San Francisco
Urban Partnership Agreement

National Evaluation:
Transit System Data Test Plan

SAN FRANCISCO URBAN PARTNERSHIP AGREEMENT

NATIONAL EVALUATION: TRANSIT SYSTEM DATA TEST PLAN

By

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16. Abstract

This report presents the test plan for collecting and analyzing the transit system data for the San Francisco Urban Partnership Agreement (UPA) under the United States Department of Transportation (U.S. DOT) UPA Program. The San Francisco UPA projects focus on reducing congestion by employing strategies consisting of combinations of tolling, transit, telecommuting/travel demand management (TDM), and technology, also known as the 4 Ts. The national evaluation focuses on the San Francisco UPA projects that deal with parking pricing in downtown San Francisco and technology and telecommuting/TDM projects. The SF*park* parking pricing pilot will implement variable pricing in on-street and garage parking in selected parking zones. Information on parking availability and price will be available by phone, websites, and variable message signs. Outreach events for alternate commute programs will inform the public about the parking pricing and information projects. The Transit System Data Test Plan is based on the San Francisco UPA National Evaluation Plan. This test plan describes the transit system data sources, data availability, and possible risks associated with the data. The methods for analyzing the transit system data are discussed. The schedule and responsibilities for collecting, analyzing, and reporting the transit system data are presented.

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LIST OF ABBREVIATIONS

4Ts	Tolling, Transit, Telecommuting, and Technology
APC	Automatic passenger counter
BART	Bay Area Rapid Transit
CVO	Commercial vehicle operator
DOE	Department of Environment
FHWA	Federal Highway Administration
ISP	Information service provider
ITS	Intelligent transportation systems
MTC	Metropolitan Transportation Commission
Muni	San Francisco Municipal Railway
PMD	Parking management district
SFCTA	San Francisco County Transportation Authority
SFMTA	San Francisco Municipal Transportation Agency
TDM	Travel demand management
UPA	Urban Partnership Agreement
U.S. DOT	United States Department of Transportation
VT	Vehicle trips

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1.0   INTRODUCTION

This report presents the test plan for collecting and analyzing transit system data for the national evaluation of the San Francisco Urban Partnership Agreement (UPA) under the United States Department of Transportation (U.S. DOT) UPA program. The San Francisco UPA is one of several large field deployments around the United States that are receiving U.S. DOT funding and which are intended to demonstrate congestion pricing and supporting strategies. The San Francisco UPA national evaluation will address the four primary U.S. DOT UPA evaluation questions shown in Table 1-1.

Table 1-1. U.S. DOT National Evaluation "Objective Questions"

Objective Question #1	How much was congestion reduced in the area impacted by the implementation of the tolling, transit, technology, and telecommuting strategies? It is anticipated that congestion reduction could be measured by one of the following measures, and will vary by site and implementation strategy: • reductions in vehicle trips made during peak/congested periods; • reductions in travel times during peak/congested periods; • reductions in congestion delay during peak/congested periods; and • reductions in the duration of congested periods.
Objective Question #2	What are the associated impacts of implementing the congestion reduction strategies? It is anticipated that impacts will vary by site and that the following measures may be used: • increases in facility throughput during peak/congested periods; • increases in transit ridership during peak/congested periods; • modal shifts to transit and carpools/vanpools; • traveler behavior change (e.g., shifts in time of travel, mode, route, destination, or forgoing trips); • operational impacts on parallel systems/routes; • equity impacts; • environmental impacts; • impacts on goods movement; and • effects on businesses.
Objective Question #3	What are the non-technical success factors with respect to the impacts of outreach, political and community support, and institutional arrangements implemented to manage and guide the implementation?
Objective Question #4	What are the overall costs and benefits of the deployed set of strategies?

The questions shown in Table 1-1 will be addressed by carrying out the following ten "evaluation analyses" described in the San Francisco UPA National Evaluation Plan: congestion, pricing, telecommuting/travel demand management (TDM), technology, equity, environmental, goods movement, business impacts, non-technical success factors, and cost-benefit. Each of these 10 analyses relies upon various evaluation measures of effectiveness.

"Test plans" are the evaluation planning documents that describe how specific data will be collected and processed to yield the evaluation measures of effectiveness required for the various analyses. Whereas evaluation analyses are categorized according to related evaluation questions or types of impacts, for example all equity-related impacts are addressed in the equity analysis, test plans are categorized according to common data types or sources. For example, the "Traffic System Data Test Plan" collects and processes all of the traffic data required for the national evaluation. In addition to this Transit System Data Test Plan, the other nine test plans focus on the following types of data: traffic, parking, traveler information, telecommuting/travel demand management, surveys and interviews, environmental, content analysis, cost benefit analysis, and exogenous factors.

The relationship between test plans and evaluation analyses is discussed in Section 1.2. In short, analyses describe the evaluation questions and hypotheses to be investigated and the test plans describe how the data and measures of effectiveness needed to support the evaluation will be collected and processed. Most test plans collect data and provide measures of effectiveness that will be used in multiple analyses and most analyses rely upon data and measures developed through several different test plans.

The remainder of this introduction chapter describes the San Francisco UPA deployments and elaborates on the relationship between test plans and evaluation analyses. The remainder of the report is divided into three sections. Chapter 2 presents the data sources, data availability, and risks associated with evaluating the transit system data elements of the San Francisco UPA. Chapter 3 describes the techniques that will be used to test hypotheses and assess the measures of effectiveness in which transit data are used. Chapter 4.0 presents the schedule and responsibilities for collecting and analyzing the transit system data.

1.1   The San Francisco UPA

San Francisco was selected by the U.S. DOT as an Urban Partner to implement projects aimed at reducing congestion based on four complementary strategies known as the 4Ts: Tolling, Transit, Telecommuting/TDM, and Technology. Under contract to the U.S. DOT, a national evaluation team led by Battelle is assessing the impacts of the projects in a comprehensive and systematic manner in San Francisco and other sites. The national evaluation will generate information and produce technology transfer materials to support deployment of the strategies in other metropolitan areas. The national evaluation will also generate findings for use in future Federal policy and program development related to mobility, congestion, and facility pricing.

The San Francisco local UPA partners for the national evaluation consist of three public agencies. Two of the partners represent the City of San Francisco – the San Francisco County Transportation Authority (SFCTA) and the San Francisco Municipal Transportation Agency (SFMTA). The third partner is the Metropolitan Transportation Commission (MTC), the metropolitan planning organization for the Bay Area.

The San Francisco projects are focused on reducing traffic congestion related to parking in downtown San Francisco. Intelligent transportation systems (ITS) technologies underlie many of the San Francisco UPA projects, including those utilizing parking sensors and real-time parking

information. The San Francisco UPA projects that will be evaluated[1] are described briefly below.

SF*park* Variable Pricing. SF*park* is the name given to the parking pricing system to be implemented by SFMTA. The primary goal of SF*park* is to use intelligent parking management technology and techniques, in particular demand-responsive pricing, to manage the on-street and off-street parking supply and demand. SFMTA expects this approach to increase parking availability, reduce the number and duration of vehicle trips (VT), and reduce double parking and, thereby, reduce congestion. The parking technologies to be tested include networked parking meters, parking occupancy sensors, and parking information systems. Pricing policies may change over the course of the evaluation period, as SF*park* managers adjust rates in response to demand. Some extensions in times of day/week that meters are operable are also possible pending SFMTA Board actions.

The pilot areas for SF*park* are highlighted in red (or dark lines) in Figure 1-1. The new system will consist of approximately 6,000 metered on-street parking spaces (about one-quarter of the city's total supply) and 12,250 parking spaces in fourteen city-operated garages and one lot. Control areas, highlighted in yellow (or light lines) in Figure 1-1, will be equipped with traffic sensors for monitoring use of the parking supply where variable pricing is not implemented.

To assist travelers in making choices about parking pre-trip and en-route, SFMTA will disseminate parking information in various ways. Strategically placed variable message signs[2] will show parking availability in city-operated garages, and parking availability and pricing information will also be displayed on SFMTA's website and by text messaging to mobile devices.

511 Upgrades. The 511 phone and website in the San Francisco Bay Area, operated by MTC, is one of the most advanced in the country, including a variety of multi-modal information. However, at the present time, the parking information on 511 is limited to static information about park and ride lots and rail stations (on the web) and airport parking (on the phone). The planned upgrades will provide parking space availability and pricing information for selected parking facilities in downtown San Francisco by 511 phone and web and by information service providers (ISPs) in the region who receive a feed of 511 data from MTC. MTC will receive a real-time data feed of parking availability for parking garages managed by SFMTA and pricing data for those SFMTA garages, lots, and on-street parking. The user interfaces on 511 phone and website will be enhanced to disseminate the parking information to 511 customers.

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[1] The Clipper[SM] electronic payment card (formerly known as TransLink®) that was to be piloted for parking payment at five SFMTA garages was removed from the national evaluation owing to uncertainty about when it would be deployed.

[2] The deployment of the variable message signs has been delayed to December 2011, placing them several months behind the other UPA projects. Rather than delay evaluation of the rest of the projects, the decision was made not to include them in the national evaluation.

San Francisco Municipal Transportation Agency, used with permission.
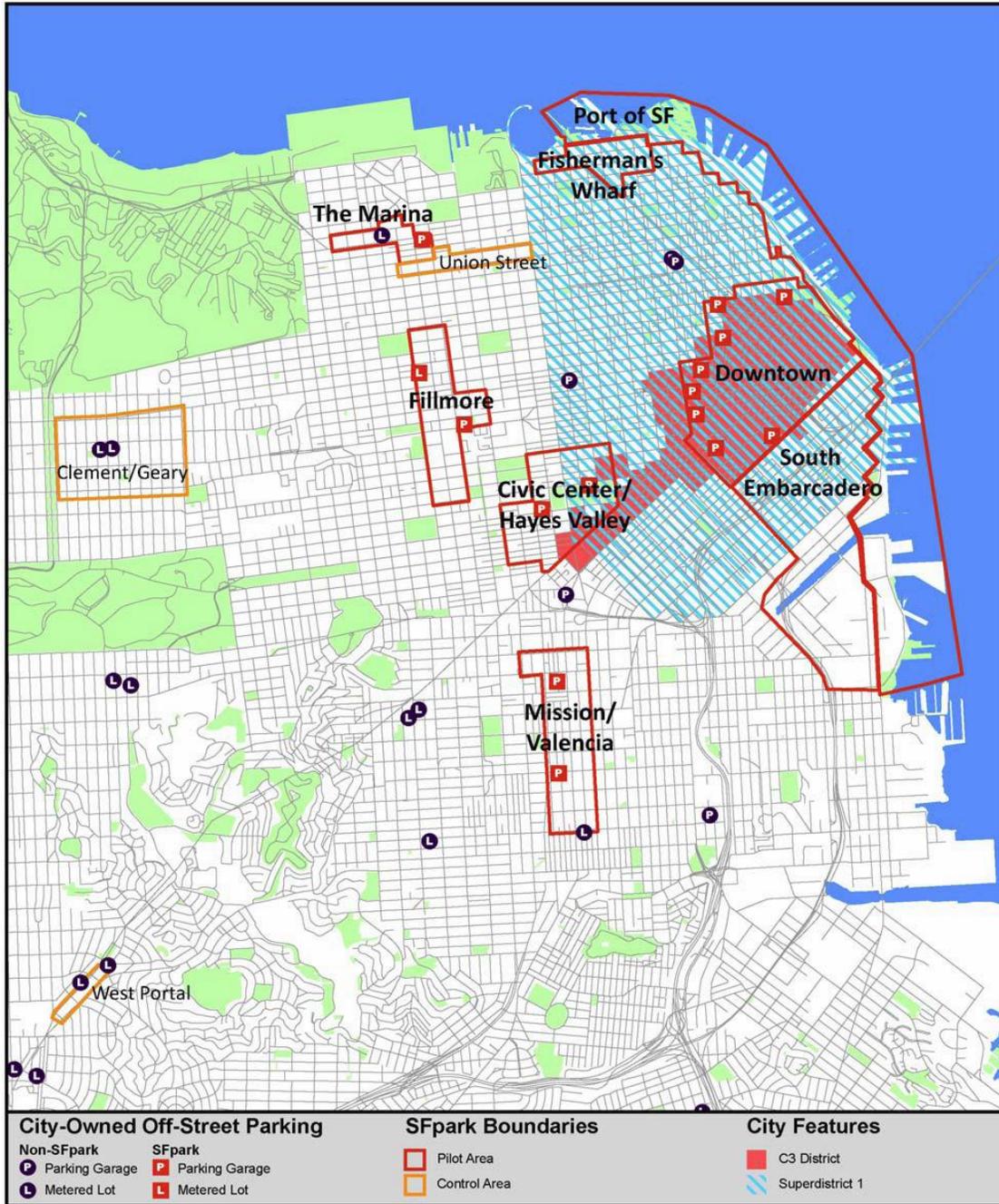
Figure 1-1. SF*park* Pilot and Control Zones

Expansion of San Francisco Telecommuting and Alternate Commute Programs. Under the
direction of the SFCTA, the telecommuting and alternate commute programs will be undertaken
by the City of San Francisco's Department of the Environment (DOE). In support of the SF*park*
and 511 enhancements, DOE and SFCTA plans include two activities: promotion of SF*park* at
DOE outreach events and promotion of 511 enhancements at outreach events. Through the
outreach efforts, downtown workers will be better informed about the UPA initiatives and can
better use the parking and information resources available to them.

Schedule for the San Francisco UPA Projects. The projects to be evaluated will go into operation between mid-2011 and late 2011. SFMTA will be implementing variable pricing in SF*park* zones in mid-2011. Also in mid-2011, real-time parking information will become available via SFMTA's website and text messaging and the MTC 511 phone system. In late 2011 parking information will be available on the 511 website. As the SFMTA and MTC projects are deployed, SFCTA will conduct its expanded outreach and alternate commute program.

1.2 San Francisco UPA National Evaluation Plan and the Use of the Transit Data

Table 1-2 shows which of the various San Francisco UPA test plans will contribute data to each of the evaluation analyses. The "flow" between test plans is "one way" in the sense that test plans feed data and measures to the analyses rather than the reverse. The solid circles show where data from a given test plan constitutes a major input to an analysis; the open circles show where data from a given test plan constitutes a supporting input to an analysis. Data from the Transit System Data Test Plan will be used with the congestion, pricing, environmental, and cost benefit analyses. Table 1-3 presents the transit system data elements and the measures of effectiveness and the hypotheses/questions the transit data will be used to evaluate.

Table 1-2. Relationship Among Test Plans and Evaluation Analysis

San Francisco UPA Test Plans	Congestion Analysis	Pricing Analysis	Telecommuting/ TDM Analysis	Technology Analysis	Equity Analysis	Environmental Analysis	Goods Movement Analysis	Business Impact Analysis	Non-Technical Success Factors Analysis	Cost Benefit Analysis
Traffic System Data Test Plan	●				○		○			○
Parking Data Test Plan		●		○	○	○	●	○		
Transit System Data Test Plan	○	●				○				○
Telecommuting/TDM Data Test Plan			●							
Traveler Information Data Test Plan				●						
Surveys and Interviews Test Plan	●	●	●	●	●	○		○	●	○
Environmental Data Test Plan					○	●				○
Content Analysis Test Plan									●	
Cost Benefit Analysis Test Plan										●
Exogenous Factors Test Plan	○	○	○	○	○	○	○	○	○	○

● — Major Input   ○ — Supporting Input

Table 1-3. Transit Test Plan Data Elements Use in Testing Evaluation Hypotheses/Questions

San Francisco Tolling Data Element	San Francisco UPA Measure of Effectiveness	San Francisco UPA Hypotheses/Questions*
1. Transit Ridership	• Change in ridership	SFPricing-5 SFEnv-1 SFEnv-3 SFCBA-1
2. Transit Travel Time	• Change in average transit route segment travel time	SFCong-1 SFPricing-5 SFCBA-1
3. Transit Reliability	• Change in schedule adherence • Change in headway adherence	SFPricing-5

*Listed are acronyms corresponding to hypotheses/questions to be addressed with data from this test plan. An explanation of these acronyms can be found in Appendix A, which contains a compilation of the hypotheses/questions for all the analysis areas from the San Francisco UPA National Evaluation Plan.

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2.0   TRANSIT ROUTES

As noted in Chapter 1.0, the San Francisco UPA projects include variable parking pricing for on-street and off-street parking and 511 upgrades to better communicate the location of available parking. These projects are expected to reduce roadway congestion and improve travel time reliability by improving parking availability, reducing parking search travel and double parking, and encouraging mode shifts. As a result, transit travel time and ridership are also expected to improve.

Table 2-1 presents the major San Francisco Municipal Railway (Muni) bus routes influenced by the San Francisco UPA projects that will be included in the transit analysis. These routes provide significant service to the pilot areas, including Civic Center/Hayes Valley, Downtown, the Fillmore, Fisherman's Wharf, the Marina, Mission/Valencia, Port of SF, and South Embarcadero. The route number, route description, and service type (express or local) are included in this table.

Table 2-1. Transit Routes in Pilot Parking Management Districts

Pilot Parking Management Districts	Regular Service	Peak Hour Service	Peak Hour Express Service
Civic Center/Hayes Valley	31, 5, GG, F, 6, 21, 71, 71L, 49, 47 19	16X	16X
Fillmore	24, 10, 1, 2, 3, 38, 38L, 31, 5, 22	1 BX	1.31.38 AX BX
Fisherman's Wharf	F, GG, 47, 39, 8X, PM, 30, PH, 19	8BX	
The Marina	30, 43, 76, 28, 22	30X	
Mission/Valencia	22, 33, 49, 14L, 14, 67, 12		
South Embarcadero	T, N, 10B, 27, 47, 45, 30, 8X, 76, 12, 10, 10B	8BX, 14X, 80X, 82X, 81X	
Downtown	F, 41,1,10,GG, 8X, 30, 45, 76, 27, 12,14, 14L,3,2, PM, PH, 38, 38L, 31	8A, 8B, 16X, 41	10B, 80X, 81X, 82X, 30X, 14X, 1AX, 1BX, 31AX, 31BX, 38 AX, 38 BX
Port of SF	F, T, N		

Source: http://transit.511.org/schedules/index.aspx#m1=S&m2=rail&cid=SF

In addition to the routes listed in Table 2-1, selected routes in the control areas—Union Street, and Clement/Geary—are listed in Table 2-2. Information on these routes is presented in Table 2-2. Total annual transit ridership will also be monitored. Changes in ridership in the control corridors and system-wide will be used as comparisons with changes in the SF*park* pilot areas.

Table 2-2. Transit Routes in Control Parking Management Districts

Control Parking Management Zone	Regular Service	Peak Hour Service	Peak Hour Express Service
Clement/Geary	1, 2, 28, 28L, 33, 38, 38L,44, 71, 71L, 49, 47	1BX, 1AX	1BX, 31AX, 38AX
Union Street	17, K, M		

Source: http://transit.511.org/schedules/index.aspx#m1=S&m2=rail&cid=SF

Table 2-3 presents the major Bay Area Rapid Transit (BART) routes influenced by the San Francisco UPA projects that will be included in the transit analysis. These routes provide significant service to the pilot areas, including Civic Center/Hayes Valley, Downtown, Mission/Valencia, Port of San Francisco, and South Embarcadero. There are no BART stations in or adjacent to the control zones.

Table 2-3. BART Stations in or Near Pilot Parking Management District

Pilot Parking Management District	Bart Stations
Civic Center/Hayes Valley	Civic Center/UN Plaza
Mission/Valencia	16th Street Mission 24th Street Mission
South Embarcadero	Embarcadero Montgomery Powell
Downtown	Embarcadero Montgomery Powell
Port of San Francisco	Embarcadero

Source: http://transit.511.org/schedules/index.aspx#m1=S&m2=rail&cid=SF

3.0   DATA SOURCES, AVAILABILITY, AND RISKS

This chapter identifies the sources for the transit data and discusses the availability of those data and any potential risks associated with collecting and processing them for use in the evaluation. Table 3-1 summarizes the data requirements for the Transit System Data Test Plan. The details associated with source, timing and other particulars are discussed in the sections that follow.

3.1   Data Sources

As discussed above, the data elements included in the Transit System Data Test Plan are transit ridership, transit travel times, and transit service reliability. The specific data sources supporting these elements include automated passenger counts (APCs) collected by Muni. BART passenger arrivals and departures by station by hour are also available. The APC and BART data will be made available by SFMTA, for all the routes in the SF*park* data warehouse. The data warehouse is an Internet-based repository maintained by SFMTA from which the evaluation team will be able to access the transit data sources specified in this test plan. Once the data is made available to the evaluation team, they will assess the quality of the data and decide whether one or both of the data sets are necessary to conduct the travel time and reliability analyses.

Muni Automatic Passenger Counters Data. APCs are installed on approximately 30 percent of Muni's rubber tired fleet and vehicles with APC circulate throughout the system to provide samples that are used, with standard statistical techniques, to factor up and provide estimates for all system routes. Table 3-2 provides the data that will be available in the SF*park* warehouse from Muni's APC data. Data on total passengers on the bus at stop departure by stop location, route, direction, time of day, and date can be used to calculate changes in transit ridership that may result from SF*park*. Data on transit vehicle running and dwell time by location, route, direction, time of day, and date can be used to calculate change in transit travel times in the parking management zones. Travel time variability data can be used to calculate changes in transit service reliability.

BART Data. BART passenger arrivals and departures by station by hour will be made available to the national evaluation team. This data is routinely collected by BART, and SFMTA will post this data in the warehouse.

Table 3-1. Data Requirements for the Transit System Data Test Plan

| Data Element | Parking Management District (Pilot and Control) & System-Wide | Data Granularity | Data Collection Frequency: Continuous Sampling (Automatic) | Data Collection Timing* | | | | Data Reporting Freq. | Data Source | Respon-sible Agency |
| | | | | Baseline | | Post-Deployment | | | | |
				Begin	End	Begin	End			
1. Transit Ridership	− Clement/Geary − Civic Center/Hayes Valley − Downtown − Fillmore − Fisherman's Wharf − The Marina − Misson/Valencia − Port of SF − South Embaracdero − Union Street − Muni System for San Francisco − BART System for San Francisco and Region	− route − location − time of day − date − travel time segment (timepoint to timepoint)	X	Mid-2008	Mid-2011	Mid-2011	Mid-2012	Quarterly	Muni APC, BART	SFMTA
2. Transit Travel Time			X	Mid-2008	Mid-2011	Mid-2011	Mid-2012	Quarterly	Muni APC	SFMTA
3. Transit Service Reliability			X	Mid-2008	Mid-2011	Mid-2011	Mid-2012	Quarterly	Muni APC	SFMTA

*assumes mid-2011 launch of SF*park*. Actual baseline and post-deployment months could vary.

Table 3-2. Muni Automated Passenger Counts Data Provided for Transit Routes in Pilot and Control Parking Management Districts

APC Data Elements
• Route number
• Date
• Trip-block number
• Direction of Travel (inbound or outbound)
• Bus travel time segment name (from timepoint to timepoint)
• Bus travel time segment length
• Actual cumulative time bus experienced dwelling at bus stops from last timepoint (arrival-departure)
• Actual cumulative bus running time from last timepoint (departure – arrival)
• Total actual travel time from last timepoint (arrival-arrival)
• Schedule travel time from last timepoint (arrival-arrival)
• Difference between schedule and actual travel times
• Total number of boardings from last timepoint
• Total number of alightings from last timepoint
• Number of passengers on-board from time last timepoint

3.2   Data Availability

Pre-deployment and post-deployment data will be available for all the transit data elements including ridership, travel time, and reliability, as summarized in Table 3-3 below. Muni APC and BART data will be made available by SFMTA through the data warehouse.

Table 3-3. Transit System Test Plan Data Sources and Availability

Data Source	Pre-Deployment		Post-Deployment	
	Muni APC	BART	Muni APC	BART
1. Transit Ridership	Yes	Yes	Yes	Yes
2. Transit Travel Time	Yes	No	Yes	No
3. Transit Reliability	Yes	No	Yes	No

The SF*park* data warehouse will serve as a repository for the data elements in this test plan. The national evaluation team will be given access to the data warehouse to perform queries to obtain the data for analysis.

3.3   Potential Risks

There do not appear to be any significant risks associated with collecting transit ridership, travel time, and reliability data. These data are collected and used by SFMTA on a regular basis. Potential issues may arise during the data collection process, however. To address any potential problems, the national evaluation team members will work with partnership agency staff to initiate the data request early in the evaluation process. This will provide an opportunity to perform some very limited analysis of the initial data to determine whether the data format and syntax are suitable for the evaluation. Any issues identified can be resolved in time for the formal analysis once the data collection period is over.

4.0 DATA ANALYSIS

The Transit System Data Test Plan focuses on collecting and analyzing transit ridership, travel time, and service reliability data on routes in the SF*park* pilot and control parking management districts (PMDs). Figure 4-1 provides an example transit route segments in the PMD to be evaluated. Pre-deployment and post-deployment data will be used to assess the pricing analysis measures of effectiveness. The transit data will also be used in the congestion and environmental analyses. Data will be quality-checked for outliers, missing information, or other irregularities, and any issues will be resolved with the agency providing the data.

All analyses will consider the potential impact of exogenous factors on the collected data, including employment, gas prices, general system impacts, and construction events. Collection of the exogenous factors data are discussed in the exogenous factors test plan. As described above, there are three SF*park* control areas that will be used to compare changes due to parking pricing in the seven pilot areas. All data collected in the pilot area will also be collected in the three control areas.
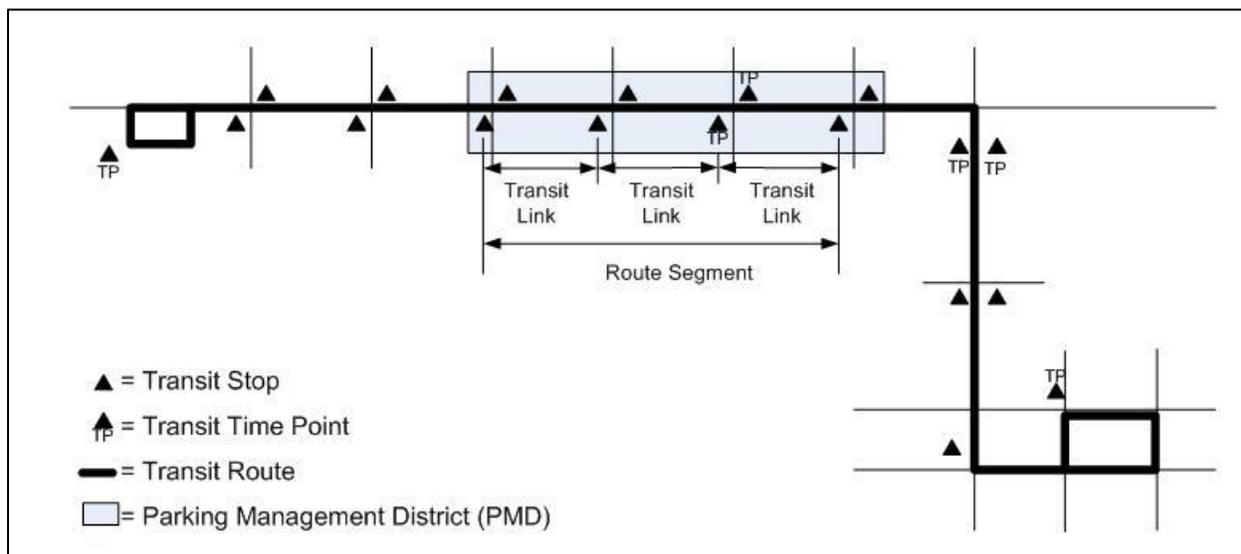

Figure 4-1. Example of a Transit Route Segment in a Parking Management District

The analysis of transit system data will focus on developing specific measures of effectiveness that will be used in the pricing, congestion, and environmental analyses of the San Francisco UPA evaluation as noted in Table 1-2. Standard statistical techniques will be applied to measures of effectiveness calculated using the transit data. Measures in the SF*park* pilot PMDs will be compared with control PMDs before and after each change in parking pricing. Consideration will also be given to the potential impact of exogenous factors, such as system-wide trends in transit usage and unemployment trends. In general, the techniques will be uses to identify total change, percentage change, and significant change (relative to control and/or accounting for exogenous factors) in transit ridership, travel times, and service reliability in the pilot PMD. The following are examples of these measures:

- **Average ridership** in the pilot and control PMDs will be calculated by route, time of day, date, and direction using MUNI's APC data. BART ridership for stations in the pilot and control PMDs will also be analyzed.

- **Transit mode share (percentages of total PMD person trips)** will be determined by calculating the proportion of total person-throughput generated by each travel mode. Average vehicle occupancy and traffic volumes collected through the Traffic System Data Test Plan, along with transit ridership using MUNI's APC data will be used to calculate mode share. Average ridership on transit services within the specified a.m. and p.m. peak periods will be isolated within each evaluated PMD to determine transit person-throughput during these periods.

- **Transit travel times**, as vehicles enter and exit the pilot and control PMDs, will be calculated by route, time of day, data, and direction using Muni APC data.

- **Schedule and headway adherence** in the pilot PMD will be calculated by route, time of day, data, and direction using Muni APC data. Upstream delays will be controlled for in the analysis of this measure of effectiveness.

Transit ridership, travel time, and service reliability data will be aggregated in this analysis by time periods suitable to the effects of the SF*park* in each PMD. The definition of appropriate time periods will be determined in consultation with SFMTA so that the impact of pricing changes can be assessed.

5.0   SCHEDULE AND RESPONSIBILITY

The collection schedule for the transit data is based on three years of baseline data and a year of post-deployment data geared to the start of operation of SF*park* in mid-2011. The details on the schedule for collection and reporting of the data were presented in Table 3-1. As described previously, all the transit data are collected on a continuous basis by SFMTA and BART, and the data will be included in SFMTA's data warehouse.

SFMTA is responsible for collecting and storing all of the transit system data in the data warehouse and will grant the national evaluation team access to the data warehouse. The national evaluation team expects to query the data warehouse to obtain the data and examine the data quarterly. The national evaluation team will analyze the data to assess the measures of effectiveness and report the findings. Prior to using any of the transit data, the evaluation team, with the assistance of SFMTA, will inspect the data so as not to include any suspect or obviously invalid data which could bias the results of the analyses.

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APPENDIX A – COMPILATION OF HYPOTHESIS/QUESTIONS FROM THE SAN FRANCISCO UPA NATIONAL EVALUATION PLAN

Evaluation Analysis	Hypothesis/ Question Number	Hypothesis/Question
Congestion	SFCong-1	The deployment of SF*park* and the 511 improvements will reduce traffic congestion on selected travel routes in the downtown area
	SFCong-2	Travelers will perceive that congestion has been reduced
Pricing	SFPricing-1	Parking pricing will increase parking availability
	SFPricing-2	Parking pricing will lead to reduced search time and variability
	SFPricing-3	Parking pricing will reduce double parking
	SFPricing-4	Parking pricing will shorten the duration of the average on-street parking session
	SFPricing-5	Parking pricing will improve reliability and speed of public transit
	SFPricing-6	Parking pricing will cause a shift to other routes, modes, and other parking garages
Telecommuting/ TDM	SFTele/TDM-1	TDM events will increase the demand for information about SF*park* and 511 enhancements
	SFTele/TDM-2	SF*park* and 511 enhancements will increase effectiveness of TDM program
	SFTele/TDM-3	Distribution of UPA-related information at events will influence parking program awareness and behavior change
Technology	SFTech-1	Implementing advance parking technology will improve agency ability to manage parking
	SFTech-2	Improving the dissemination of parking information via 511 phone, websites, and text messaging, will reduce parking search times
Equity	SFEquity-1	What are the direct social effects (parking fees, travel times, adaptation costs) for various transportation system user groups?
	SFEquity-2	What is the spatial distribution of aggregate out-of-pocket and inconvenience costs, and travel-time and mobility benefits?
	SFEquity-3	Are there any differential impacts on certain socioeconomic groups?
	SFEquity-4	How does reinvestment of parking pricing revenues impact various transportation system users?

Evaluation Analysis	Hypothesis/ Question Number	Hypothesis/Question
Environmental	SFEnv-1	SF*park* will improve air quality by reducing parking search times and shifting trips from car to transit
	SFEnv-2	The public will perceive an improvement in air quality resulting from SF*park*
	SFEnv-3	SF*park* will reduce fuel consumption by reducing parking search times and shifting trips from car to transit
Goods Movement	SFGoods-1	Commercial vehicle operator (CVO) double parking will decrease in the SF*park* areas
	SFGoods-2	CVO double parking fines will decrease in the SF*park* areas
	SFGoods-3	Parking availability, including loading and freight zones, will increase in the SF*park* areas
	SFGoods-4	Travel times will decrease in the SF*park* areas for CVOs and other vehicles
Business	SFBusiness-1	Sales will increase in the SF*park* areas
	SFBusiness-2	Overall travel to access retail and similar businesses will increase in the SF*park* areas
Non-Technical	SFNonTech-1	What role did factors related to "people" play in the success of the deployment? People (sponsors, champions, policy entrepreneurs, neutral conveners)
	SFNonTech-2	What role did factors related to "process" play in the success of the deployment? Process (forums including stakeholder outreach, meetings, alignment of policy ideas with favorable politics, and agreement on nature of the problem)
	SFNonTech-3	What role did factors related to "structures" play in the success of the deployment? Structures (networks, connections and partnerships, concentration of power and decision-making authority, conflict-management mechanisms, communications strategies, supportive rules and procedures)
	SFNonTech-4	What role did factors related to "media" play in the success of the deployment? Media (media coverage, public education)
	SFNonTech-5	What role did factors related to "competencies" play in the success of the deployment? Competencies (cutting across the preceding areas: persuasion, getting grants, doing research, technical/technological competencies; ability to be policy entrepreneurs; knowing how to use markets)
	SFNonTech-6	Does the public support the UPA strategies as effective and appropriate ways to reduce congestion?
Cost Benefit	SFCBA-1	What is the net benefit (benefits minus costs) of the UPA strategies?

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