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Urban Partnership Agreement

National Evaluation:
Traffic System Data Test Plan

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SAN FRANCISCO
URBAN PARTNERSHIP AGREEMENT

NATIONAL EVALUATION:
TRAFFIC SYSTEM DATA TEST PLAN

By

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16. Abstract

This report presents the test plan for collecting and analyzing traffic 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 supporting technology and telecommuting/TDM projects. The SF*park* parking pricing pilot will implement variable pricing in on-street and garage parking in selected parking districts. 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 parking information projects. The Traffic System Data Test Plan is based on the San Francisco UPA National Evaluation Plan. This test plan describes the traffic system data sources, data availability, and possible risks associated with the data. The methods for analyzing the traffic system data are discussed. The schedule and responsibilities for collecting, analyzing, and reporting traffic data are presented.

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LIST OF ABBREVIATIONS

4Ts	Tolling, transit, telecommuting/travel demand management, and technology
CVO	Commercial vehicle operator
DOE	Department of Environment
FHWA	Federal Highway Administration
ISP	Information service provider
ITS	Intelligent transportation systems
MTC	Metropolitan Transportation Commission
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

1.0 INTRODUCTION

This report presents the test plan for collecting and analyzing traffic 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 ten 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 Traffic System Data Test Plan, the other nine test plans focus on the following types of data: parking, transit, telecommuting/travel demand management, traveler information, 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 2.0 presents the data sources, data availability, and risks associated with evaluating the traffic system data elements of the San Francisco UPA. Chapter 3.0 describes the techniques that will be used to test the hypotheses and assess the measures of effectiveness in which traffic data are used. Chapter 4.0 presents the schedule and responsibilities for collecting and analyzing the traffic 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.

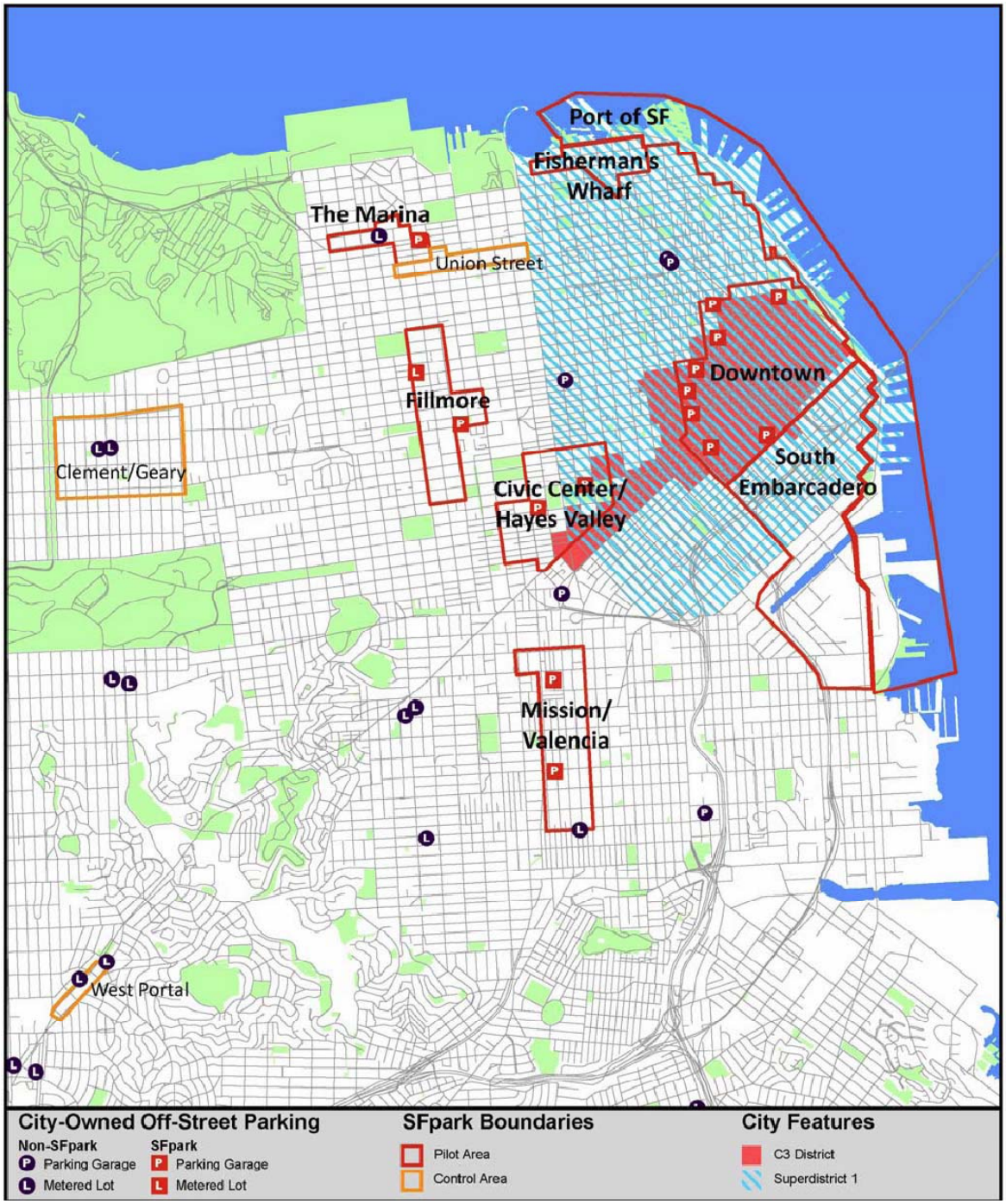
The pilot areas for SF*park* are highlighted in red (or dark lines) in Figure 1-1. The new system will consist of approximately 6,000 metered on-street parking spaces (about one-quarter of the city's total supply) and 12,250 parking spaces in fifteen city-operated garages and one lot. Control areas, 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.

[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 Traffic System 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 Traffic System Data Test Plan will be used with the congestion, equity, goods movement, and cost benefit analyses. Table 1-3 presents the traffic system data elements and the measures of effectiveness and the hypotheses/questions the traffic 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	○	○	○	○	○	○	○	○	○	○

● — Test Plan Data Constitute a Major Input to the Evaluation Analysis

○ — Test Plan Data Constitute a Supporting Input to the Evaluation Analysis

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

San Francisco Traffic Data Element	San Francisco UPA Measure of Effectiveness	San Francisco UPA Hypotheses/Questions*
1. Vehicle Counts	• Change in vehicle throughput in high-demand parking management districts	SFCong-1, SFEquity-1, SFEquity-2, SFGoods-4
2. Average speed	• Ratio of average speeds peak to off-peak	SFCong-1, SFEquity-1, SFEquity-2, SFGoods-4, CBA-1

*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 DATA SOURCES, AVAILABILITY, AND RISKS

This chapter identifies the sources for the traffic system data and discusses the availability of those data and any potential risks associated with collecting and processing them for use in the evaluation. Table 2-1 summarizes the data requirements for the Traffic System Data Test Plan. The details associated with source, timing and other particulars are discussed in the sections that follow.

2.1 Data Source

Three types of traffic data are needed to support various UPA evaluation analyses:

- Traffic volume counts, and
- Average speed.

The primary sources of this traffic data will be the traffic detectors installed at strategic locations in each parking management district (PMD).

SFMTA Traffic Detector Systems. SFMTA will be installing a network of traffic detectors in each of the pilot and control parking management districts that will allow traffic volume and speed data to be obtained automatically. These detectors will utilize the same sensor technology as the parking space occupancy sensors; however, unlike the parking space sensors, these sensors will be installed in each travel lane in each direction. The planned locations of the sensors are presented in Appendix B.

The traffic sensors will sense vehicle presence and transmit this data to the reader via a wireless connection. Vehicle presence data will then be converted into vehicle volume counts and travel speeds. The count and speed data will be aggregated into 15-minute intervals and will be periodically transmitted to SMFTA's data warehouse for storage. Vehicle counts will represent the total number of vehicles during each 15-minute interval while vehicle speed will represent the average speed of all vehicles during each 15-minute interval.

Vehicle count data is needed for the congestion analysis to assess changes in vehicle throughput as a result of implementing new parking pricing strategies. Average speed data is needed by the congestion analysis to assess the effects of using parking pricing on vehicle speeds.

Table 2-1. Summary of Traffic System Data Requirements for the San Francisco UPA National Evaluation

Data Element	Location/Termini	Data Granularity	Minimum Data Collection Frequency	Baseline Data Collection Period	Post-deployment Data Collection Period	Data Reporting Frequency	Data Source	Responsible Agency
1. Arterial Street Traffic Volumes	Parking Management Districts (Pilot and Control) – Civic Center/Hayes Valley – Downtown – Fillmore – Fisherman's Wharf – The Marin-Union Street – Mission/Valencia – Port of SF – South Embarcadero – Richmond District	5-minute intervals	Continuous	Late 2010 – Mid-2011	Mid-2011 – Mid-2012	Monthly	SFMTA Traffic Sensors / Data Warehouse	SFMTA
2. Average Speed		5-minute intervals	Continuous	Late 2010 – Mid-2011	Mid-2011 – Mid-2012	Monthly	SFMTA Traffic Sensors / Data Warehouse	SFMTA

2.2 Data Availability

Assuming that the sensor systems remain operational throughout the evaluation period, the traffic sensor data is expected to be readily available. Traffic volume and speed information is expected to be posted to SFMTA's data warehouse at the same intervals as the parking sensor data from each PMD. The national evaluation team will download and process volume and speed data after SFMTA has notified the evaluation team that new pricing has been implemented in a district.

2.3 Potential Risks

The traffic sensor installation has been completed expect for locations where there have been delays in obtaining construction permits. However, the sensor installation schedule was interrupted in December 2010 by the hiatus in installation during holiday shopping season. Therefore, one potential risk is the duration of the baseline condition in which all sensors were in operation. Under the currently proposed schedule, the roadway sensors would only be in place for a few months to collect baseline data. This may not be sufficient time to allow a true traffic pattern to be observed (i.e., daily variations, seasonal variation, etc.). However, it may be possible to use data from the control PMDs to provide insight into naturally occurring variations in data.

Another potential risk is that the sensors may malfunction under heavy traffic conditions, although the Sensys sensors that were installed are designed for roadway applications. If a significant number of detectors malfunction during the evaluation period, critical data could be lost. Detectors will need to be replaced in a timely fashion to mitigate this risk.

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3.0 DATA ANALYSIS

Traffic system data is the primary data input into the congestion analyses and also supports the equity, goods movement and cost benefit analyses. This section describes how traffic system data will be used in these analyses.

3.1 Quality Assurance/Quality Control

Volume and speed data will be collected automatically and continuously using SFMTA's traffic sensor system and stored in SFMTA's data warehouse. Data from each sensor should be time-stamped and stored in 15-minute intervals. The national evaluation team will access traffic data directly from the data warehouse and be responsible for aggregating data to the appropriate spatial and temporal scales for the evaluation.

The national evaluation team will perform visual inspection of the data to assess its quality. Standard data quality tests will be performed on the stored data to identify erroneous or suspect data. Erroneous or suspect data will be flagged and removed from the data to ensure the quality of the analysis results.

3.2 Performance Measures

The traffic data will be used to compute the following performance measures which are used in several of the analyses:

- Vehicle throughput and
- Ratio of peak to off-peak travel speed.

The methodology to be used to compute each of these performance measures is discussed below.

Vehicle Throughput. Vehicle throughput is a measure of the number of vehicles that are serviced in one direction of a facility during the analysis period. The San Francisco UPA evaluation will focus on the changes in throughput that result from implementing the variable pricing strategy. This analysis will focus on three periods:

- Weekday a.m. peak period – defined from 7:00 a.m. to 9:00 a.m. on a typical weekday
- Weekday p.m. peak period – defined from 4:30 p.m. to 6:30 p.m. on a typical weekday
- Weekday off-peak – from 9:00 a.m. to 4:00 p.m. on a typical weekday.

Vehicle throughput will be determined by averaging the total vehicle counts from each of the traffic detectors in a specific parking management district. All the detectors in a single PMD will be averaged together to obtain an estimate of average throughput for the district.

Ratio of Peak to Off-Peak Travel Speeds. The San Francisco UPA evaluation will also include calculation of the ratio of the peak travel speed to off-peak travel speed as a measure of congestion. The average peak speed will be computed by averaging the weekday a.m. peak period speed with the average p.m. peak period speed. The a.m. peak period will be from 7:00 a.m. to 9:00 a.m. while the p.m. peak period will be from 4:30 p.m. to 6:30 p.m. The off-peak travel period will be from 9:00 a.m. to 4:30 p.m. on a typical weekday.

3.3 Analysis Procedures

The above performance measures will be analyzed using a "before and after" approach, with each PMD analyzed separately. The "before" period is intended to represent travel conditions on the streets in each PMD prior to implementing the new parking pricing strategy. An "after" period represents travel conditions in a PMD after a new parking price strategy is implemented. A new "after" period will begin after each parking price changes. As SFMTA is expected to vary parking price regularly in some PMDs, data from multiple "after" periods are expected to be analyzed. An "after" analysis period will begin two weeks after SFMTA implements a new parking price. This two week window will allow travelers in each PMD to adjust their travel patterns in response to new parking prices while still allowing sufficient sample sizes of data to assess the impacts of the parking price strategy.

Standard statistical analysis techniques, including analysis of variance, will be used to assess whether statistically significant changes in vehicle throughput, passenger throughput, or travel speed ratio were observed between each analysis period. Regression analysis or analysis of covariance techniques will be used to relate changes in parking pricing (and/or parking turnover rates) to changes in vehicle and/or passenger throughput in each PMD.

Two control areas have been established for the national evaluation. Traffic system data from these control areas will also be examined throughout the duration of the evaluation to assess how the exogenous factors, such as the price of gasoline and the economic health of the area, impact travel patterns. Changes in vehicle and/or passenger throughput observed in the control PMDs will be compared to the PMDs where the parking pricing strategies are implemented to determine the extent to which the exogenous factors may have affected travel patterns in evaluation areas.

For the congestion analysis the traffic performance measures will be used to test the hypotheses that variable parking pricing will reduce traffic congestion. For the goods movement analysis, changes in the traffic performance measures will also be examined for their impact on commercial vehicles in the PMDs. For the equity analysis, spatial variation in the traffic performance measures will be assessed for potential impacts on different populations within the areas where pricing changes take place.

4.0 SCHEDULE AND RESPONSIBILITY

SFMTA is responsible for collecting volume and speed data and storing the data in the data warehouse. The national evaluation team will be responsible for retrieving the data from the warehouse and aggregating the data to the appropriate spatial and temporal units for evaluation.

The national evaluation team will be responsible for analysis of the traffic data and reporting on the findings.

Table 4-1 summarizes the data collection schedule for the traffic system data described in this test plan.

Table 4-1. Traffic System Data Collection Schedule

Data Element	Baseline Data	Post-Deployment Data
Traffic sensor data	Late 2010 through Mid-2011	Mid-2011 through Mid-2012

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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?

APPENDIX B – PROPOSED LOCATIONS OF TRAFFIC SENSORS IN EACH PARKING MANAGEMENT DISTRICT

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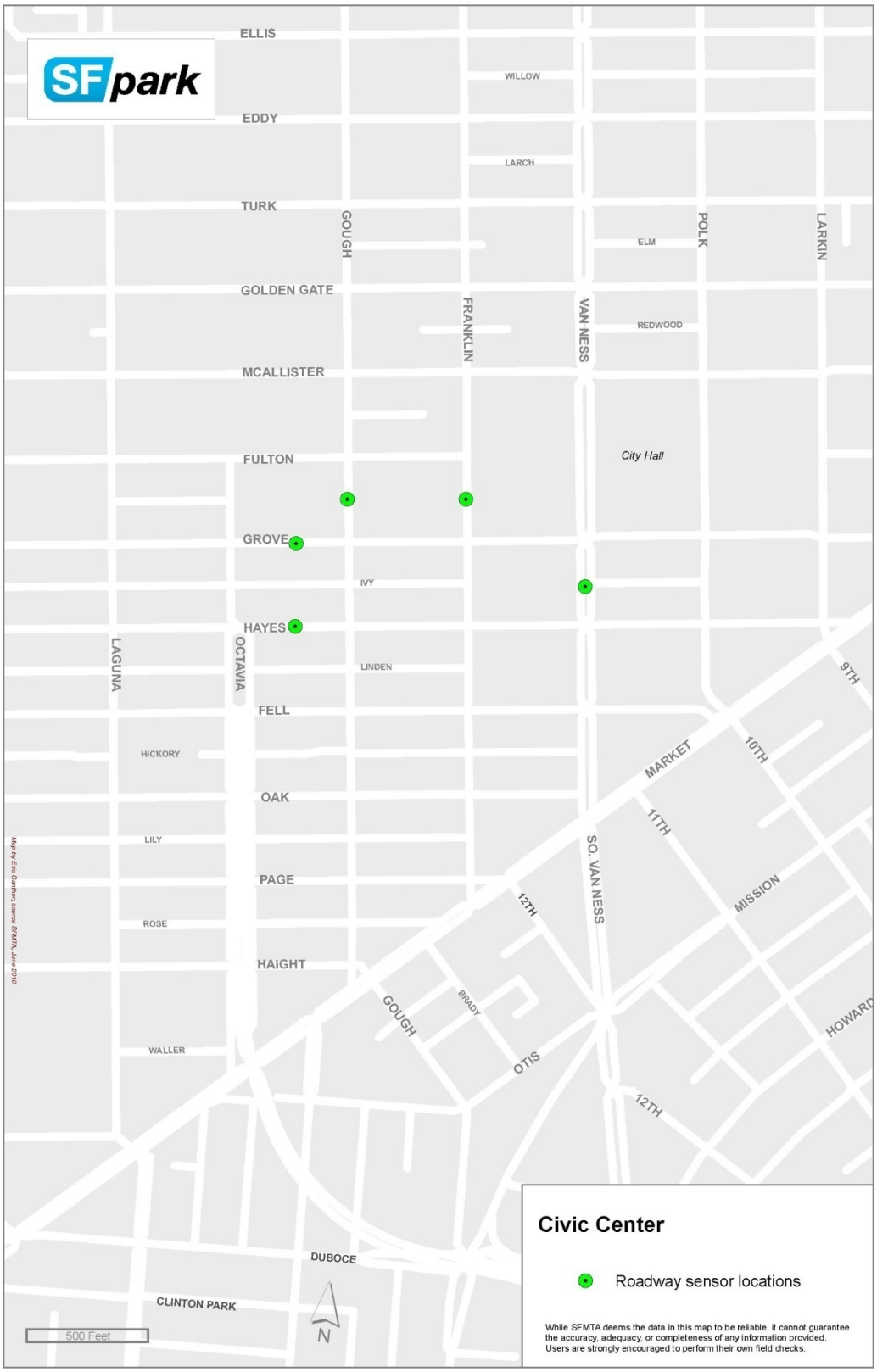

Figure B-1. Proposed Location of SFMTA Roadway Sensors for the Civic Center PMD

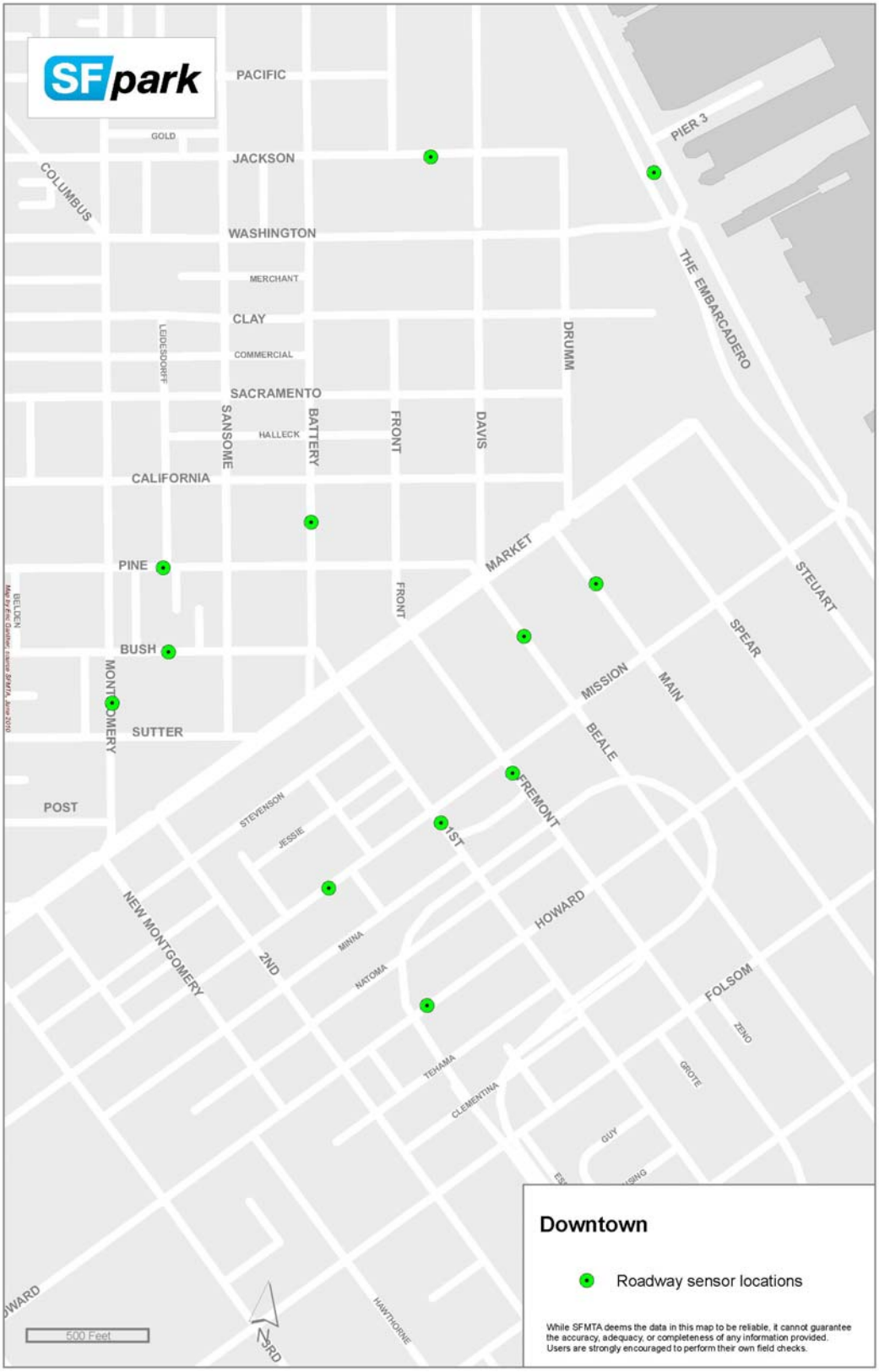

Figure B-2. Proposed Location of SFMTA Roadway Sensors for the Downtown PMD

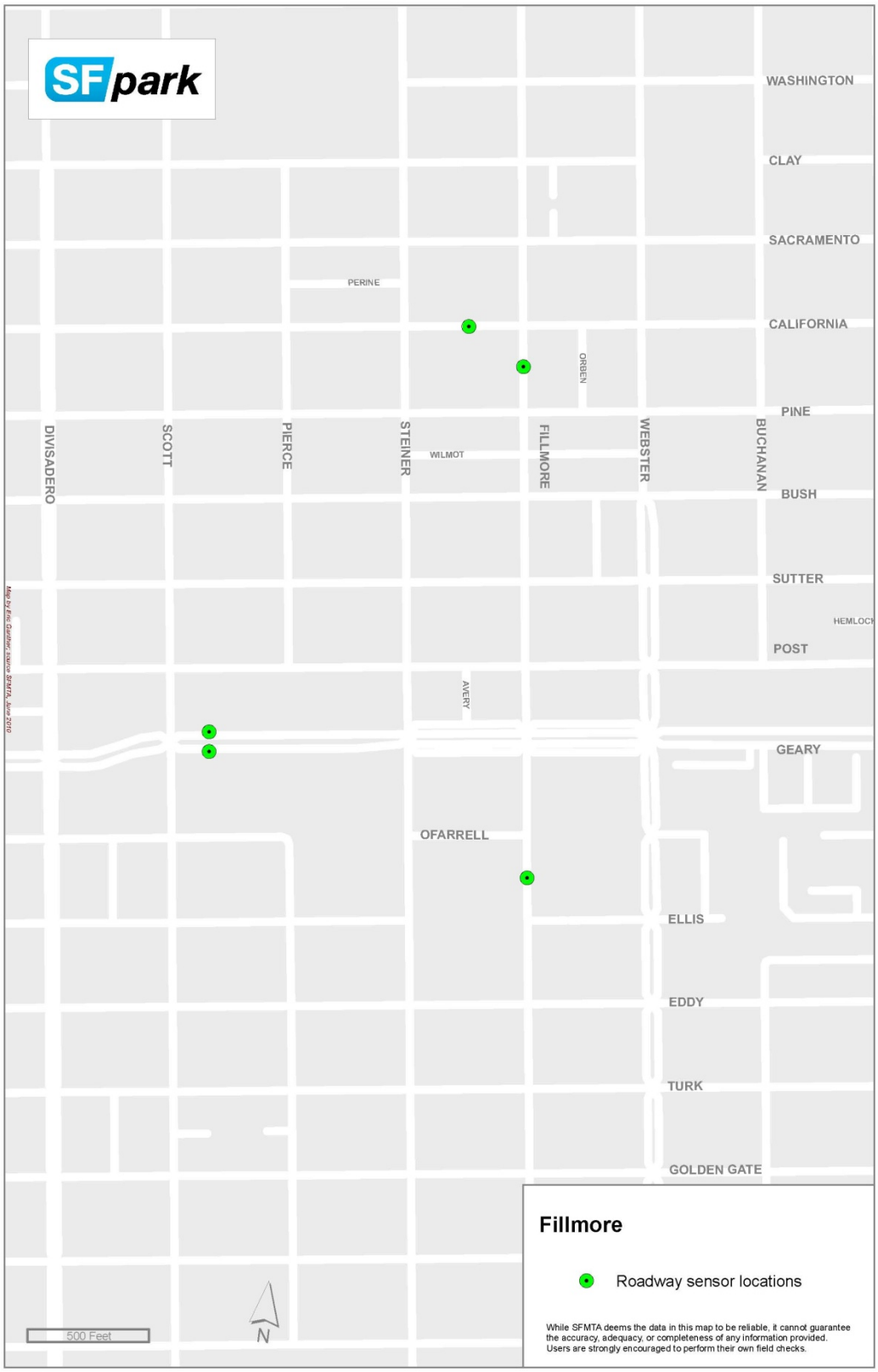

Figure B-3. Proposed Location of SFMTA Roadway Sensors for the Fillmore PMD

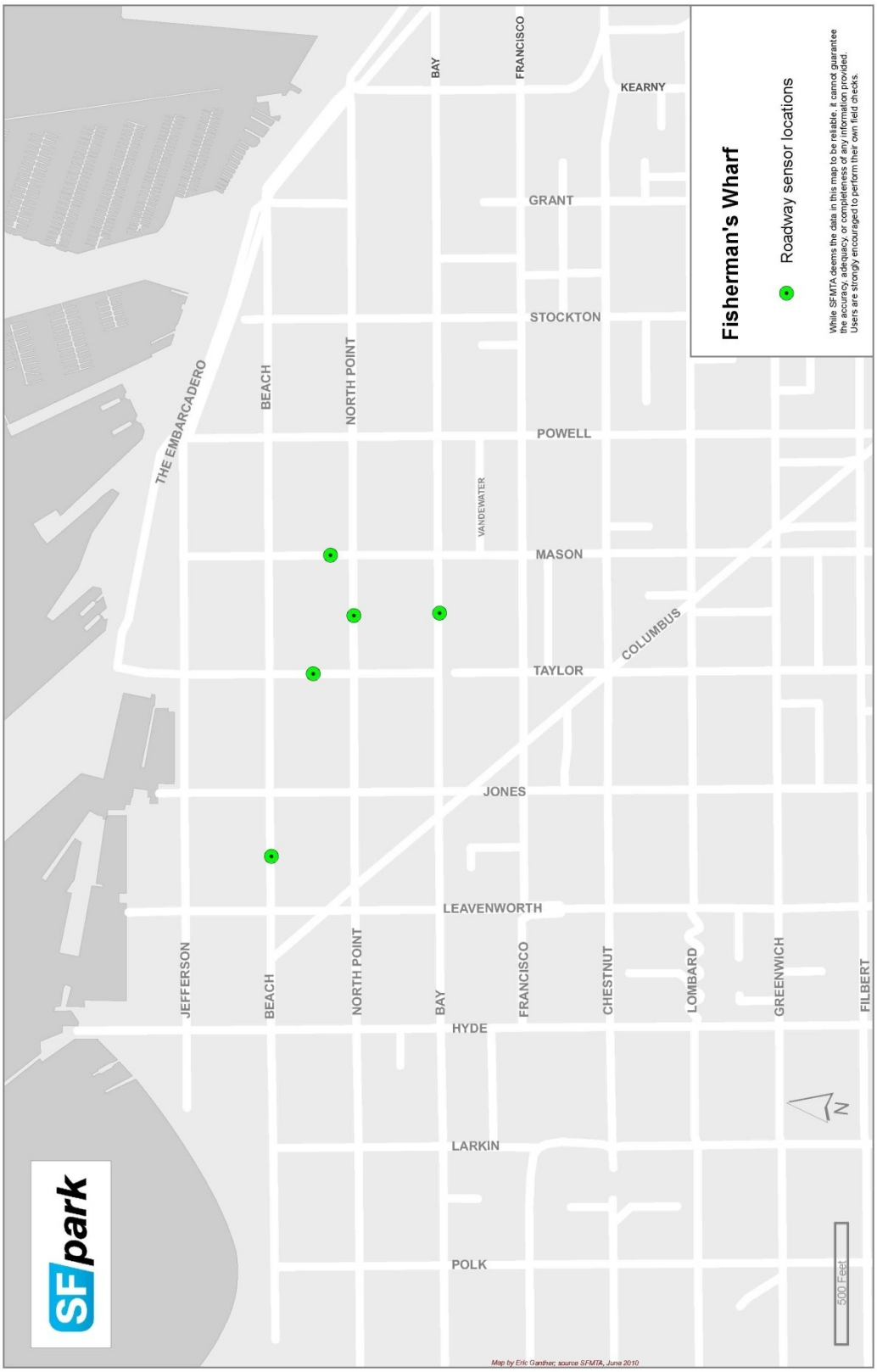

Figure B-4. Proposed Location of SFMTA Roadway Sensors for the Fisherman's Wharf PMD

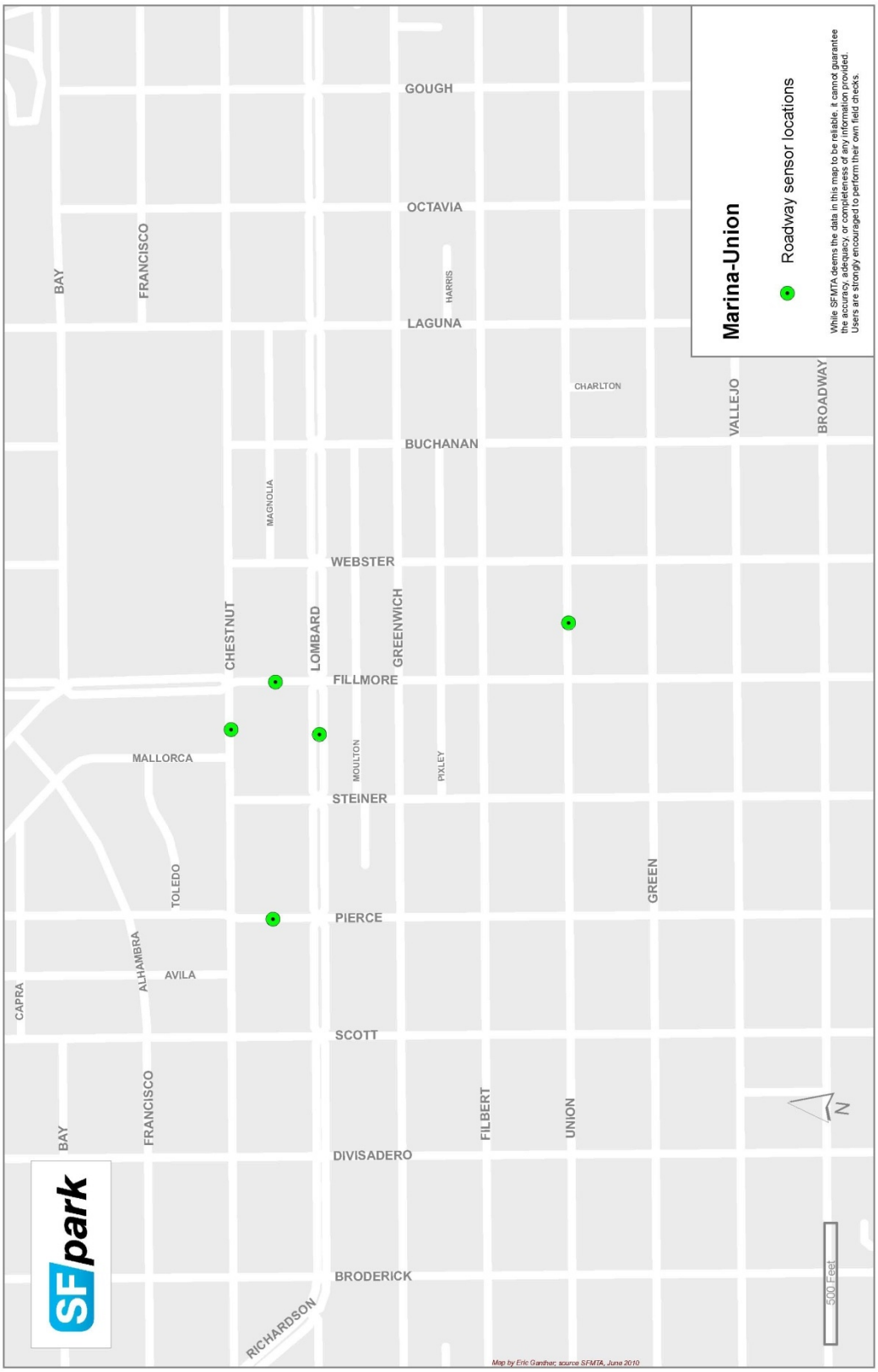

Figure B-5. Proposed Location of SFMTA Roadway Sensors for the Marina-Union PMD

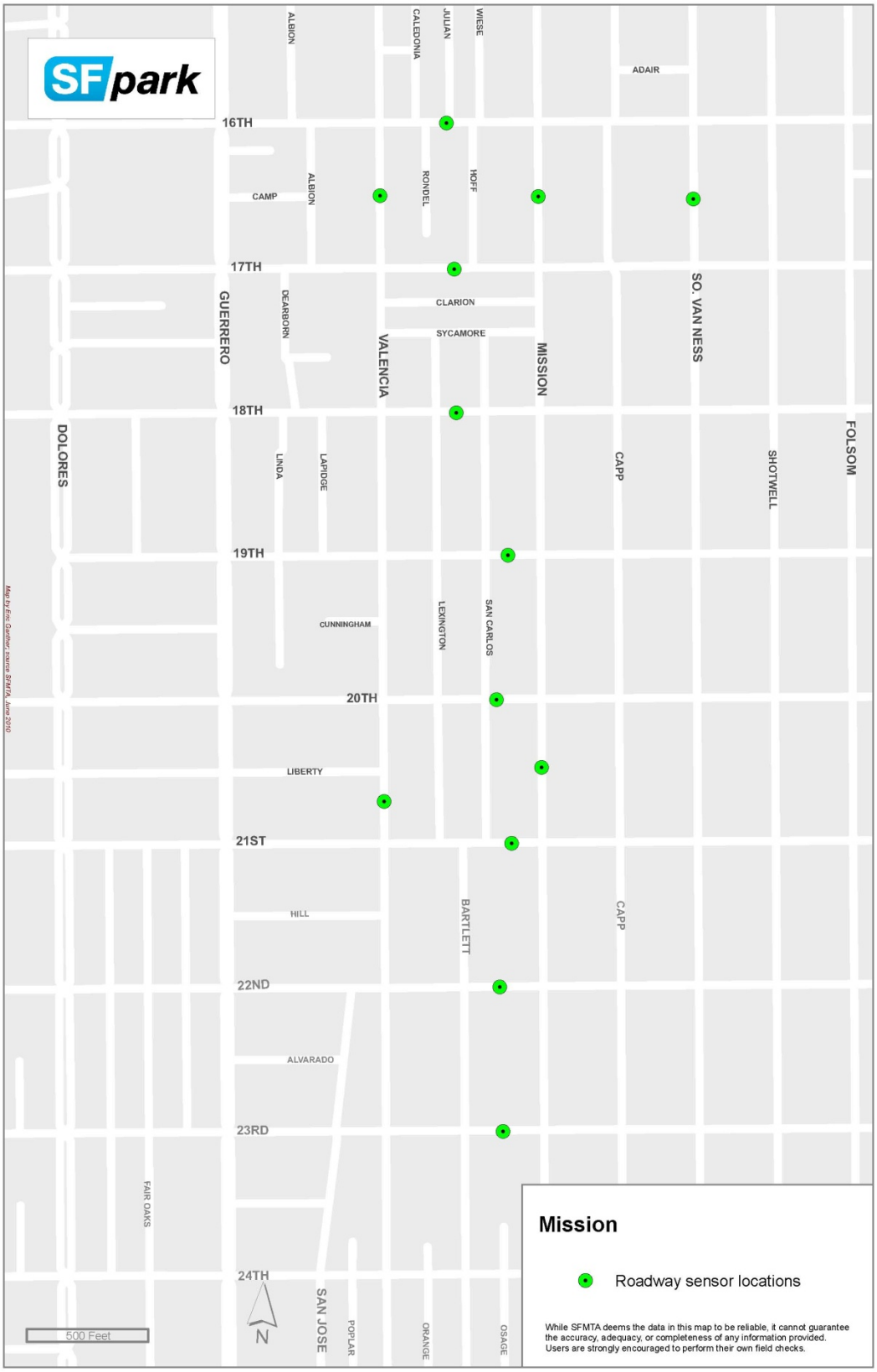

Figure B-6. Proposed Location of SFMTA Roadway Sensors for the Mission PMD

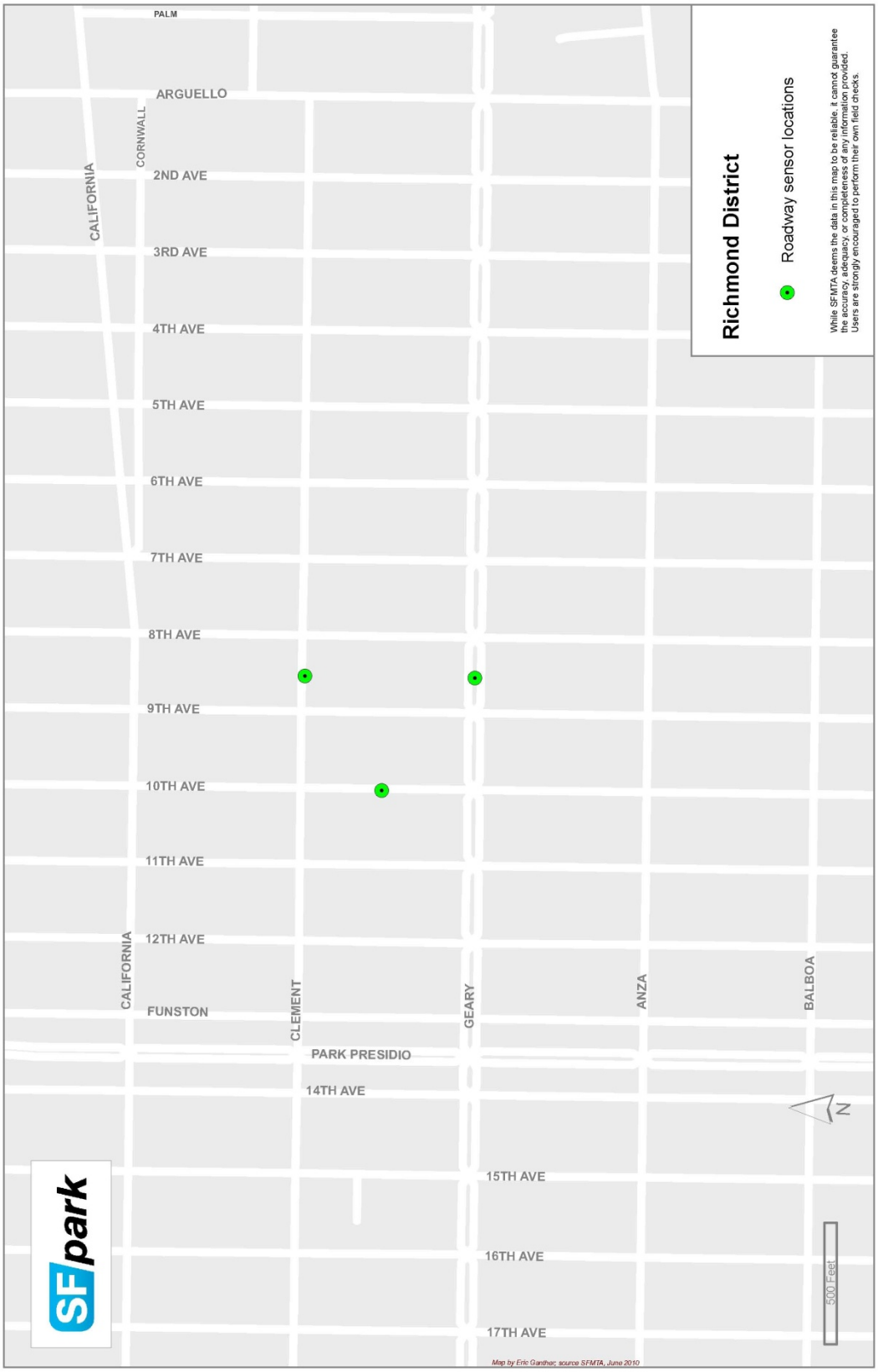

Figure B-7. Proposed Location of SFMTA Roadway Sensors for the Richmond PMD

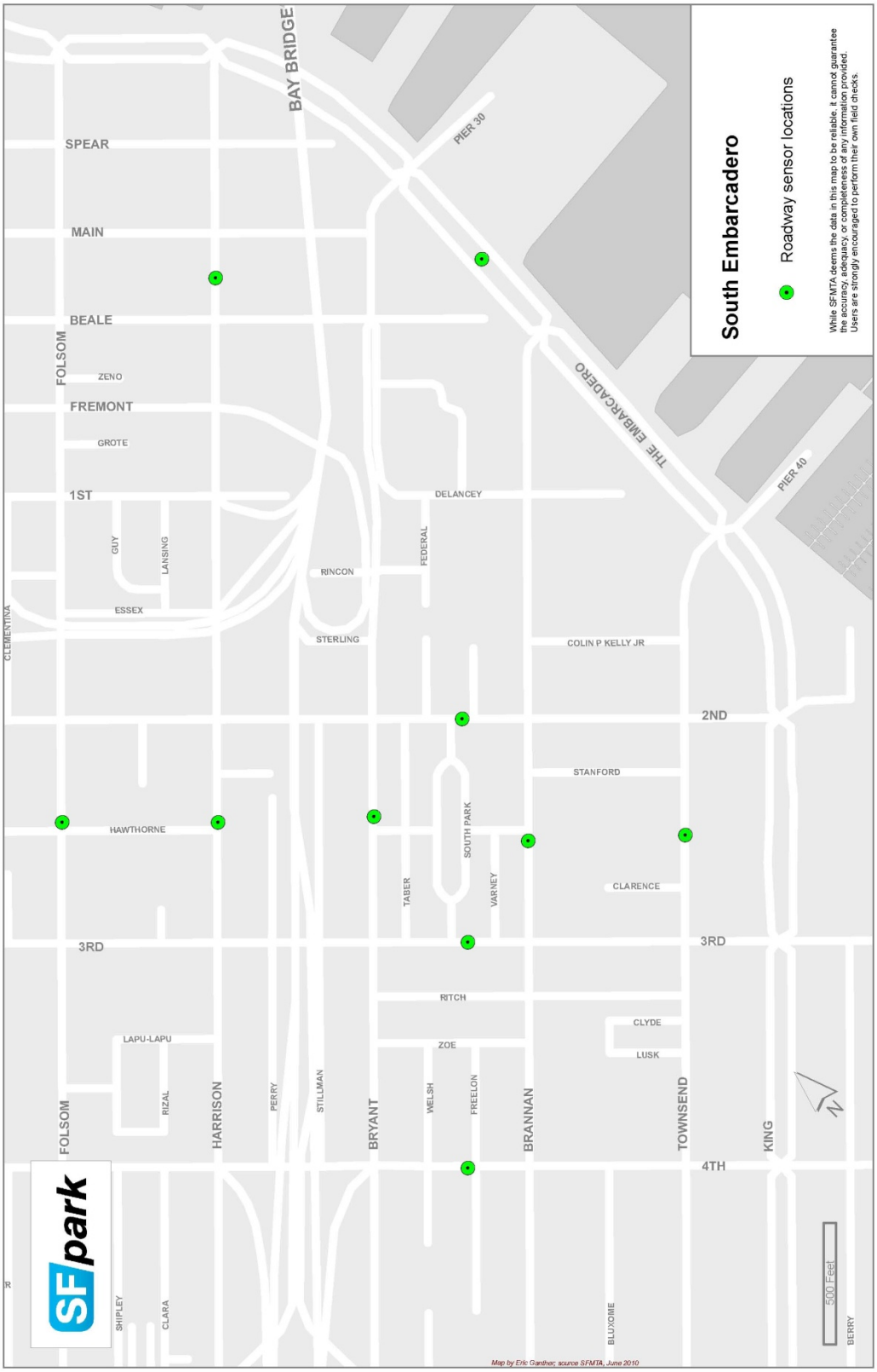

Figure B-8. Proposed Location of SFMTA Roadway Sensors for the South Embarcadero PMD

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