MOD

MOBILITY ON DEMAND

MOD SANDBOX DEMONSTRATIONS INDEPENDENT EVALUATION

BART INTEGRATED CARPOOL TO TRANSIT ACCESS PROGRAM EVALUATION PLAN

U.S. Department of Transportation

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16. Abstract

The Mobility on Demand (MOD) Sandbox Demonstration Program provides a venue through which integrated MOD concepts and solutions – supported through local partnerships – are demonstrated in real-world settings. For each of the 11 MOD Sandbox Demonstration projects, the MOD Sandbox Independent Evaluation includes an analysis of project impacts from performance measures provided by the project partners, as well as an assessment of the business models used.

This report constitutes the Evaluation Plan for the BART Integrated Carpool to Transit Access Program Sandbox project. It includes the following chapters: project overview; evaluation approach and process; evaluation schedule and management; and data collection & analysis plan.

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Chapter 1. Project Overview

This chapter gives a brief introduction to the San Francisco Bay Area Rapid Transit (BART) Integrated Carpool to Transit Access Program that will be evaluated through this independent evaluation.

Introduction

BART is the fifth-busiest heavy rail rapid transit system in the United States, carrying more than 430,000 daily riders. BART provides service in Northern California in four Bay Area counties: Alameda County, Contra Costa County, San Francisco County, and San Mateo County. The BART system is comprised of 107 miles of track, 46 stations, and 669 revenue vehicles. It provides access to many of the San Francisco Bay Area's key destinations for work, school, and recreation. BART has over 3,400 employees and a combined annual capital and operating budget of over $1.5 billion.

Project Scope

BART, the Metropolitan Transportation Commission (MTC), and Scoop Technologies, Inc. (Scoop), are partnering on a program to better integrate carpool access to public transit by matching passengers with a transit station as their destination, and providing a seamless way to reserve and pay for highly-coveted parking spaces at BART stations.

BART offers 48,000 parking spaces at 34 of its 46 stations. The parking mix at BART includes "daily fee" first come/first served spaces (approximately 35,000 spaces), permit spaces (approximately 12,000 spaces), and a small number of carpool spaces (approximately 900 spaces). Demand for parking is high and the majority of spaces fill by 8am each weekday. However, only about 0.8 percent of those parking at BART carpool with others to the station, according to a 2015 passenger profile survey. Therefore, as most vehicles remain parked all day, the majority of parking spaces serve just one patron per day.

MTC operates BART's legacy carpool permitting program, which provides dedicated carpool spaces at 21 BART stations. Unfortunately, this legacy carpool program is unsuccessful, as first-come/first served carpool spaces are difficult to preserve for legitimate carpools. Preventing fraudulent use of these spaces by single occupancy vehicles requires live observation of passengers as they exit their vehicles, which is impractical given staffing resources. As a result, BART does not provide dedicated carpool spaces at one-third of its stations and has been reluctant to expand the number of spaces at stations where the legacy carpool program does not exist.

The MOD partnership between BART, MTC and Scoop allows BART to address some of the issues that were previously limiting BART from expanding carpooling options. Scoop provides an app that matches drivers and passengers with similar destinations into carpools. MTC and Scoop had already been working together since 2015 to promote carpooling in the Bay Area region. In 2016, BART, MTC and Scoop began working together to develop a pilot program which would use the Scoop app to match users going to BART stations into carpools and as an incentive would guarantee a parking space at the BART station.

Since the number of users matched might vary from day to day, in order to provide flexibility, matched drivers are allowed to park anywhere in BART's permit parking areas. Permit spaces are reserved for permit holders and matched Scoop drivers until 10am, offering passengers more flexibility about when to arrive at the station. Scoop provides license plates of matched drivers to BART on a daily basis and BART uses this information to enforce the program.

The pilot program initially launched at the Dublin/Pleasanton BART station in January 2017 and through the MOD Sandbox grant, the program is able to expand to additional stations. The grant will also be used to more fully develop Scoop's app functionality in BART-specific ways by including BART stations as preset origins and destinations, integrating parking payments into the app, and pre-screening for wheelchair-accessible vehicles. Grant funds will also be used to market the program and increase the critical mass of users.

The total project funding is $521,000, including $358,000 in USDOT funds from the MOD Sandbox grant and $163,000 in matching funds from the three project partners.

Key Partners

BART is partnering with Scoop and MTC.

Project Timeline

The main milestones for the BART program are captured in the timeline below. Please note that the evaluation timeline is provided in a later chapter of this report.

1. **January 23, 2017** – Launch of Pilot Scoop Demonstration at the Dublin/Pleasanton BART Station (pre-grant pilot)
2. **February 14th, 2017** – Agreement Execution Date for MOD Sandbox grant with the USDOT
3. **September 2017** –Demo Start: Launch of MOD Field Demonstration at the Millbrae and San Bruno BART stations. The program will continue to roll out at 2 stations per month through June 2018.
4. **June 2018** –Field Demonstration of launch program complete
5. **October 2018** – Final Project Report submitted by the BART team to USDOT.

BART will collect data that is relevant to this MOD demonstration between January 2017 and June 2018. This data will be shared with the Independent Evaluation (IE) team for conducting the evaluation. More details on data collection planning is provided in Chapter 3 of this report.

Chapter 2. Evaluation Approach and Process

For each of the 11 MOD Sandbox projects, the IE team developed an evaluation framework in coordination with the project team. The framework is a project-specific logic model that contains the following entries:

1. **MOD Sandbox Project** – Denotes the specific MOD Sandbox project.
2. **Project Goals** – Denotes each of the project goals for the specific MOD Sandbox project. The project goals capture what each MOD Sandbox project is trying to achieve.
3. **Evaluation Hypothesis** – Denotes each of the evaluation hypotheses for the specific MOD Sandbox project. The evaluation hypotheses flow from the project-specific goals.
4. **Performance Metric** – Denotes the performance metrics used to measure impact in line with the evaluation hypotheses for the specific MOD Sandbox project.
5. **Data Types and Sources** – Denotes each of the data sources used for the identified performance metrics.
6. **Method of Evaluation** – Denotes the quantitative and qualitative evaluation methods used.

This chapter details the evaluation approach and process, as finalized in the evaluation logic model for the BART MOD Sandbox project. This includes project goals, evaluation hypotheses, performance metrics, data types and sources, and methods of evaluation.

Project Goals

The project goals denote what BART is aiming to achieve through the MOD Sandbox demonstration. The project goals include the following:

1. Increase total carpooling to BART stations
2. Increase utilization of parking spaces by carpool vehicles
3. Reduce the costs of enforcement for carpool spaces at BART stations
4. Reduce the rate of fraudulent use of carpool spaces
5. Spread out the arrival of BART riders over the morning peak commute period
6. Increase vehicle occupancy rate of vehicles parking at BART stations
7. Induce increased carpooling by helping people to carpool to BART stations that otherwise would not
8. Reduce vehicle miles travelled (VMT) and greenhouse gas (GHG) emissions from travel

9. Increase BART ridership
10. Reduce traveler cost
11. Increase revenue relative to long run (operational) BART cost of implementation
12. Produce lessons learned through stakeholder interviews.

The project goals set the foundation for the evaluation hypotheses.

Evaluation Hypotheses

The evaluation hypotheses flow from the project-specific goals, and denote what should happen if each project goal is met. The evaluation hypotheses include the following:

1. Carpooling to stations increases following the implementation of the Scoop pilot project.
2. The utilization of parking spaces by carpooling vehicles increases after the project is implemented.
3. The cost of enforcement per carpool space declines with no sacrifice in enforcement quality.
4. The number of instances of illegal use of carpool spaces per total carpool spaces available will be lower than before the pilot initiation.
5. The distribution of legal arrivals to carpool spaces will be closer to uniform distribution between the hours 6 am and 10 am than before the pilot.
6. The number of persons per vehicle parking space at BART stations increases after the program.
7. The technological changes to carpooling have caused people who would have driven alone to carpool to BART stations instead.
8. The expansion of Scoop to additional BART stations will lower VMT and reduce GHG emissions that would have occurred in its absence.
9. Overall ridership increases as a result of the Scoop program.
10. Scoop application users reduce their cost of travel relative to their previous method of travel to BART or commuting.
11. The enforcement and abuse of Scoop permits are low, and the fraud rate is low (less than 5 percent).
12. The marginal cost to BART for implementing the program is less than the revenue earned from additional ridership.
13. The process of deploying the project will produce lessons learned and recommendations for future research and deployment.

The success of each evaluation hypothesis is measured by the performance metrics described below.

Performance Metrics

The performance metrics are used to measure impact in line with the evaluation hypotheses for the BART IE. These performance metrics include the following:

- Total number of carpooling riders to each BART station
- Number of verified carpool vehicles at each BART station
- Cost and time spent on carpool enforcement per carpool space
- Total number of citations given to illegal carpool vehicles over time for each station
- Carpool arrival by station by hour
- Number of persons per vehicle parking at each BART station
- Estimated total number of people who would be driving alone to work without project
- Measured travel behavior change and estimated emissions change
- Ridership at all stations over time
- Cost of travel by users prior to Scoop
- Measured fraud rate of Scoop permits by station
- Estimated revenue gain from ridership increases and parking exceed the marginal cost incurred by BART to implement the Scoop program
- Lessons learned and recommendations.

The performance metrics will draw from a set of data sources that are specific to the project.

Data Sources

The following data sources are used for the data collection for the BART IE:

- Scoop Usage Database
- Parking Lot Usage
- Parking Enforcement
- BART Ridership Data
- BART Cost/Revenue Data
- User Surveys
- Interview Data.

Data Elements

The following data elements are used for the performance metrics that are defined for the BART IE:

- Count of people carpooling to BART stations by station by hour
- Spaces occupied by carpooling vehicles before and after pilot by station by day
- Hours of labor devoted to carpool enforcement
- Count of cumulative carpool spaces available by station by day
- Citations per station per day
- Counts of illegal use of carpool spaces
- Arrivals of carpool vehicles by station by hour
- Number of single occupancy vehicles (SOVs) parking
- Number of carpool vehicles parking
- Carpool vehicle occupancy
- Total number of spaces utilized
- Survey of program users
- Activity data of Scoop user origin and destinations (from user survey)
- BART ridership
- BART rider origin and destination stations
- BART fares
- BART enforcement of parking spaces (citations)
- Marginal costs incurred by BART (operational)
- Stakeholder interview results.

Data Sources Mapping

The following diagram shows the mapping of data sources, data sets, and performance measures that will be used in the independent evaluation of the BART MOD Demonstration. As shown, the datasets include both quantitative and qualitative data, and will be submitted to the USDOT Public Data Hub.

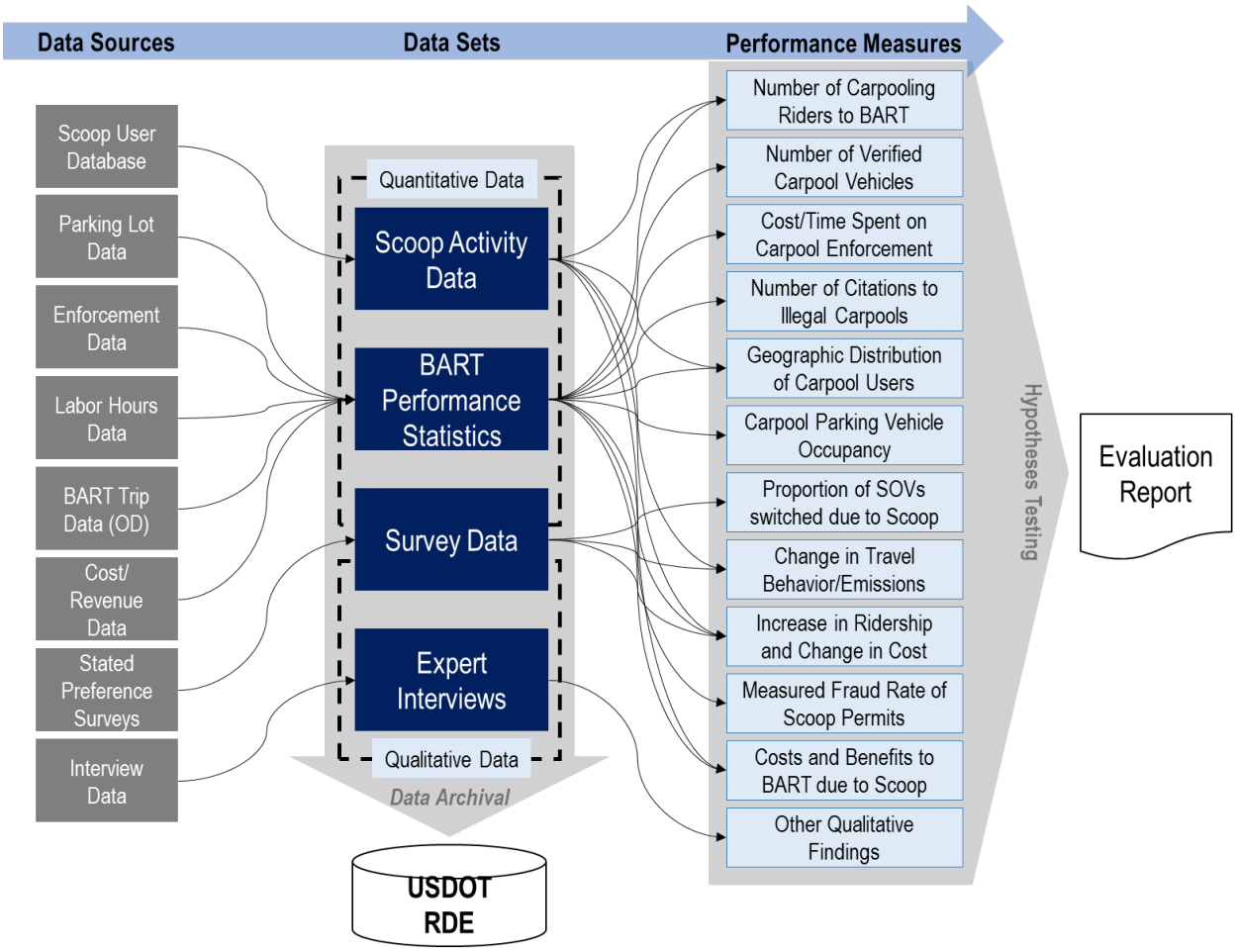


Figure 1. Map of Data Sources, Data Sets, and Performance Measures

Methods of Evaluation

The quantitative and qualitative evaluation methods used in the BART IE include the following:

- Time series and cross-sectional analysis
- Statistical analysis, expert interviews
- Survey analysis
- Survey and activity data analysis
- Survey and revenue analysis
- Summary of expert interviews.

Further details about the analysis methods by evaluation hypothesis are provided in Chapter 3.

Evaluation Logic Model

Table 1 below represents an extract from the final BART evaluation logic model. Building on the project goals, the logic model lists evaluation hypotheses, performance metrics, and data sources for the BART project.

Table 1. Evaluation Hypotheses, Performance Metrics, and Data Sources for the BART Sandbox Project

Evaluation Hypothesis	Performance Metric	Data Elements	Data Sources
1. Carpooling to stations increases following implementation of the Scoop pilot project	Total number of carpooling riders to each BART station	Count of people carpooling to BART stations by station by hour	Scoop data/license plate logs
2. Utilization of parking spaces by carpooling vehicles increases	Number of verified carpool vehicles	Spaces occupied by carpooling vehicles before and after pilot by station by day	BART parking data/scoop license plate logs
3. The cost of enforcement per carpool space declines with no sacrifice in enforcement quality	Cost and time spent on carpool enforcement per carpool space	Hours of labor devoted to carpool enforcement; count of cumulative carpool spaces available by station by day	BART parking enforcement
4. The number of instances of illegal use of carpool spaces per total carpool spaces available will be lower than before the pilot initiation	Total number of citations given to illegal carpool vehicles over time	Citations per station per day	BART parking enforcement
5. The distribution of legal arrivals to carpool spaces will be closer to uniform distribution between the hours 6 am and 10 am than before the pilot	Carpool arrival by station by hour	Arrivals of carpool vehicles by station by hour	Scoop data logs

Evaluation Hypothesis	Performance Metric	Data Elements	Data Sources
6. The number of persons per vehicle parking at BART stations increases after the program	Number of persons per vehicle parking at BART	Number of SOVs parking, number of carpool vehicles parking, carpool vehicle occupancy, total number of spaces utilized	BART parking data
7. The technological changes to carpooling have caused people who would have driven alone to carpool to BART stations	Estimated total number of people who would be driving alone to work without project	[Self-reported] Number of people who would be driving alone to work without project	User survey
8. The expansion of Scoop to all BART stations will lower VMT and reduce GHG emissions that would have occurred in its absence	Measured travel behavior change and estimated emissions change	Scoop user origin and destinations, Average emissions per person per mile	User survey Scoop data
9. Overall ridership increases as a result of the Scoop program	Ridership at all stations over time	Ridership data time-series of stations	BART farebox data
10. Users of the Scoop application reduce their cost of travel relative to their previous method of travel to BART or commuting	Cost of travel by users prior to Scoop	[Self-reported] Fare paid by users to commute, BART fare tables	User survey BART data
11. Enforcement and abuse of Scoop permits are low. The fraud rate is low (less than 5%)	Measured fraud rate of Scoop permits	Number of illegally used Scoop permits per station per day	BART parking enforcement/Scoop license plate logs
12. The marginal cost to BART for implementing the program is less than the revenue earned from additional ridership	Estimated revenue gain from ridership increases and parking exceed the marginal cost incurred by BART to implement the Scoop program	Ridership, revenue, marginal costs incurred by BART (operational)	BART, MTC, Scoop Data
13. The process of deploying the project will produce lessons learned and recommendations for future research and deployment	Lessons learned and recommendations	Qualitative documentation from stakeholder interviews	Stakeholder interviews

Documentation and Reporting

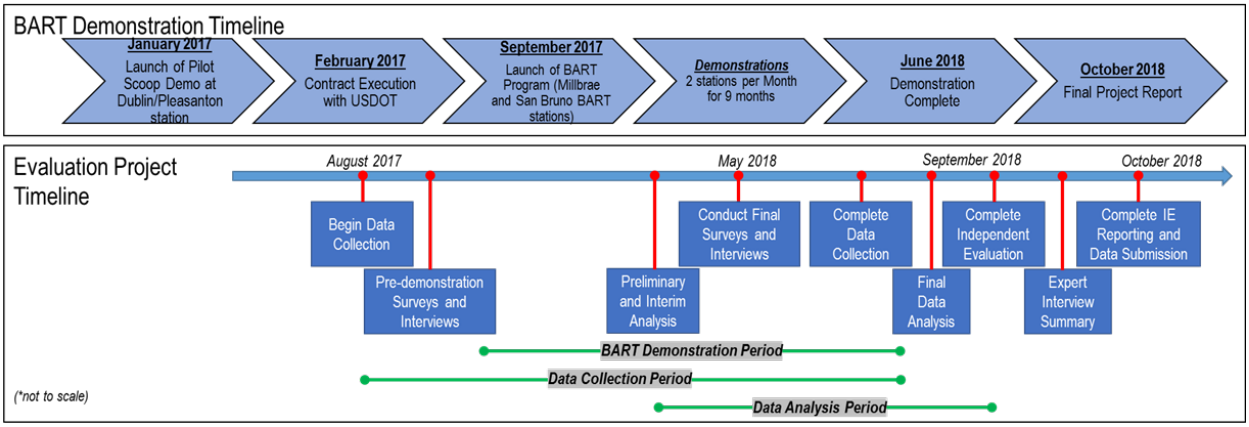
The IE team will develop an evaluation report for this MOD Sandbox demonstration project. The report will include a summary of major findings of the project in the executive summary section, followed by multiple sections providing demonstration details, evaluation hypotheses, data collected, analysis performed, findings, and results. The results will be reported through a mix of exhibits including tables, graphs, and charts.

Chapter 3. Evaluation Schedule and Management

This chapter provides details on the evaluation project schedule and other details on the management of the evaluation project.

Evaluation Schedule

Figure 2 shows the IE schedule from the beginning of the quantitative and qualitative data collection that spans throughout the demonstration period and leads to the analysis, whose results are included in the site-specific evaluation report. Note that interim data spot checks and sample analyses will be performed throughout the demonstration period to proactively mitigate data-related risks.



Source: Booz Allen Hamilton, February 2018

Figure 2. MOD Sandbox Evaluation and Demonstration Schedule

Data relevant to the program will be collected between January 2017 and June 2018. This data will be shared with the IE team for evaluation purposes. More details on the data types, elements, and collection timeframes are provided in Chapter 4.

Roles and Responsibilities

The three main entities involved in the evaluation and their corresponding high-level roles are as follows:

- **The site team** coordinates the collection of the requested evaluation data from the various project partners throughout the demonstration period, and transfers the data to the IE team.

- **The IE team** supports the site team in defining the requested data elements. This team also performs analysis using the data provided by the site team.
- **The USDOT team** supervises the work and provides support for topics that encompass more than one site (e.g., coordination with transportation network companies who are partnering with several Sandbox sites).

Data Transfer and Storage

Various types of qualitative and quantitative data sources are involved in the evaluation, as specified in Chapter 4. Figure 3 below shows the overall data collection framework, including the steps and parties involved in data design, collection, transfer, and storage.

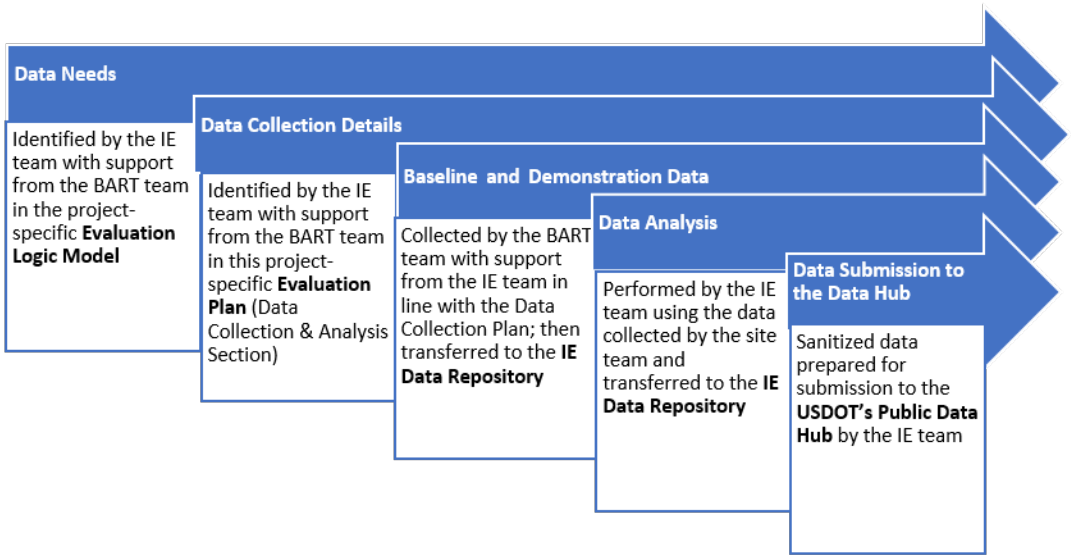


Figure 3. BART Data Collection Framework

Data Collection Responsibilities

Table 2 denotes the data collection responsibilities for the various data types required for the evaluation.

Table 2. Data Type and Data Collection Responsibilities for BART Sandbox Evaluation

Data Type	Data Collection Responsibilities
Scoop Activity Data	• Collected by the BART team and transferred to the IE team (alternatively, access to the data can be given to the IE team, as appropriate)
Survey Data	• Survey questions are developed by the IE team in collaboration with the BART team • Surveys are administered by the BART team

Data Type	Data Collection Responsibilities
	• Survey responses are transferred by the BART team to the IE team (alternatively, access to the data can be given to the IE team, as appropriate)
BART Statistics	• Collected by the BART team and transferred to the IE team (alternatively, access to the data can be given to the IE team, as appropriate).
Expert Interviews	• Interviewees are identified by the IE team in collaboration with the BART team • The IE team is connected to the interviewees by the BART team • The IE team conducts the expert interviews via phone or in person

Risk Management

The IE team will continually monitor risk in an ongoing process throughout the demonstration period and identify the best resources within the team to address each risk.

Some of the main risks involved in the evaluation are included below.

Schedule:

The IE team will maintain a demonstration tracking schedule to track and contact the demonstration teams for data and documentation. The team will keep an up-to-date integrated schedule that reflects updates from the site teams on a constant basis. Components of the evaluation reports will be created throughout the demonstration period, as the data and documentation for the project becomes available. The site team should inform the IE team of any changes in schedule that could affect the overall evaluation schedule (e.g., delays in the demonstration schedule).

Data Quality Assurance:

The IE team will perform spot checks on the data as it is being collected throughout the demonstration period to proactively manage risks related to data quality. This will allow the following:

- Avoiding insufficient data on performance of MOD demonstration to reliably estimate impacts and/or benefits
- Addressing challenges in empirical data including lack of consistency, biases, and incompleteness
- Identifying and controlling sources of error
- Consideration of quality and quantity issues in data collection
- Ensuring data privacy and proprietary protections in line with human subjects' protections
- Consideration of confounding factors.

Table 3 includes risk mitigation strategies that will be employed to ensure the availability of the requested data types for the evaluation.

Table 3. Data Type and Risk Mitigation Strategies for BART Sandbox Evaluation

Data Type	Risk Mitigation Strategies
Scoop Activity Data	• The BART team will include the data needs/requirements in the agreement with Scoop • The BART team will ensure that the needed data is collected from Scoop and transferred to the IE team
Survey Data	• The BART team will ensure that participants in the pilot are willing to take the surveys
BART Statistics	• The BART team has access to the requested BART statistics and can provide these to the IE team
Expert Interviews	• The BART team will facilitate the connection between the IE team and expert interviewees, and will help in getting their commitment to participate in the interviews

Chapter 4. Data Collection & Analysis Plan

This chapter describes the plan for data collection and analysis for the BART MOD Sandbox project evaluation. It summarizes the data that needs to be collected, and how that data should be processed and delivered to the IE team. Where possible, the IE team will help the Sandbox project team with processing the data in order to get the requested data format to conduct the calculations necessary for the evaluation. Any personally identifiable information will need to be removed when present in the data.

The data collection plan follows the evaluation logic model, with each data field discussed in association with a hypothesis and performance metrics. Certain types of data collected address multiple hypotheses. In cases where the data structure is the same for more than one hypothesis, the plan refers to the data structure for a hypothesis already described.

Most demonstration data (i.e., data provided by Scoop or BART about Scoop activity) should be provided from the beginning of the pilot demonstration period. The IE team also requests that data about general BART activity, such as ridership and citations, be provided back to 2015 if possible. This request for longer time series of activity that existed before and after the pilot demonstration is made to help discern background trends that may have been present before the project and continued through it. Naturally, any data collected as a result of the pilot demonstration itself, can only be produced from the beginning of the data collection period. All hypotheses will be evaluated at the BART station level, when data permits. An aggregate analysis will be performed on system-wide impacts as well.

Table 4 summarizes the data types, data elements, collection periods, and hypothesis alignment for the BART Sandbox project evaluation. The table is followed by a more detailed data collection and analysis plan for each evaluation hypothesis.

Table 4. Data Type, Data Elements, Period of Collection, and Hypothesis Alignment for BART Sandbox Project Evaluation

Data Type	Data Elements	Period and Frequency of Data Collection	Hypothesis Alignment
Scoop Activity Data	• Count of people carpooling to BART stations by station by hour • Driver trip miles (i.e., the cumulative distance from driver's home to the final destination) • Passenger/rider miles saved (i.e., the cumulative distance a passenger saves when they carpool with another driver)	To the extent possible, Scoop data is requested from the start of Scoop activity at each station, to help identify longer running trends that might be underlying leading up to the project.	1, 2, 5, 6, 8, 10, 12

Data Type	Data Elements	Period and Frequency of Data Collection	Hypothesis Alignment
		Demonstration data is requested for the period extending throughout the BART Sandbox demonstration.	
Traveler Survey Data (*sample survey is provided in Appendix A*)	Survey questions addressing: • Demographics • Location of home and work (in terms of neighborhood/zip code, not addresses) • Travel behavior • Change in travel behavior as a result of Scoop • Use of Scoop • Vehicle ownership	Implemented by BART quarterly throughout the pilot demonstration period	7, 8, 10
BART Statistics	• Number of carpooling spaces available at each station before and after the pilot • Before Scoop implementation: BART-provided baseline estimates of designated "carpool" space occupancy, which is present at some of the stations; baseline estimates for number of carpooling vehicles • After Scoop implementation: BART-provided estimates for its existing carpool spaces (plus activity data provided by Scoop) • Data on the number of spaces available for carpooling by station over time • Enforcement labor hours before and after the pilot implementation. • Number of citations given to illegal carpool vehicles per day • BART parking counts and capacity measurements • Ridership data describing origins and destinations by time (origin and destination pairs by day) • BART fare tables • Parking revenue data by day from participating stations.	Where relevant, data is requested from the year 2015 to the start of the project, to help identify longer running trends that might be underlying leading up to the project.	1, 2, 3, 4, 5, 6, 9, 10, 11, 12

Data Type	Data Elements	Period and Frequency of Data Collection	Hypothesis Alignment
	• [Estimate of the] operational costs that have been incurred for the duration of the pilot		
Expert Interviews	Qualitative documentation from stakeholder interviews	Conducted six months or more after the launch of the demonstration	13

Detailed Data Collection and Analysis Plan by Evaluation Hypothesis

Hypothesis 1: Carpooling to stations increases following implementation of the Scoop pilot project.

Performance Metric: Number of carpooling riders to BART

Data Elements & Sources:

- **Baseline estimates for number of carpooling vehicles before Scoop.**

  The IE team recognizes that BART has limited data tracking carpooling activity prior to the implementation of the Scoop pilot project. BART can provide baseline estimates for number carpooling, but cannot provide details such as count per station per hour. This data will be used to understand carpooling activity to the degree possible before Scoop implementation. If possible, the data is requested from the year 2015 to the start of the project, to help identify longer running trends that might be underlying leading up to the project.

- **Count of people carpooling to BART stations by station by hour**

  To measure whether carpooling activity increases as a result of the project, the IE team proposes tracking the count of people carpooling to the stations by hour over the course of the project. Scoop is providing BART with data on carpooling activity by station over time. The IE team has been provided access to the dashboard displaying this data, which allows for downloads of individual trip activity by timestamp. This data has the following fields:

  trip_time: is the time stamp of the trip to nearest 15 minutes

  matched_flag: is whether the trip was matched (all reported trips are matched)

  cancelled_flag: indicates whether the trip was canceled, this happens sometimes

mode: indicates whether the person is a looking to be a driver or either (driver or rider)

is_driver: a Boolean variable indicating whether the trip record belongs to the driver

license_plate: a vehicle ID of the carpooling that can be used to evaluate repeat activity over time

carpool_size: number of people in the vehicles

bart_station: the BART station at which the trip ended.

The IE team will use the data to evaluate carpool data over time.

Analysis Procedure:

The analysis procedure will evaluate the baseline estimates for number of carpooling vehicles before Scoop. The levels of carpooling before the implementation of Scoop will be compared against levels following implementation. Comparison will be made using Scoop data, and averages will be compared using the t-test (if permitted by the baseline data). If the average carpooling following Scoop implementation is higher and statistically different from the baseline estimates, then it suggests a confirmation of the hypothesis. This comparison will be done over several periods during the implementation. In addition, the trend in Scoop data will be evaluated and regressed against trend variable in a standard ordinary least squares (OLS) regression. If the trend coefficient is positive and statistically significant, it will suggest increased carpooling over time, confirming the hypothesis. Other variables may be added to regression mode to control for external factors. The analysis may be disaggregated to the station level, where the hypothesis is confirmed for some stations and unconfirmed for others. This will be done if the data permits (it should be done for this hypothesis).

Furthermore, a system-wide aggregation will also be evaluated. As described below, the phased implementation will result in two stations being added to the Scoop system each month. By analyzing the carpool data by station for the entire timeline of deployment, the project team can analyze the before-and-after data for stations as and when the deployment happens. Quantitative analysis will also yield results on near-term impacts of most stations and long-term impacts on the initial set of stations.

Hypothesis 2: Utilization of carpooling spaces by actual carpooling vehicles increases

Performance Metric: Number of verified carpool vehicles.

Data Elements & Sources:

- **Before Scoop: BART-provided baseline estimates of designated "carpool" space occupancy, which is present at some of the stations.**

BART will provide baseline data of estimates of carpool space occupancy. This data may be derived from the baseline data provided for Hypothesis 1.

- **After Scoop Implementation: BART will have both its ongoing carpool program for designated "carpool" spaces plus the Scoop program data in which carpoolers will be parking in the "permit" area.**

  BART will provide estimates for its existing carpool spaces *plus* activity data provided by Scoop. This latter data is described in Hypothesis 1.

- **Number of spaces utilized by carpooling vehicles at each station before and after the pilot**

  To calculate occupancy, BART will provide data on the number of spaces utilized by carpooling vehicles by station over time (if it changes).

Analysis Procedure:

The analysis procedure will follow a pattern similar to that proposed for Hypothesis 1, with application of the t-test and a regression model to determine if differences in before-and-after utilization of carpooling spaces changed. The data described above will be transformed into variables describing utilization over time.

Hypothesis 3: The cost of enforcement per carpool space declines with no sacrifice in enforcement quality.

Performance Metric: Cost and time spent on carpool enforcement per carpool space.

Data Elements & Sources:

- **Hours of labor devoted to carpool enforcement**

  BART will provide enforcement labor hours before and after the pilot implementation. Data is requested starting in 2015.

- **Number of carpooling spaces available at each station before and after the pilot**

  This is the same data as described in Hypothesis 2.

Analysis Procedure:

The analysis of this hypothesis will depend on the continuity of the data and its resolution. Several approaches are possible. The preferred procedure is similar to that outlined in Hypothesis 1, which can be followed if the data permits enough observations to produce a statistically significant sample before and after the pilot. Otherwise, a general trend can be evaluated over time and modeled with a regression model, where enforcement hours are the dependent variable. The approach will be numerical, but the exact method will be contingent on the time and space resolution of the data that BART has available.

Hypothesis 4: The number of instances of illegal use of carpool spaces per total carpool spaces available will be lower than before the pilot.

Performance Metric: Number of citations given to illegal carpool vehicles over time

Data Elements & Sources:

- **Citations per station per day**

  BART will provide data on citations given each day. However, BART does not enforce every station every day. BART will provide data that is available in this regard. Data is requested starting in 2015.

- **Any count of illegal use of carpool spaces**

  Scoop may be able to provide some information on enforcement. However, engaging in fraudulent activity with Scoop is somewhat difficult to do by design. Scoop drivers would have to get regularly matched with a rider that is "in" on it, and then have that rider agree to not ride with them every day. Since the rider would be paying the driver, some financial arrangement would have to compensate the rider's participation in the fraud. Because driver does not control the match process, this would seem difficult to do. It might only be doable through planning between spouses who share a home location and income. The IE team will evaluate whether there is any Scoop data that can investigate whether fraud is occurring with its system.

Analysis Procedure:

The data will be processed into a count of illegal use of carpool spaces over time, before and after the pilot. The time-series of citation data will be analyzed using statistical tests such as the t-test for evaluating average citations before and after the pilot. The data will be processed to consider "citations per carpool vehicle" to control for any increased carpooling activity. Regression models may be applied if needed to confirm any trends in citation activity. However, statistical tests of before-and-after activity may be sufficient to confirm this hypothesis. This hypothesis may only be evaluated at the aggregate level, since it is unclear whether citation activity will be frequent enough at the station level to produce statistically valid samples.

Hypothesis 5: The distribution of legal arrivals to carpool spaces will be closer to uniform distribution between the hours 6 am and 10 am than it was before the pilot.

Performance Metric: Carpool arrival by station by hour

Data Elements & Sources:

- **Arrivals of carpool vehicles by station by hour**

  This data will be exactly the same as the data structured for Hypothesis 1.

- **Baseline estimates for number carpool before Scoop**

  This data will be exactly the same as the data structured for Hypothesis 1.

Analysis Procedure:

This hypothesis can be evaluated in several ways. Non-parametric tests can be applied to evaluate whether the before-and-after distributions are different. But this is all that can be determined statistically from such tests. Ultimately, the IE team wishes to determine whether the distribution of arrivals will be closer to the uniform distribution than the distribution of arrivals before the pilot. The Kolmogorov-Smirnov (KS) Goodness-of-Fit Test can be applied to evaluate the nearness of the before distribution to the uniform distribution. The same test can be applied to the distributions after the pilot. The resolution of the data will determine the degree to which further statistics can be applied. For example, the Scoop data will permit a series of many KS tests to be made, which would allow for hypothesis testing on the test statistics themselves. The evaluation of the test statistic over time can be used to determine if the distribution of arrivals is converging to a distribution that looks more uniform than earlier in the pilot or before it. The distribution of arrivals will be characterized in this analysis, and data permitting, the analysis will be executed at the station level.

Hypothesis 6: The number of persons per vehicle parking at BART stations increases after the program

Performance Metric: Number of persons per vehicle parking at BART.

Data Elements & Sources:

- **Number of SOVs parking**

  This data will be derived from BART parking counts and capacity measurements. It is unlikely that BART has any data source that can determine number of SOVs parking at its lots. BART can inform the IE team if this assumption is incorrect. Rather, it will be assumed that each BART station parking fills to capacity each day. BART is at record ridership and this is a reasonable assumption today. The number of SOVs parked at each BART station will be the difference between the estimated carpooling activity at each station and the nameplate non-carpool capacity of parking at BART. That is, any vehicle that is not a permitted carpool via Scoop or via the pre-existing carpool permit regime will be considered an SOV. Data from Scoop will need to be able to detail which carpooling vehicles park at BART. This requires an extension of the data described in Hypothesis 1, with Boolean variables embedded within the trip level data that determine whether riders and drivers finished the trip at BART.

- **Number of carpool vehicles parking**

This data will be determined by a summation of carpool parking data provided by BART and the activity data provided by Scoop as described in Hypothesis 1.

- **Carpool vehicle occupancy**

  This data will be provided by the Scoop activity as described in Hypothesis 1.

- **Total number of spaces utilized**

  This data will be provided by the Scoop activity as described in Hypothesis 1, as well as any parking data that BART has with respect to carpool parking, SOV parking, and station parking lot capacity.

Analysis Procedure:

This hypothesis will be evaluated in a manner that is similar to Hypothesis 1, using variables transformed to determine the level of SOV parking and carpooling vehicles.

Hypothesis 7: The technological changes to carpooling have caused people who would have driven alone to carpool to BART stations instead.

Performance Metric: Number of people who would be driving alone to work without the project.

Data Elements & Sources:

- **Survey of people who carpool to BART via Scoop**

  The IE team is currently providing input into surveys being conducted by BART. In this continued collaboration, the IE team will assist in surveying Scoop users to evaluate how they would have traveled in the absence of the Scoop project.

  The survey will ask questions about demographics, location of home and work, travel behavior, change in travel behavior as a result of Scoop, use of Scoop, and vehicle ownership.

Analysis Procedure:

The survey analysis will evaluate the distribution of responses to questions asked of respondents. It is expected that survey responses will show a distribution of behavioral impacts across the sample population. The survey responses will evaluate the share of respondents who indicate that the Scoop pilot is impacting behavior. The survey questions will be designed to be “causal” or “attributional” in nature. That is, respondents must attribute their behavioral change to the presence of Scoop as an enabler, and indicate that the alternative action would have been the drive alone mode to work or to the BART station.

Hypothesis 8: The expansion of Scoop to all BART stations will lower VMT and reduce GHG emissions that would have occurred in its absence.

Performance Metric: Measured travel behavior change and estimated emissions change.

Data Elements & Sources:

- **Survey of people who carpool to BART via Scoop**

  The data collected from this survey will be part of same effort as described in Hypothesis 7.

- **Activity data of Scoop user origin and destination (or trip distance)**

  The activity data provided by Scoop will contain data on Driver Trip Miles, which is the cumulative distance from driver's home to final destination, as well as Rider Miles Saved. The Rider Miles Saved will be that traveled between their pick-up point and their drop-off point. If there are three people in the carpool (including the driver), it would describe the sum of miles for both riders, but not the driver. The miles that are calculated by Scoop are the Google maps distance between the rider pick-up and drop-off points. This data will be available at an aggregate level by month.

Analysis Procedure:

The analysis will evaluate the distribution of responses to questions asked of respondents. It is expected that survey responses will show a distribution of behavioral impacts across the sample population. The survey responses will evaluate the share of respondents who indicate that the Scoop pilot is changing behavior. The survey questions will be designed to be "causal" or "attributional" in nature. That is, respondents must attribute their behavioral change to the presence of Scoop as an enabler, and indicate that the alternative action would have been the drive alone mode to work or to the BART station.

Hypothesis 9: Overall ridership increases as a result of the Scoop program.

Performance Metric: Overall ridership increases as a result of the Scoop program.

Data Elements & Sources:

- **Ridership data by station by hour or by day**

  The IE team would also seek BART ridership data by day to determine if increases in ridership are correlated with increases in carpooling activity as seen in the Scoop data. Ridership data would be preferred to describe origins and destinations by time. If the data can be rendered in station origin and destination (OD) pairs by day; that would be the most complete representation of activity. Each row would be an OD pair (e.g., El Cerrito-Berkeley, each column would be a time slice). If data is not available at this resolution, summation of origins and destinations by day, without pairs, is likely sufficient for the analysis.

The time frame for this data would be requested for the beginning of 2015 to the end of the project term. Data well before the project establishment provides a baseline to evaluate existing trends and avoid attributing activity that is the result of broader trends to the project.

Analysis Procedure:

This analysis will take ridership data and Scoop activity data and evaluate whether they are correlated over time. The analysis will model ridership as the dependent variable in a regression model and Scoop activity will serve as the independent variable. Other control variables, such as time-trend, seasonal dummy variables will also be included in the model to distinguish outside effects that may influence ridership. If the Scoop activity coefficient is statistically significant after controlling for other known factors, the hypothesis will be considered confirmed. This hypothesis will be evaluated at the station level.

Hypothesis 10: Users of the Scoop application reduce their cost of travel relative to their previous method of travel to BART or commuting.

Performance Metric: Cost of travel by users prior to Scoop.

Data Elements & Sources:

- **User survey**

  The data collected from this survey will be part of the same effort as described in Hypothesis 7. This data will support the calculation of a travel cost function for respondents across a variety of modes.

- **Activity data of Scoop users**

  Activity data, as described for Hypothesis 8, can be used to estimate the costs (or revenue) to Scoop users. This data can be used to support an evaluation of Scoop costs.

- **BART fare tables**

  The BART fare tables will be used to calculate the full cost of the trip and compare against the costs of alternative modes.

Analysis Procedure:

This hypothesis requires the combination of survey data with Scoop activity data. Since the survey is a sample, it will describe how respondents would have traveled in the absence of Scoop for a sample of the population. This will inform mode shift for population level estimates. The population level data will be derived from Scoop activity data. This data will be used to estimate the costs that users are experiencing with Scoop. When combined with the mode shift data derived from the survey, the analysis will estimate the change in cost experienced within the sample and for the population more

broadly. Translation of the results to the population level analysis may encounter barriers that limit the analysis. If the survey analysis cannot be appropriately scaled to the population (e.g., for lack of representativeness or other limitations), this hypothesis may only be evaluated using data from the survey sample. The approach will remain the same, in that a calculation of cost of using Scoop will be compared against the alternative mode that the respondent would have taken.

Hypothesis 11: Enforcement and abuse of Scoop permits are low. The fraud rate is low (less than 5 percent).

Performance Metric: Measured fraud rate of Scoop permits

Data Elements & Sources:

- **Scoop detection of permit violation**

  This data will be the same as described in Hypothesis 4.

- **BART enforcement citation data**

  The IE team would use any citation data provided by BART to evaluate whether trends in citations have changed as a result of the project. Data is requested starting in 2015.

Analysis Procedure:

The data will be transformed into a fraud rate, which controls for increased carpooling activity. The analysis will evaluate whether the average fraud rate is lower than 5 percent over time. The test and the time frames evaluated will depend on the structure and frequency of the data. Assuming a large enough sample size of observations, the t-test will be applied to evaluate whether the fraud rate is statistically less than 5 percent. An analysis of citation trends and regression analysis may also be applied depending on the data structure from BART and Scoop.

Hypothesis 12: The marginal cost for BART for implementing the program is less than the revenue earned from additional ridership.

Performance Metric: Estimated revenue gain from ridership increases and parking exceed the marginal cost incurred by BART to implement the Scoop program.

Data Elements & Sources:

- **Ridership data by station by hour or by day**

  This data would be the same as detailed in Hypothesis 6. If the data contains full origin-destination specifications, it can be used to derive BART revenue.

- **Activity data of Scoop users**

Activity data, as described Hypothesis 8, can be used to estimate the increase in carpooling activity that results from the program.

- **BART revenue**

  If BART revenue cannot be derived from provided ridership data and fare tables, then the IE team would request BART to provide revenue data by day from participating stations.

- **Marginal costs incurred by BART (operational)**

  BART will provide an estimate of the operational costs that have been incurred for the duration of the pilot.

Analysis Procedure:

The analysis will estimate the revenue gained from the ridership gained through Scoop activity. This estimate will be derived from a combination of activity data and ridership data. It may use a regression model to inform the marginal contribution of Scoop activity to ridership, or another approach may be applied with the support of the survey data. The marginal contribution of Scoop activity to ridership must be scaled to the population of system users, since the marginal costs incurred by BART will be measured at this level. The exact approach for this will be dependent in part on the resolution of BART data available. Once an estimate of the contribution that Scoop has made to system ridership is generated, and revenue derived from that, it will be compared with the reported marginal costs incurred by BART to determine if it is higher or lower.

Hypothesis 13: The process of deploying the project will produce lessons learned and recommendations for future research and deployment.

Performance Metric: Qualitative documentation from stakeholder interviews

Data Elements & Sources:

- **Stakeholder interviews**

  This data is qualitative in nature. The project team will identify members that can be available to interview with the IE team. The project team should specify at least three people with enough knowledge on the project to talk candidly about its successes and challenges. The IE team will interview these candidates to understand the lessons learned from project implementation.

- **Data collection period:**

  This data collection will be conducted at six months after the launch of the Scoop pilot, but it may be conducted later. It will be conducted as late as possible such that all implementation lessons learned are captured during the interviews.

Analysis Procedure:

An expert interview protocol will be developed. The interviews will be conducted and synthesized from notes and recordings into a summary describing key insights from experts directly involved in the project.

Appendix A. Selected Draft Survey Questions

This section presents draft questions for the survey of app users. These survey questions are subject to revision and not all questions are presented. These questions provide examples of the proposed structure of selected key questions. The survey questions will be revised and augmented with input from the BART project team.

1. How often have you used Scoop when traveling to or from BART?

    - More than 4 times a day
    - 2 to 4 times a day
    - Once a day
    - 4 to 6 days per week
    - 1 to 3 days per week
    - Every other week
    - Once a month
    - Less than once a month
    - Never.

2. How often do you currently ride BART?

    - More than 4 times a day
    - 2 to 4 times a day
    - Once a day
    - 4 to 6 days per week
    - 1 to 3 days per week
    - Every other week
    - Once a month
    - Less than once a month
    - Never.

3. How often do you currently use Scoop?

    - More than 4 times a day
    - 2 to 4 times a day
    - Once a day
    - 4 to 6 days per week
    - 1 to 3 days per week
    - Every other week
    - Once a month
    - Less than once a month
    - Never.

4. Before you started using Scoop, how often did you use BART?

    - More than 4 times a day
    - 2 to 4 times a day
    - Once a day
    - 4 to 6 days per week
    - 1 to 3 days per week
    - Every other week
    - Once a month
    - Less than once a month
    - Never.

    As a result of Scoop, would you say that you ride BART:

    - Much more often; more often; about the same; less often; much less often; I have changed how much I ride BART, but not because of Scoop; I did not ride BART before and do not ride it now.

    As a result of Scoop, would you say that you drive your personal vehicle:

    - Much more often; more often; about the same; less often; much less often; I have changed how much I drive a personal vehicle, but not because of Scoop; I did not ride before and do not ride it now.

5. By about how many miles per month do you **think that your personal vehicle driving has increased?**

    - Miles per month: <Drop-down menu, Less than 10, 20, then increments of 20 to 500, more than 500>

6. By about how many miles per month do you **think that your personal vehicle driving has decreased?**

    - Miles per month: <Drop-down menu, Less than 10, 20, then increments of 20 to 500, more than 500>

7. As a result of Scoop, would you say that you travel by bus:

    - Much more often; more often; about the same; less often; much less often; I have changed how much I use the bus, but not because of Scoop; I did not ride the bus before and do not ride it now.

8. Are you currently on the waitlist for a BART parking permit?

9. Why did you decide to take Scoop to or from BART? (please select all that apply)

10. Do you regularly take Scoop TO a BART station, FROM a BART station, or both?

Section 2: Non-Scoop Travel

11. When you take Scoop TO a BART station, how do you travel FROM that station on your return trip?
12. When you take Scoop FROM a BART station, how do you return to that station?

Section 3: Your Most Recent Scoop Trip

13. What day was this trip?
14. Approximately what time did you start this Scoop trip?
15. Were you the driver or a rider on this most recent Scoop trip to or from BART?
16. Did you go TO or FROM a BART station with Scoop on this trip?

Section 4: Your Scoop Trip TO BART

17. Which BART station did you take Scoop to?
18. Did you begin this Scoop trip from your home or from another location?
19. What is the address (or nearest intersection of streets) of this starting point?
20. What was the purpose of your BART trip?
21. At which BART station did you exit the system on this trip?
22. After exiting BART, where was your destination located?
23. If Scoop had not been available, how would you have gotten to BART for this trip?
24. How did you return from the BART station that you took Scoop to?

Section 54: Your Scoop Trip FROM BART

25. At which BART station did you enter the system?
26. Before entering BART, what was the location of your starting point?
27. What was the purpose of your BART trip?
28. At which BART station did you exit the system on this trip?
29. Did you begin this Scoop trip from BART or from another location?
30. After taking Scoop, where was your destination located?
31. If Scoop had not been available, what mode of travel would you have used to get to your final destination for this trip?
32. How did you return to the BART station that you took Scoop from?

Section 6: Follow Up (if questions 22/30 were answered that the trip would not have been taken)

33. How would you have gotten to your destination instead of taking BART?

Section 7: About You

34. Do you own or lease a car?
35. What is the make/model/year of the car that you drive?
36. Please indicate your gender.
37. In what year were you born?
38. What is the highest level of education you have completed?
39. What is your race or ethnicity?

40. What was your total annual household income in 2016 before taxes? (Your household includes people who live with you and with whom you share income.)
41. Including yourself, how many people live in your household? (Your household includes people who live with you and with whom you share income.)

Section 8: Conclusion

42. Please provide any comments or suggestions on the Scoop to BART program. You can elaborate here on how Scoop has impacted how you travel and provide any information you feel was not covered by the question in this survey.
43. If you would like to be entered into a drawing to win a $50 BART ticket, please enter your name and email address here.

Addendum. Documentation of Evaluation Plan Variance Following Demonstration Deployment

The evaluation plans for the MOD Sandbox Demonstration projects were developed in the planning phase of the project, prior to the execution of the demonstration. As part of this process, data structures and data availability were anticipated. As project implementation proceeded, certain elements of the project and data availability changed.

This addendum presents differences between the planned and executed analyses for the independent evaluation of the Bay Area Rapid Transit (BART) Integrated Carpool to Transit Access Program. Due to changes to pilot operations, data availability issues, and other unforeseen circumstances, some of the hypotheses proposed as part of the original scope of work were modified or their analyses were adjusted to better encompass these changes. In this addendum, changes that were made to each hypothesis (if any) and the key reasons why study methods may have differed from what was planned are identified and discussed. Many hypotheses and their proposed analytical approaches did not change significantly or at all. In these cases, it is noted that there were no differences between the proposed and executed analyses.

Hypothesis 1:	Carpooling to stations increases following the implementation of the Scoop to BART pilot project.

There were no differences between the proposed and executed analyses for Hypothesis 1. Carpool activity data was analyzed before and after the pilot to evaluate any changes due to the implementation of the Scoop to BART pilot project.

Hypothesis 2:	Utilization of parking spaces by carpooling vehicles increases.

There were no differences between the proposed and executed analyses for Hypothesis 2. Carpool activity data was used to derive parking activity at BART stations which was then used to evaluate the change in parking utilization as a result of the pilot.

Hypothesis 3:	The cost of enforcement per carpool space declined with no sacrifice in enforcement quality.

Proposed analysis: The analysis outlined in the evaluation plan proposed using enforcement labor data and carpooling space utilization data to evaluate trends in the cost and time spent on carpool enforcement before and after the pilot.

Executed analysis: The executed analysis did not evaluate trends in the cost and time spent on carpool enforcement before and after the pilot due to the lack of continuous enforcement labor data. Instead, the analysis used estimations, provided by BART, of labor hours and cost spent on carpool enforcement to evaluate the change in cost per enforcement per carpool space as a result of the pilot.

Hypothesis 4:	The number of instances of illegal carpool spaces per total carpool spaces available will be lower than before the pilot initiation.

Proposed analysis: The analysis outlined in the evaluation plan proposed analyzing citation data to evaluate the magnitude of illegal use of carpool spaces before and after the pilot.

Executed analysis: The executed analysis did not calculate the number of instances of illegal carpool spaces before and after the pilot due to the lack of required attributes that define the type of violation in the citation data. This hypothesis was not quantitatively assessed as originally intended. Instead, aggregate citation data and BART's anecdotal experience were combined to understand the effect of the pilot on the fraudulent use of carpool spaces.

Hypothesis 5:	The distribution of legal arrivals to carpool spaces will be closer to a uniform distribution between the hours of 6am and 10am than before the pilot.

Proposed analysis: The analysis outlined in the evaluation plan proposed analyzing carpool activity data to compare the distributions of arrivals to carpool spaces before and after the pilot.

Executed analysis: The executed analysis did not directly calculate distributions of arrivals to carpool spaces before and after the pilot due to the lack of arrival activity data. Instead, carpool activity data was used to analyze the distribution of planned trip start times throughout the evaluation period.

Hypothesis 6:	The number of persons per vehicle at BART stations increases after the program.

Proposed analysis: The analysis outlined in the evaluation plan proposed analyzing BART data, if available, about parking counts and capacity measurements to evaluate the change in number of persons per vehicle at BART stations before and after the pilot.

Executed analysis: The executed analysis did not directly calculate the number of persons per vehicle at BART stations due to the lack of broader BART parking data. Instead, assumptions of occupancy for non-carpool vehicles were applied to estimate an upper bound for the aforementioned metric.

Hypothesis 7:	The technological changes to carpooling have caused people who would have driven alone to carpool to BART stations.

There were no differences between the proposed and executed analyses for Hypothesis 7. After survey questions gauged the change in user travel behavior as a result of the pilot.

Hypothesis 8:	The expansion of Scoop to all BART Stations will lower VMT and reduce GHG emissions that would have occurred in its absence.

There were no differences between the proposed and executed analyses for Hypothesis 8. Carpool activity data and survey data were analyzed to evaluate the effect of the pilot on VMT.

Hypothesis 9:	Overall ridership increases as a result of the Scoop program.

There were no differences between the proposed and executed analyses for Hypothesis 9. BART ridership data and carpool activity data were used to evaluate changes in ridership as a result of the pilot.

Hypothesis 10:	Users of the Scoop application reduce their cost of travel relative to their previous method of travel to BART or commuting.

Proposed analysis: The analysis outlined in the evaluation plan proposed analyzing survey data and carpool activity data to derive estimates for user cost of travel before and after the pilot.

Executed analysis: The executed analysis did not directly evaluate the change in user cost of travel as a result of the pilot due to the lack of origin and destination information within carpool activity data, which made an activity-based analysis of user cost infeasible. Instead, survey data was analyzed to evaluate the use of Scoop as a cost-reducing travel alternative.

Hypothesis 11:	Enforcement and abuse of Scoop permits are low. The fraud rate is low (less than 5%).

Proposed analysis: The analysis outlined in the evaluation plan proposed analyzing BART enforcement citation data and Scoop permit violation data to calculate the fraud rate of Scoop permits during the pilot.

Executed analysis: The executed analysis did not calculate the fraud rate of Scoop permits during the pilot due to the lack of data on fraud and abuse of Scoop permits. This hypothesis was not quantitatively assessed as originally intended. Instead, a qualitative assessment of the Scoop system and BART's anecdotal experience were combined to evaluate the fraud rate of Scoop permits during the pilot.

Hypothesis 12:	The marginal cost for BART for implementing the program is less than the revenue earned from additional ridership.

Proposed analysis: The analysis outlined in the evaluation plan proposed using BART ridership data and carpool activity data to estimate revenue earned from additional ridership. Then, the planned analysis proposed comparing generated revenue to marginal operational costs incurred by BART during the pilot.

Executed analysis: The executed analysis used BART ridership data and carpool activity data to estimate revenue earned from additional ridership. However, the analysis did not compare the marginal revenue to marginal costs incurred by BART during the pilot due to the lack of data concerning the latter.

Hypothesis 13:	The process of deploying the project will produce lessons learned and recommendations for future research and deployment.

There were no differences between the proposed and executed analyses for Hypothesis 13. Expert (stakeholder / project partner) interviews were conducted and summarized to describe key insights about the pilot.

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