. traveling at 7:29 A.M. would be considered a shift), or whether the adjacent time window and train were congested or not. This difference can be seen when comparing before and after plots of Perks Phase I and II. Phase I (**Figure 9**) shows a spike in travel just before and after the



7:30 – 8:30 time window, whereas Phase II (**Figure 8**) shows a smoother shifting of travel in the desired direction.

**Figure 9: Inbound A.M. Transbay Participant Trips Before and During BART Perks Phase I Program**



### Comparison of Prior Perks Participants to New Participants

About one third of Perks Phase II participants were recruited from a list of Perks Phase I participants who had previously opted-in to receive updates from BART about future incentives programs. Their choice to opt-in to future communications suggests a high level of interest in incentive programs, potentially translating into a higher propensity to make travel shifts. To investigate this, the travel behavior of prior Perks participants was compared with new recruits. **Table 5** presents the results and shows that prior Perks participants were indeed significantly more likely to make travel behavior shifts, especially in the morning. These findings suggest that the behavior change results among prior Perks participants are higher than what would be expected for typical participants should the program be scaled up.

**Table 5: Comparison of Behavior Change Between Prior Perks Participants and New Recruits**

Type of Offer	Change in Share of Travel During Incentivized Periods	
	Prior Perks Phase I Participants	Non-Perks Phase I Participants
Morning – shift earlier	19%	5%
Morning – shift later	31%	6%
Afternoon/evening – shift earlier	21%	15%
Afternoon/evening – shift later	27%	16%

Note: Differences significant at the 95% confidence level.

### Evaluation of Morning-Only Offers

During the month of April, a program variation was tested in which participants only received offers to shift their commute during the morning. This was done to establish whether encouraging people to change their AM commute time also changes their PM commute time. No clear evidence was found to suggest that people who commuted earlier or later in the AM time as a result of the offers change their PM commute time.

### Response to Evening, Weekend, and Airport Incentives

In addition to receiving offers to shift their commute time, participants also received offers encouraging them to make additional BART trips on selected evenings and weekends and to the airport (referred to as “Extra Rewards” offers). These Extra Reward offers were not advertised by email to participants, to avoid distracting from the commute shift offers, which were the main focus of the program. Participants could discover the extra offers by logging into the Perks program interface and scrolling down to see additional offers listed below any offers they received to shift their commute time. **Table 6** lists a subset of the offers (those that had been provided to all participants as of mid-April 2019 when the participant survey was fielded) and shows that with the exception of the “Take BART to the Airport” offer (which ran for almost two months, longer than other offers), only 18-21% of participants noticed the offers they were given

**Table 6: Which of the Following Offers to Earn Points Do You Remember Seeing?**

<b>Offer Name</b>	<b>% Reporting they saw the offer</b>
Enjoy the Bay Lights! Exit Embarcadero after 7 pm	18%
Ride BART with your Sweetheart: Ride BART Feb 16 and 17	18%
Take BART to the airport: Exit from SFO or OAK	56%
Enjoy the Macy's Flower Show: Exit at Powell St. Station	21%
Enjoy the Bay Lights! Exit Embarcadero after 7 pm	18%

Note: N = 1017. Survey was distributed in April 2019, so offers made in May and June were not included. List only includes offers shown to both A and B groups.

As described in the prior chapter, the same Extra Rewards offers were initially provided to all participants. The effectiveness of these early offers is not evaluated in this report, because of lack of comparison group. Beginning March 2019, participants were randomly assigned to an A and B group (different from the groups used to evaluate the commute offers), and each group received different offers at different times for the remaining months of the program, so their effectiveness could be evaluated. **Table 7** lists the offers and their value.

**Table 7: Extra Reward Offers (March 2019 – June 2019)**

#	Offer Title	Point Value	Offer Rules
1	Oakland Art Murmur (Encourage evening travel)	300	Exit 12 <sup>th</sup> or 19 <sup>th</sup> Street Oakland Stations on Friday March 1st, 5-9 PM
2		500	Exit 12 <sup>th</sup> or 19 <sup>th</sup> Street Oakland Stations on Friday May 3 <sup>rd</sup> , 5-9 PM
3	Cheer the St Patrick’s Day Parade (encourage weekend travel)	200	Ride BART on March 16 <sup>th</sup>
4	Enjoy the Macy’s Flower Show (encourage weekend travel)	300	Exit Powell Street Station March 30 <sup>th</sup> or 31 <sup>st</sup>
5		300	Exit Powell Street Station April 6 <sup>th</sup> or 7 <sup>th</sup>
6	Explore the Bay! (encourage weekend travel)	200	Ride BART on Saturdays in April
7		200	Ride BART on Saturdays in May
8	Ride BART to the A’s (encourage weekend travel)	300	Exit Coliseum Station April 20 <sup>th</sup> or 21 <sup>st</sup>
9		300	Exit Coliseum Station May 4 <sup>th</sup> , 5 <sup>th</sup> , 25 <sup>th</sup> & 26 <sup>th</sup>
10	Spring getaway (encourage airport travel)	500	Exit SFO or OAK in April
11		500	Exit SFO or Oak in May

Five of the offers listed above resulted in a positive and statistically significant effect on travel behavior. **Table 8** shows those five offers and their result. Effects ranged from a 13 to 169% difference between the share of trips made in the incentivized period between the test and comparison groups. These results indicate that incentives hold promise for encouraging additional evening and weekend travel.

Note however, that the absolute change in trip-making associated with most of these offers was quite small. For the “Ride BART to the A’s” incentive example, less than half a percent of the treatment group, or 4 people, made the requisite trip (exit Coliseum station on April 20<sup>th</sup> or 21<sup>st</sup>). This is in part because most offers were narrowly defined (exit a specific station on a specific day), and because, as described above, most participants did not notice the offers they were given. To fully understand the potential of programs such as Perks to encourage evening and weekend travel,

further testing would be necessary, as would better promotion of the offers to ensure they are noticed.

**Table 8: Participant Response to Extra Reward Offers**

#	Offer Title	Offer Rules	Share of Trips – No offer	Share of trips- with offer	Increase attributable to offer
2	Oakland Art Murmur (Encourage evening travel)	Exit 12 <sup>th</sup> or 19 <sup>th</sup> Street Oakland Stations on Friday May 3 <sup>rd</sup> , 5-9 PM	3.5%	5.4%	55%
3	Cheer the St Patrick’s Day Parade (encourage weekend travel)	Ride BART on March 16 <sup>th</sup>	6.9%	7.8%	13%
4	Enjoy the Macy’s Flower Show (encourage weekend travel)	Exit Powell Street Station March 30 <sup>th</sup> or 31 <sup>st</sup>	0.9%	1.6%	67%
5	Enjoy the Macy’s Flower Show (encourage weekend travel)	Exit Powell Street Station April 6 <sup>th</sup> or 7 <sup>th</sup>	1.0%	1.2%	23%
8	Ride BART to the A’s (encourage weekend travel)	Exit Coliseum Station April 20 <sup>th</sup> or 21 <sup>st</sup>	0.2%	0.4%	169%

Note: All differences are significant at the 95% confidence level.

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## Response to \$5 Sign-Up Incentive

As noted previously, half of participants were recruited with a \$5 sign up bonus to test whether it would encourage higher rates of enrollment and/or higher propensity to shift. The latter question stemmed from a Perks Phase I finding that those who received higher rewards early in the program showed greater propensity to shift throughout the pilot.

The \$5 bonus did not affect rates of program enrollment. In fact, the share of those who chose to enroll was slightly higher among those who received no bonus. The bonus did appear to impact travel behavior during the program, but not in the manner expected based on Perks Phase I results. Those who received the early offers to shift their commute, and who received the \$5 bonus earned 88 points less on average than those who didn't, indicating that the bonus may have slightly decreased their likelihood of following the offers they were given. Conversely, those who received the delayed offers to shift and received the \$5 bonus earned 129 points more on average than those who did not get the bonus. These results suggest that the \$5 bonus was helpful only in that it stimulated some program engagement among those who did not get other forms of rewards early in the program.

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# Chapter 4: Participant Characteristics and Feedback

This chapter describes participant characteristics, based on analysis of their travel trends and the results of a participant survey distributed in April 2019 (mid-way through the program), including participant demographic characteristics, feedback about the program, and ability to shift their schedules. More than half of participants (about a thousand) responded to the survey.

## Travel Characteristics

Both the Perks Phase I and II recruitments focused on enrolling commuters in the Transbay Corridor by targeting outreach efforts in the downtown San Francisco Station, but the recruitment strategies had several key differences. The Perks Phase I recruitment took place over several days, anyone could register, and the program was publicized by a press release that was picked up by more than 20 local news outlets. The Perks Phase II recruitment was done via distributing flyers for a single hour on a single day as well as through email, was not advertised, and an individualized coupon code was required to participate. In spite of these differences, the recruitments enrolled similar types of individuals.

**Table 9** below compares the percentage of participants who were regular commuters and travelled regularly in the Transbay market and shows that these characteristics were very similar across the two pilots, with a slightly higher concentration of Transbay riders in Perks Phase II.

**Table 9: Share of Transbay Trips and Commuters by Perks I and Perks II**

	Perks I	Perks II
Share of Transbay trips	69.4%	73.8%
Share of commuters	65.7%	65%

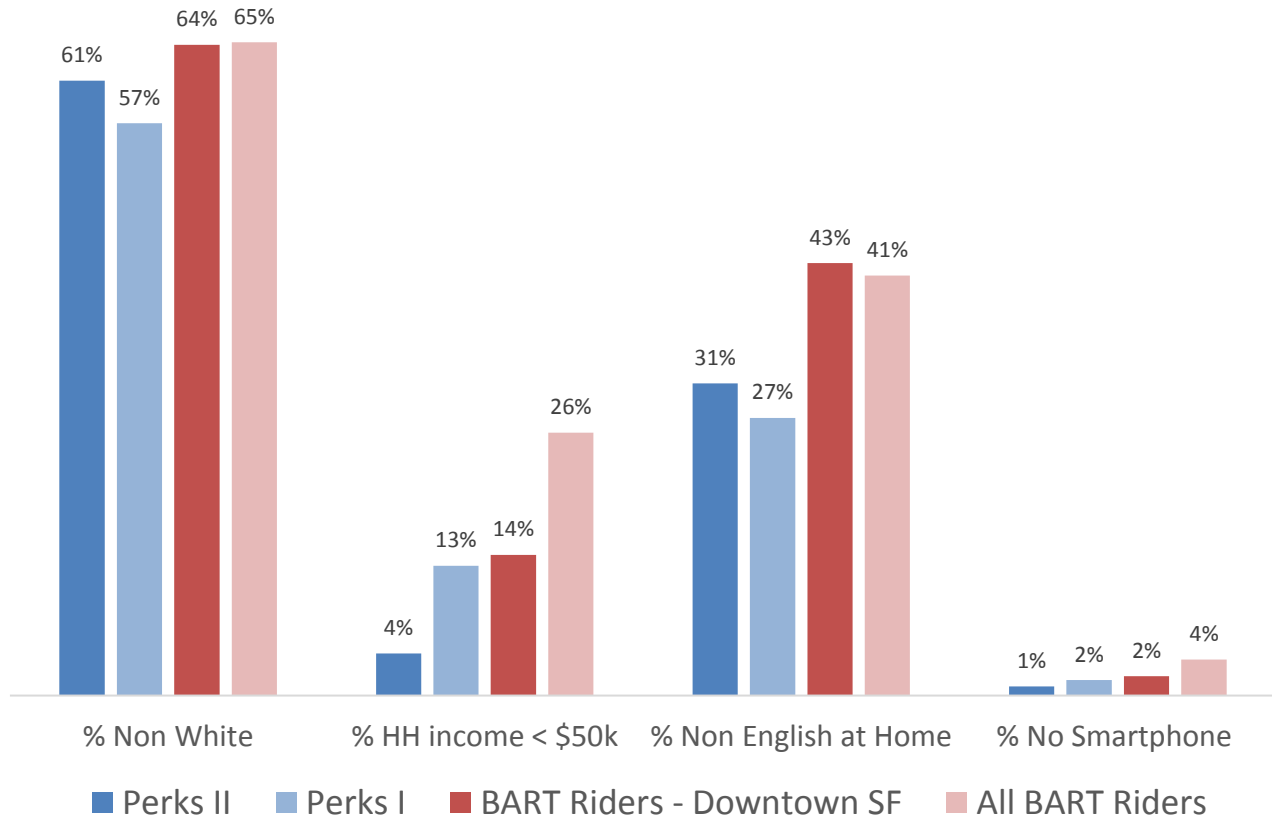
Note: Share of Transbay trips are share among all trips. Share of commuters is number of users who had at least 8 trips per week for a median week. Perks Phase II characteristics reflect patterns up through March 2019.

## Demographic Characteristics

Perks Phase I Participants were asked to report their demographic and personal characteristics including their ethnicity, household income, whether they speak a language other than English at home, and whether they have access to a smartphone. **Figure 10** compares their responses to those of Perks Phase I participants, all BART riders, and BART weekday riders to downtown San Francisco stations. It illustrates that Perks Phase I and II participants had similar characteristics, and in both pilots, non-whites and non-Asians, low-income households, non-English language speakers and those without a smartphone were under-represented compared to all BART riders, and to a lesser extent, compared to BART downtown commuters. As expected based on the fact that recruitment took

place in downtown San Francisco during peak times, Perks participant characteristics match more closely with BART commuters to San Francisco than they do with BART riders as a whole.

**Figure 10: Comparison of Demographic Characteristics of Perks Phase I & II participants and all BART riders**



**Notes**

Perks Phase II Survey (n=1,007) administered April 2019.

Perks Phase I Survey (n=10,351) reflects the combined results of two similar surveys administered fall 2017 and spring 2018.

BART Riders – Downtown Commuters (n=1693) reflects the weighted results of the BART Customer Satisfaction Survey, administered fall 2018, but limited to respondents who reported entering or exiting BART in downtown San Francisco (Embarcadero, Montgomery, Powell, Civic Center Stations) and if the survey was collected on a “weekday peak” train (train run dispatched from end of line between 5:30-8:30 AM or 3:30-6:30 PM on a weekday).

All BART Riders” reflects the weighted results of the BART Customer Satisfaction Survey (n=5,294), administered fall 2018.

All differences between the Perks Phase I, Phase II, and all BART Riders groups are statistically significant at the 95% confidence level, with the exception of the difference between the share of smartphone users between Perks Phase I and II. The significance of differences with the BART Riders – Downtown Commuters group was not evaluated.

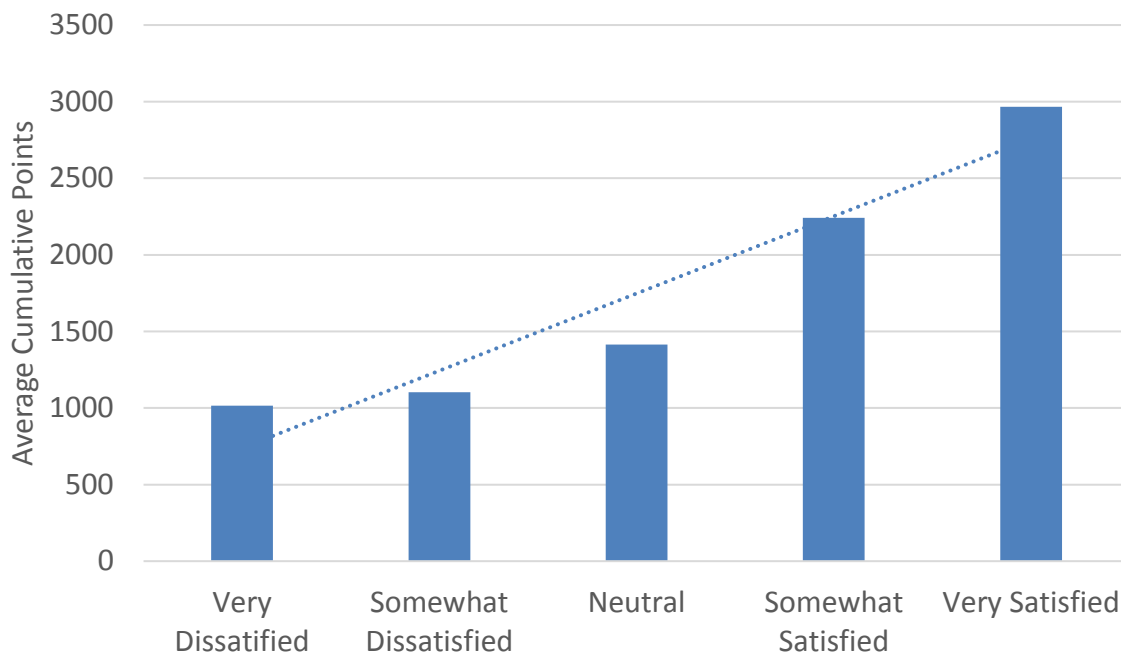


# Customer Feedback

## Satisfaction

Customer response to the Perks program was gauged via an online survey administered in early April, 2019. Responses are indicated only for the group that received early offers to shift, since the delayed offers group would have just begun receiving such offers. The early offer group reported 65% satisfaction (with 37% somewhat and 27% very satisfied) with the program. As shown in **Figure 11** satisfaction was closely correlated with the amount of rewards received.

**Figure 11: Average Cumulative Points Earned Compared to Satisfaction with the Perks II Program**



Notes: Reflects cumulative points earned up to mid-April, 2019, when the satisfaction survey was administered. N=1071.

These satisfaction rates are comparable to, or somewhat lower than, results from Perks Phase I. During Perks Phase I, two similar surveys were administered to the same group of participants. The first (from December 2016), indicated satisfaction levels of 68%, but this rose to 78% by the time the second-round survey was completed in February 2017.

Nevertheless, the plurality of Perks II early-offer participants who had previously participated in Perks Phase I indicated a preference for the new program: 43% indicated they liked the new Perks better than the old, and 22% said they liked the old Perks better. The remainder said they liked them both the same or didn't know.

About 600 respondents provided open ended responses about the program. Based on a randomly-selected sample of 100 of these responses, the top comments related to:

- Desire for more/expanded ways to earn points (19% of comments)
- Desire for in-app or push notifications to ensure they were made aware of the point offers (18% of comments)
- Desire for different types of reward (besides gift cards) (12% of comments)

- 
- Desire to be rewarded on an ongoing basis for riding BART, rather than having just limited time offers (10% of comments)

In comparison, the top responses from the Perks Phase I program (based on a qualitative classification of more than 6,000 open-ended survey comments submitted) included a desire for expanded ways to earn points (about 30%), different types of rewards (about 20%), and a concern that the rewards were too low (about 18%). Far fewer respondents in Phase II expressed concern about rewards being too low (about 3%). In Perks Phase I, a typical commute reward trip earned less than \$0.10<sup>9</sup>, whereas a typical commute reward trip in Perks II earned about \$1.

Customers were also asked about their satisfaction with receiving various electronic gift cards as the form of reward. About 74% of the A group indicated “very or somewhat” satisfied. This appears to be comparable to the satisfaction experienced with use of PayPal for Perks Phase I, although comparisons are difficult because the Perks Phase I question was asked on a 4-point scale (Excellent, Good, Only Fair, Poor), whereas Perks Phase I was asked on a 5-point scale. About 70% of Perks Phase I participants rated use of PayPal for rewards “excellent” or “good.”

### Responses to Commute Offers

Participants were asked about various factors that might have influenced whether they followed the commute offer they were given.

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<sup>9</sup> This value is based the exchange value of points to dollars. The actual payout varied by individual, because most rewards were paid out via a random rewards generator (Spin to Win Game), in which participants could receive nothing for their points or a value of up to as much as \$100 at a time.

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**Table 10** shows the results. The top barrier listed was shifting commute time (34% indicating they could rarely or never do so). This was followed by the burden of having to check the offers and remember when to enter the station. The offer point value not being high enough was also cited as an issue, but not by as much of a margin. Less than a third of individuals said that they did not experience a crowding reduction as a result of the offer. This indicates that in the majority of instances, the shift offers functioned as intended to encourage travel at less crowded times.

**Table 10: Percentage of Participants by Barriers to Following Shift Commute Offers**

	<b>% Answering Rarely or Never</b>
I can shift my typical commute time by 20-40 minutes	34%
I check my offers to see how to earn points	31%
I can remember when I need to enter the station	31%
When I enter at the designated time, I experience less crowding	27%
The offer points are high enough to interest me	26%
The offers are for a station I use frequently	8%

### Ability to Shift

Participants were also asked to list barriers to shifting. They could select multiple reasons. The top reason for not being able to shift earlier was personal preference (presumably, habit and not wanting to wake up early). The top barrier to shifting later was also personal preference but was followed very closely by concerns that their employer would not allow it. These results are generally consistent with top barriers to shifting in Perks Phase I, which highlighted personal preference as the top barrier to shifting early and employer concerns as the top barrier to shifting late.

**Table 11: Barriers to Shifting Commute Time Earlier and Later**

	Shift 20-40 Minutes Earlier	Shift 20-40 Minutes Later
Personal preference	55%	41%
Employer would not allow it	29%	40%
Nature of the work would not allow it	28%	33%
Child care constraints	16%	12%
Other after-work commitments	17%	21%
Parking availability at BART	17%	24%
Other (specify)	10%	7%

## Feedback Obtained Through Customer Service

The highest concentration of customer service inquiries for Perks Phase II was during the program launch and related to a technical issue associated with program login that was resolved quickly. Following launch, inquiries came primarily from individuals who did not receive points as expected. In many cases, this was due to their trip being made very near the entry time cutoff for receiving points. Several individuals also expressed confusion about the fact that the program did not reward all their BART trips on some level, as is expected for a typical rewards program (such as for airline rewards).

This contrasts to Perks Phase I, in which most inquiries stemmed from confusion about how to redeem points. Participants were paid via PayPal and needed to use the same email address for PayPal as they did when registering for the Perks program. Many inquiries were generated by customers who did not realize that their rewards were coming via PayPal, or if they used a different email address for PayPal so could not access their rewards. In Perks Phase II, these issues were avoided by providing participants with the ability to redeem their rewards for gift cards directly within the application.

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## Chapter 5: Cost Effectiveness and Cost to Scale

This section examines the program cost effectiveness and the cost to scale up the program to achieve a desired level of crowding reduction.

### Cost Effectiveness

One metric of the program cost effectiveness is the incentive cost per shifted trip. This is estimated by dividing the approximate number of trips shifted by the program by the cost of the associated incentives. For Perks Phase I, this cost amounted to \$10 per shifted weekday Transbay Trip and \$7 for all shifted weekday trips. These shifted trips may or may not have reduced the number of people on crowded trains – the Perks program design assumed that any trip shifted out of the 7:30 – 8:30 period, regardless of the trip geography or the amount of shift in minutes, was beneficial.

In Perks Phase II, the incentive cost per shifted trip varied over the course of the program but was approximately \$1 overall, a significant improvement over the \$10 of incentive per shifted trip in Perks Phase I.<sup>10</sup> The greater degree of efficiency was achieved primarily by rewarding only behavior change (e.g. change from baseline travel behavior) rather than rewarding pre-existing behavior as was done in Perks Phase I, and by expanding the eligible windows for time shift. Moreover, trips shifted in Perks Phase II can be more readily assumed to produce a reduction in the number of people on crowded trains, since offers were only provided if they would produce a crowding benefit based on the crowding predictive model and incentive algorithm behind the program.

### Cost of Scaled-Up Program

Scaling up the Perks program to produce a meaningful reduction in system crowding would require dedicated staffing and an increased incentive budget. To estimate these costs, the study team undertook a simulation of the BART system (the technical methodology of the simulation is documented in a separate paper available upon request). The simulation assumed that BART wishes to achieve a 5% reduction in a measure of system crowding, called the total crowding score (TCS), defined as the aggregated cube of density (people per train) over system segments and time periods on a given day. This formulation gives exponentially more weight to very crowded conditions.

The analysis indicated that achieving a reduction of 5% would require a program enrollment of between 30,000 and 75,000 users (assuming a range of 10 to 20 % uptake of the incentive offers) and would cost about \$1.9 million per year including \$1.2 million annually in incentives. Additional annual program costs (for an ongoing program) are estimated at approximately \$650,000 and include staffing costs for program oversight and management and customer service, marketing and research, and information technology support for maintenance of front and back end software systems. This estimate assumes continuation of existing Perks program and excludes the start-up costs associated with developing a new program.

A full cost-benefit analysis was outside the scope of the study, but the following high-level comparisons suggest the program is likely to be cost effective:

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<sup>10</sup> Note that this figure relates only to points earned for shift commute offers, and not to “extra reward” or survey offers.

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- Train car comparison: A scaled up program that would reduce crowding (TCS) by 5% would free up an equivalent of approximately 30 train cars for an annual program cost of approximately \$1.9 million. Purchasing an equivalent amount of train car capacity (about 30 cars) would cost approximately \$6m annually (a new train car costs about \$200,000 annually, with a \$5 million up-front purchase cost over a useful life of 25 years).
  - Backfilling comparison: Assuming each shifted trip frees up space for another fare paying passenger, the \$1 per shifted trip figure compares favorably with the approximately \$4 average fare paid by the typical commuter.

## Potential Sources of Funding

New funding sources would need to be identified to support Perks II if scaled up as an ongoing program. This section discusses several options for funding sources. Although core program costs could be offset from a variety of sources, a stable, ongoing source of funds would be necessary to ensure that predictable incentives could be provided to participants and to sustain the staffing necessary to oversee the program.

### BART Operating Revenue

BART's operating budget is very constrained, with many potential uses for existing and any new revenue sources. Investment in incentives would need to be weighed against competing budget priorities. New sources of operating funding would likely need to be identified to support the program.

### Grant Funding Sources

Federal funds were used to develop the Perks Phase I and II pilots. Future state or federal grants could be used to support the addition of new program features, such as gamification or adding rewards based on mode of access to the station, as opposed to ongoing program operating costs.

**Table 12** lists potentially relevant local, regional, state and federal grant opportunities. Many grants explicitly disallow the use of funds for incentives, and most do not fund ongoing operating costs.

**Table 12: Potential Grant Funding Sources for BART Perks**

<b>Fund Source</b>	<b>Agency</b>	<b>Eligible Uses</b>	<b>Available Funding</b>	<b>Potential Limitations</b>
Measure BB: Alameda County Transportation Sales Tax	ACTC	The Technology Expenditure Category funds technology, innovation, and development programs	Approximately \$77M available in the overall category, to be distributed between 2015-2045	Must be focused on Alameda County residents
Measure J: Contra Costa County Transportation Sales Tax	CCTA	Expenditure Category 17 includes funding for commute alternatives	Approximately \$20M available in the overall category, to be distributed between 2004-2034	Must be focused on Contra Costa County residents
Proposition K: San Francisco County Transportation Sales Tax	SFCTA	The Expenditure Subcategory for Transportation Demand Management / Parking Management funds projects that can lead to reduction of single-occupant vehicle dependence and encourage alternative modes of travel	Approximately \$13M available in the overall subcategory, to be distributed between 2003-2033	Must be focused on San Francisco County residents; BART is not a sponsoring agency (BART would have to partner with a sponsoring agency to apply for funds)
Transportation Fund for Clean Air	BAAQMD	Funds eligible projects that reduce on-road motor vehicle emissions	Annual call for projects, \$10k - \$1.5M per project	Must demonstrate impact on reducing vehicle miles of travel
Sustainable Communities Transportation Planning Grant	Caltrans	Funds local and regional multimodal transportation and land use planning projects that further the region's RTP SCS or contribute to the State's GHG reduction targets	Annual call for projects, approximately \$17M per year, \$50k - \$1M per project	Intended for planning projects; incentives for public participation may be ineligible



Advanced Transportation and Congestion Management Technologies Deployment	FHWA	Funds deployment of advanced transportation and congestion management technologies	Annual call for projects, \$60M per year, up to \$12M per recipient	Must demonstrate a congestion reduction benefit
Mobility on Demand Sandbox Program	FTA	Funds activities leading to the demonstration of innovative mobility on demand and transit integration concepts	First cycle allocated \$8M in 2016, anticipate second cycle in 2019 with a similar level of funding	Primarily intended to expand mobility options

### Other Funding Options

- Merchant partnerships: BART staff could solicit merchants to provide occasional contributions to the program. The cost of additional staffing required to seek and manage partnerships would need to be compared to the potential savings obtained through merchant donations. A stable, ongoing source of funding for incentives would still be needed even with merchant contributions.
- Employer partnerships / Transportation Management Agencies: BART could seek employer partnerships and request that employers cover some of the cost of incentives for their employees. Such contributions could be voluntary or could be structured as a method for employers to meet requirements imposed on them through development impact agreements. For example, many of the buildings in downtown San Francisco are part of Transportation Management Agencies that require a financial contribution to help offset the congestion and vehicle trip related impacts associated with commuting.