San Francisco Parking Supply and Utilization Study

FINAL REPORT

NOVEMBER, 2016

ACKNOWLEDGEMENTS

This final report and study are the result of the hard work, dedication, and enthusiasm of a number of people and organizations.

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Executive Summary

The San Francisco Parking Supply and Utilization Study (PSUS) evaluated the effectiveness and feasibility of several parking-related strategies to manage congestion, reduce vehicle miles traveled (VMT) and incentivize reduced single occupancy automobile trips. PSUS focused on off-street, nonresidential parking: garages and lots used for commercial, industrial, and other nonresidential purposes. It evaluated strategies that could complement the existing on-street parking regulatory setting, including SFpark demand-based pricing. PSUS concentrated on the northeastern portion of San Francisco, which includes the downtown area (see Figure E1).[1] Applicability to other contexts around the country is also discussed.

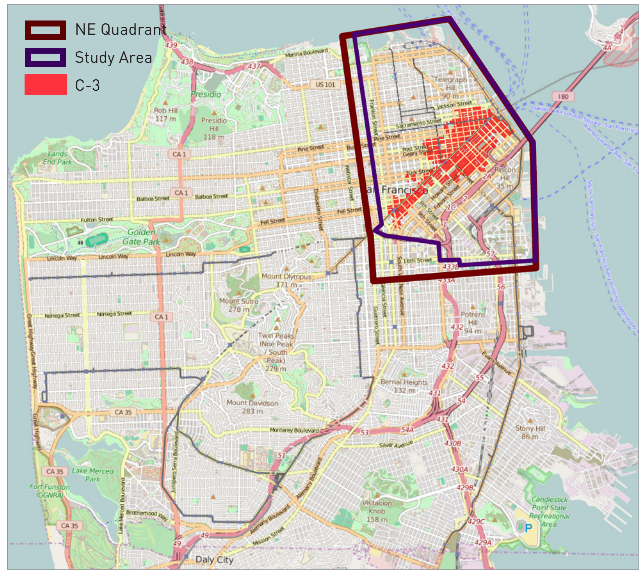


FIGURE E1. Northeast Quadrant and Study Area Boundaries

At its onset, the study considered a set of potential strategies, which were then screened for effectiveness and ability to evaluate. Table E1 shows the strategies that the study carried forward for full evaluation. These remaining strategies fall into four categories: fee-based strategies (1B, 3, 4A, and 4B), bulk discount eliminations (2A, 2B, 2C, 2D), parking cashout (7A, 7B), and supply-related strategies (5A, 5B, 5C).[2] The SF-CHAMP travel demand model was used to support analysis of several strategies (see "SF-CHAMP scenario?" column). The study analyzed the remaining strategies either by extrapolating results from

1 The study refers to multiple geographies: 1) the "City" as a whole; 2) the "Northeast Quadrant" (or "NE SF," for short), which is based on the top-performing cordon pricing scheme from the earlier Mobility, Access and Pricing Study (MAPS) and is bounded by 18th Street to the south and Guerrero Street and Laguna Street to the west; 3) the "Study Area" where data collection occurred and which is bounded roughly by Mariposa street to the south and Gough street to the west; and (4) the C-3 District, or Downtown Commercial District, a zoning designation given to many of the highest density portions of the city. The results typically refer to two different timeframes: the AM peak and 24-hour total.

2 Bulk discounts refer to the lower per-hour prices charged to parkers who purchase parking on a daily or monthly rather than hourly basis. Parking cashout refers to a policy that requires employers who provide subsidized parking to their employees to offer cash in lieu of their parking spaces; these employees can choose to cash out their parking spaces and use alternative modes to commute.

TABLE E1. Evaluated Parking Strategies

CATEGORY	NO.	STRATEGY	SF-CHAMP SCENARIO?	USES OTHER SF-CHAMP SCENARIO?	TRIPS AFFECTED	TIME PERIOD
Fee-Based	1B	Annual parking space fee: fee passed onto driver	No	No	Parkers at Privately Accessible Sites	24-Hour
Fee-Based	3	Universal parking access fee	No	Yes	All	AM/PM Peak or All-Day*
Fee-Based	4A	Flat all-day fee	Yes	–	Unsubsidized work, Nonwork	All-Day
Fee-Based	4B	Flat peak fee	Yes	–	Unsubsidized work, Nonwork	AM/PM Peak
Bulk Discount Elimination	2A	Monthly and hourly discount elimination	No	Yes	Unsubsidized work, Nonwork	24-Hour
Bulk Discount Elimination	2B	Monthly discount elimination	Yes	–	Unsubsidized work, Nonwork	24-Hour
Bulk Discount Elimination	2C	Parking sales tax bulk discount elimination incentive	No	Yes	Unsubsidized work, Nonwork	24-Hour
Bulk Discount Elimination	2D	Parking fee bulk discount elimination incentive	No	Yes	Unsubsidized work, Nonwork	24-Hour
Supply	5A	SFMTA garage redevelopment	No	No	All	24-Hour
Supply	5B	Parking supply cap	No	No	All	24-Hour
Supply	5C	Parking supply cap and trade	No	No	All	24-Hour
Cashout	7A	Increased cashout enforcement	No	Yes	Subsidized work	24-Hour
Cashout	7B	Expanded cashout law	Yes	–	Subsidized work	24-Hour

NOTE: The numbering scheme was carried over from the initial screening process.

* The all-day timeframe spans the AM Peak, Midday, and PM Peak (6:00 a.m. 6:30 p.m.).

the modeled strategies (see "Uses Other SF-CHAMP scenario?" column) or with other analytic tools. To inform the evaluation and characterize overall parking supply, PSUS developed a parking supply model that estimated the amount of off-street, nonresidential parking in the Study Area.

The study sought strategies that reduce vehicle miles traveled (VMT) and vehicle hours of delay (VHD), typically attributable to reductions in drive-alone mode share.[3] The study also examined the effects of strategies on parking-related revenue. Finally, the team considered implementation feasibility, with a particular focuson the best performing strategies.

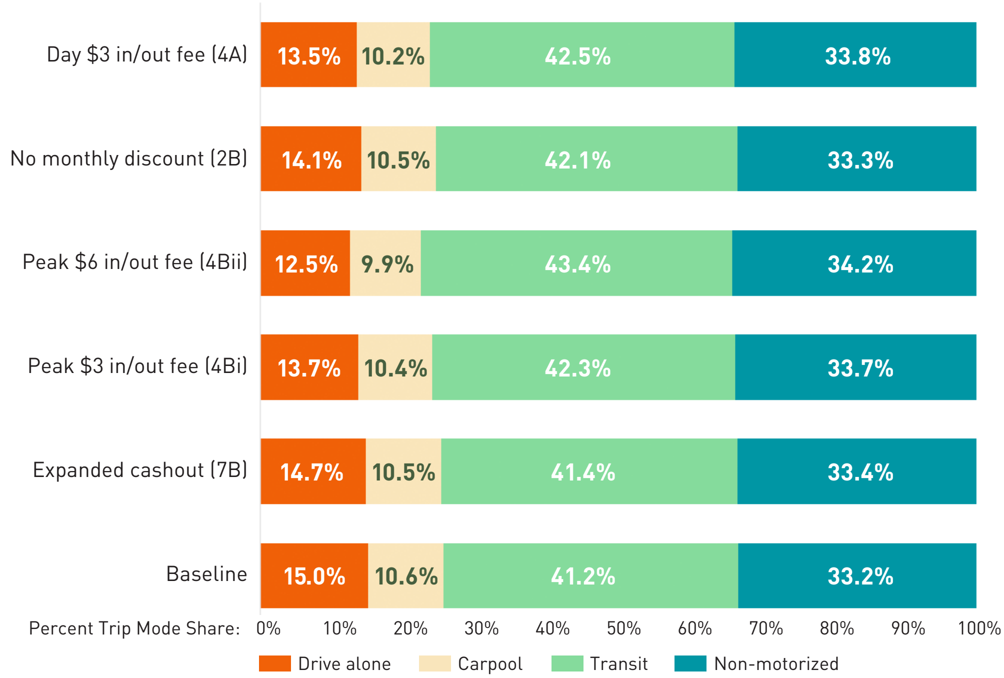


FIGURE E2. AM Peak, To/From/Within Northeast Quadrant Trip Mode Share by Scenario

EVALUATION RESULTS

Figure E2 depicts the SF-CHAMP trip mode splits for each scenario modeled, including the baseline, during the AM peak in the Northeast Quadrant.

Figure E4 (next page) shows the percent change in VHD for strategies that were either modeled directly or could be estimated indirectly using model results from a similar scenario. The shading corresponds with different timeframe-geography pairings. The changes for mode share and VMT follow a similar trend.

Key findings include:

- Increasing the cost to park through a fee or other policy mechanism influences some drivers to

3 Mode shifts are described as percentage point changes and VMT and VHD reductions are described as percent changes. A 1.0 percentage point reduction in a 15 percent drive alone mode share is roughly a 6.7 percent reduction.

FIGURE E3. Parking Supply and Utilization Study Outline

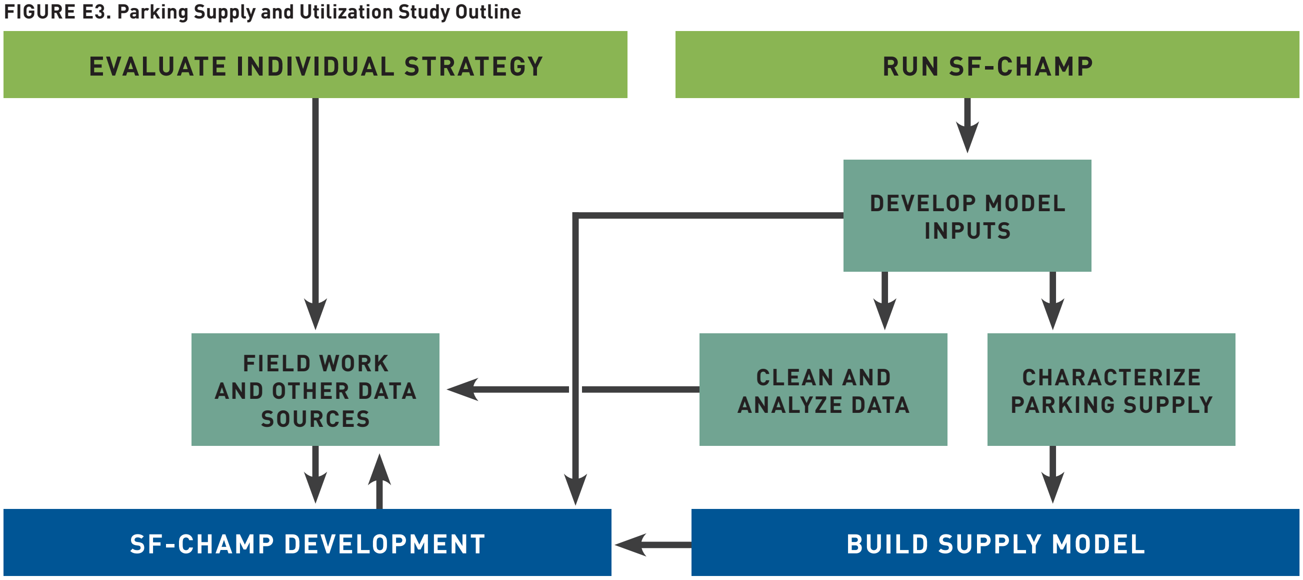
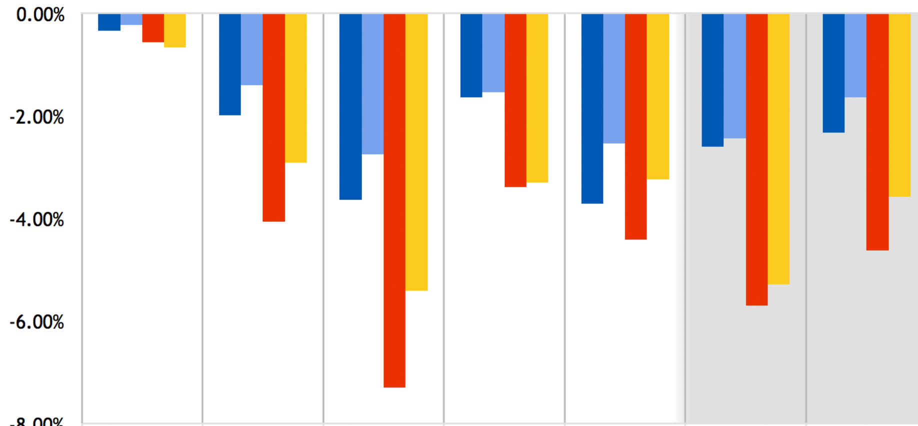


FIGURE E4. Percent Change in Vehicle Hours of Delay (VHD)



	Model: Cashout (7B)	Model: Peak $3 Fee (4Bi)	Model: Peak $6 Fee (4Bii)	Model: No Monthly Discount (2B)	Model: All-Day $3 Fee (4A)	Off-Model: No Discount (2A,2C,2D)	Off-Model: Univ. Acc. Peak $3 Fee (3)
24-Hour, NE SF	-0.3%	-2.0%	-3.6%	-1.6%	-3.7%	-2.6%	-2.3%
24-Hour, All SF	-0.2%	-1.4%	-2.8%	-1.5%	-2.5%	-2.4%	-1.6%
AM Peak, NE SF	-0.6%	-4.1%	-7.3%	-3.4%	-4.4%	-5.7%	-4.6%
AM Peak, All SF	-0.7%	-2.9%	-5.4%	-3.3%	-3.2%	-5.3%	-3.6%

choose alternative modes and/or travel times. Results vary depending on fee level, as well as the traveler population(s) and time(s) of day affected by the change.

- The travel demand model results showed that driver-response to parking scenarios was somewhat modest, which is an indication of the high price of parking in downtown San Francisco. Price changes and regulation alone may be insufficient to compensate for underlying trends in congestion and delay, particularly if parking operators were to adjust underlying pricing to maximize profits after implementation of a new regulation. However, parking policy could be used as part of a comprehensive approach to managing congestion.
- A $3 fee implemented through both the peaks and the midday (i.e., from 6am-6:30pm) could reduce VMT, VHD, and driving mode share overall and during the peak periods more effectively than a fee implemented only during the AM and PM peaks (i.e., 6-9am and 3:30-6:30pm) due to reduced peak spreading.[4]
- Each parking fee strategy would considerably increase existing parking-related revenues for the City and County of San Francisco; these revenues could be used to improve transportation system infrastructure, which could lead to improved performance outcomes.
- Most parking strategies performed somewhat similarly to each other, with no clear preferred scenario for implementation.
- Relatively few Study Area parkers receive employer-subsidized parking. Therefore, parking cashout—even when applied citywide. would only show a modest effect on system performance.
- Parking supply strategies, such as capping parking supply at current levels, are unlikely to influence mode share and congestion in the next few years but could be part of a larger strategy to manage parking for new development.
- The supply model and other parking supply data sources suggest that greater than 90 percent of the off-street, nonresidential parking in the Study Area can be accessed by the public.
- Much of the reduction in VHD through parking related strategies can be accounted for by drivers shifting to other modes of travel.

Overall, the examined parking strategies translated into modest changes in mode share and congestion in San Francisco. By their nature, parking strategies do not directly affect through trips with origins or destinations outside the pricing or policy area, so the comparable strategies (i.e., $3 fee) achieve less than half of the congestion reduction benefit as the area based cordon toll studied during MAPS.

The PSUS evaluation found that many of the strategies perform similarly and the study recommends continued pursuit of other parking related strategies currently un-

4 The study focused on two fee amounts: $3 and $6. Based on past analysis of pricing strategies (including the top performing cordon pricing scheme from MAPS) and the intercept survey results from this study, a $3 fee is likely to be high enough to influence travel behavior at meaningful levels, while still being relatively modest compared to other costs of transportation use. The $6 fee, at twice the level of the $3 fee, represents a high book-end estimate of how parking fees could influence transportation performance.

derway such as the Residential Parking Permit Evaluation and Reform Project to better manage on-street parking supply and implementation of a Transportation Demand Management Ordinance to right-size the amount of parking associated with new development.

TABLE E2. Results Summary

CATEGORY	NO.	STRATEGY	TRIPS AFFECTED	TIME PERIOD	RESULT
Fee-Based	1B	Annual parking space fee: fee passed onto driver	Unsubsidized, work, Nonwork	All	Less direct and impactful results than $3 all-day fee (Strategy 4A). Leaves discretion of which trips to charge to operator who may not share City congestion management goals
Fee-Based	3	Universal parking access fee	All	AM/PM Peak	In AM Peak, NE SF: -1.7% point drive alone mode share, -2.8% VMT, -4.6% VHD. Larger revenue increase than 4B (→71%) but less than 4A. Harder implementation than flat fees (4A, 4B).
Fee-Based	4A	Flat all-day fee ($3)	Unsubsidized work, Nonwork	All-Day	In AM Peak, NE SF: -1.5% point drive alone mode share, -2.6% VMT, -4.4% VHD. Largest revenue increase of scenarios shown here: 131%. Implementation challenges exist, but easier than 3.
Fee-Based	4B	Flat peak fee ($6)	Unsubsidized work, Nonwork	AM/PM Peak	In AM Peak, NE SF: -1.4% point drive alone mode share, -2.3% VMT, -4.2% VHD. Lags all-day fee more in 24-hour metrics. Revenue increase: 71%. Significant political challenges to implementation.
Bulk Discount Elimination	2A	Monthly and hourly discount elimination	Unsubsidized work, Nonwork	All	In AM Peak, NE SF: roughly -1.5% point drive alone mode share, -3.3% VMT, -5.7% VHD. Greater congestion reduction than $3 fees. Revenue increase: roughly 14%. Significant political challenges to implementation.
Bulk Discount Elimination	2B	Monthly discount elimination	Unsubsidized work, Nonwork	All	In AM Peak, NE SF: roughly -1.0% point drive alone mode share, -2.1% VMT, -3.4% VHD. Revenue increase: 9%.
Bulk Discount Elimination	2C	Parking sales tax bulk discount elimination incentive	Unsubsidized work, Nonwork	All	In AM Peak, NE SF: roughly -1.5% point drive alone mode share, -3.3% VMT, -5.7% VHD. Greater congestion reduction than $3 fees. Likely revenue decrease. Significant technical challenges to implementation; easier to implement than 2D.
Bulk Discount Elimination	2D	Parking fee bulk discount elimination incentive	Unsubsidized work, Nonwork	All	In AM Peak, NE SF: roughly -1.5% point drive alone mode share, -3.3% VMT, -5.7% VHD. Greater congestion reduction than $3 fees. Likely revenue decrease. Significant technical challenges to implementation; harder to implement than 2C.
Supply	5A	SFMTA garage redevelopment	All	All	SFMTA only constitutes ~13% of off-street non-residential parking supply in Study Area, and these garages have ample headroom. Likely less than -0.1% point drive alone mode shift in current year.
Supply	5B	Parking supply cap	All	All	No impact in current year. At 1.2 percent demand annual growth rate, demand will equal capacity in 10 years.
Supply	5C	Parking supply cap and trade	All	All	No impact in current year. At 1.2 percent demand annual growth rate, demand will equal capacity in 10 years.
Cashout	7A	Increased cashout enforcement	Subsidized work	All	Low levels of subsidized parking. Lower impact than 7B.
Cashout	7B	Expanded cashout law	Subsidized work	All	Low levels of subsidized parking. In AM Peak, NE SF: roughly -0.3% point drive alone mode share, -0.5% VMT, -0.6% VHD. Revenue decrease: 5%.

Introduction

PARKING SUPPLY AND UTILIZATION STUDY CONTEXT AND PURPOSE

Improving mobility and managing congestion are important elements in sustaining San Francisco's role as a growing social and economic center. According to the Texas Transportation Institute's 2015 Urban Mobility Scorecard, the San Francisco-Oakland urban area experienced the country's third-highest yearly hours of delay per auto commuter in 2014.[5] With high projected housing and job growth in northeastern San Francisco, travel demand will continue to increase. The core network can only accommodate approximately half of the motorized vehicle demand increase forecasted for 2035 before reaching perpetual gridlock during peak periods.[6] Managing congestion and encouraging alternative modes of travel is a core function of the San Francisco County Transportation Authority (SFCTA) and aligns with the City's Transit First Policy as well as the San Francisco Transportation Plan's Livability, Economic Competitiveness, and Healthy Environment goals.

Given these critical challenges, San Francisco elected officials and stakeholders requested that the SFCTA explore how policies that address parking demand and supply could help manage congestion.

An earlier SFCTA effort, the Mobility, Access and Pricing Study (MAPS), examined the feasibility of cordon-based pricing, which involves charging drivers a user fee to drive into or out of specific congested areas or corridors during certain times of day, and using the revenue generated to fund transportation improvements. MAPS found that congestion pricing would be a feasible way to meet San Francisco's goals for sustainable growth.[7]

More recently, the San Francisco Municipal Transportation Agency (SFMTA) conducted the SFpark pilot pro-

5 http://d2dtl5nnlpfr0r.cloudfront.net/tti.tamu.edu/documents/ums/congestion-data/national/national-table-all.pdf.

6 San Francisco Transportation Plan 2040. Appendix C: Core Circulation Study. The "core" refers to the Downtown, South of Market (SoMa), and Mission Bay neighborhoods.

7 http://www.sfcta.org/transportation-planning-and-studies/congestion-management/mobility-access-and-pricing-study-home.

The San Francisco County Transportation Authority (SFCTA) administers and oversees the delivery of Proposition K, San Francisco's half-cent sales tax that funds transportation programs and projects, and Proposition AA, a local vehicle registration fee that funds street repair and reconstruction, pedestrian safety, and transit reliability and mobility improvement projects. The SFCTA's governing board comprises the 11 members of the San Francisco Board of Supervisors. SFCTA is also responsible for developing and administering San Francisco's Congestion Management Program (CMP). The Authority leverages state and Federal transportation dollars to complement Prop K revenues. SFCTA tracks transportation system performance and prepares the long-range San Francisco Transportation Plan to guide future investment decisions.

The San Francisco Municipal Transportation Agency (SFMTA) oversees San Francisco's transportation system, which includes automobile, freight, Muni and other transit services, bicycle, and pedestrian networks to help the City meet its goals for quality of life, environmental sustainability, public health, social justice, and economic growth.

gram, which tested a new parking management system at many of San Francisco's metered on-street spaces and City-owned parking garages. The SFpark evaluation demonstrated that demand-responsive pricing can improve parking availability and yield secondary benefits, including reduced local congestion and mobile emissions.

This study, the Parking Supply and Utilization Study (PSUS), evaluated the feasibility of several parking-related strategies for congestion reduction through shifting trips from auto to non-auto modes (mode shift) or shifting trips to less congested time periods (peak spreading). As part of the evaluation, the study also estimated the level of undocumented off-street, nonresidential parking spaces. Finally, as a requirement of the Federal Highway Administration's Value Pricing Pilot Program, PSUS examined how the results can relate to other contexts while also exploring implementation considerations for the most promising strategies.

Table 1 identifies the types of parking found in San Francisco, distinguishing between off-street versus on-street (curbside) location, residential versus nonresidential use, and privately versus publically accessible facilities. Publically available parking is available for use by the general public while privately accessible parking is consumed by individuals or companies who obtain the rights to use the spaces beforehand, and have exclusive rights to spaces, typically on a long-term basis. PSUS focused on off-street, nonresidential parking supply (every row in Table 1 except the last two), looking at policies that could complement the existing on-street regulatory setting, including SFpark demand-based pricing. PSUS concentrated most of the analysis on the northeastern portion of San Francisco, which includes the downtown area (see Figure 1 map, page 8). Some findings are extended to the city as a whole.

PARKING STRATEGIES

At its onset, PSUS compiled a list of candidate parking strategies through literature review, discussions with San Francisco stakeholders and other City agencies. The team then screened the strategies based on 1) effectiveness—i.e., a strategy's potential to meaningfully reduce drive-alone mode share and congestion, and 2) ability to evaluate—i.e., the availability of tools (e.g., travel demand model, analytical best practices) and data to sufficiently measure a strategy's impact.

Table 2 (next page) lists the specific candidate strategies considered at the study onset. The unshaded strategies were carried forward and evaluated. The blue-shaded strategies were screened out. Appendix A (Candidate Strategies) describes the strategies and details the screening process, including specific rationale for eliminating or retaining each strategy. In the left column of Table 2, the numbers group similar strategies. After screening, the remaining strategies were regrouped into four categories but retained their original numbering scheme: fee-based strategies (1B, 3, 4A, and 4B), bulk discount eliminations (2A, 2B, 2C, 2D), parking cashout (7A, 7B), and supply-related strategies (5A, 5B, 5C).[8]

REPORT STRUCTURE

The remainder of this report is broken up into five major sections. The Methodology chapter explains the overall evaluation approach. The Parking Supply chapter summarizes the Study's efforts to estimate the total non-residen-

8 Bulk discounts refer to the lower per-hour prices charged to parkers who purchase parking on a daily or monthly rather than hourly basis. Parking cashout refers to a policy that requires employers who provide subsidized parking to their employees to offer cash in lieu of their parking spaces; these employees can choose to cash out their parking spaces and use alternative modes to commute.

TABLE 1. San Francisco Parking Types

LOCATION	RESIDENTIAL/ NONRESIDENTIAL	OPERATOR/ MANAGER	ACCESS	NAME AND EXAMPLES
Off-Street	Nonresidential	Private companies	Public	Publically accessible, privately operated parking (e.g., most garages advertising parking to street traffic)
Off-Street	Nonresidential	SFMTA	Public	Public parking garages (e.g., SFpark garages/lots)
Off-Street	Nonresidential	Private companies	Private/ public	Customer Parking Only (e.g., exclusive parking for retail customers); anyone from public can access these spaces by being a customer
Off-Street	Nonresidential	Private companies/ Government agencies	Private	Permit Holder Only (e.g., employee-only parking provided by private- or public-sector employers)
Off-Street	Nonresidential	Government agencies	Public	Free off-street parking (e.g., parking at public sites such as beach or parks)
Off-Street	Residential	Residences	Private	Residential parking (e.g., parking spaces in driveways or garages in or attached to private homes)
On-Street	Nonresidential	SFMTA	Public	On-street parking (e.g., metered or unmetered street parking)

tial parking supply in the study area and citywide, including previously undocumented off-street, nonresidential parking spaces. The Evaluation Findings chapter describes the process used to evaluate the individual strategies, presents detailed results for individual strategies organized by group, and then synthesizes findings across groups. The Roadmap to Implementation chapter assesses implementation feasibility for the most promising strategies. Finally, the Applying Results to Other Context chapter discusses how findings can be applied to other cities and regions.

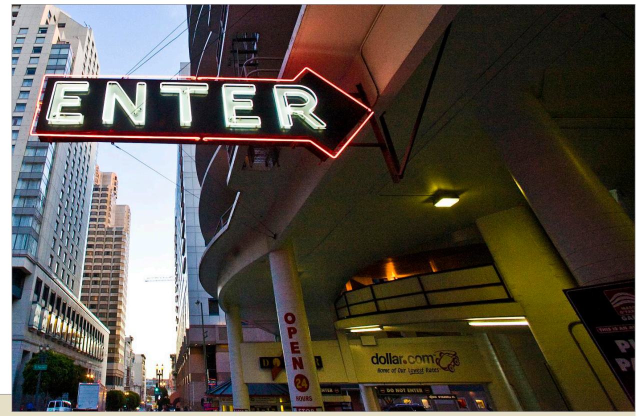


TABLE 2. PSUS Candidate Parking Strategies

NO.	STRATEGY*
~~1A~~	Annual fee for prepaid parking: Landlord is not required to pass annual fee to driver. This strategy would assess an annual fee landlords for privately accessible parking stalls.
1B	Annual fee for prepaid parking: Landlord is required to pass annual fee to driver. This strategy would assess an annual fee on drivers who use privately accessible parking stalls.
2A	Eliminate all bulk parking discounts citywide: This strategy would eliminate daily and monthly pricing discounts for publically accessible and privately accessible parking stall users. All users would pay hourly parking.
2B	Eliminate prepaid monthly parking: This strategy would eliminate monthly parking passes for publically accessible and privately accessible parking stall users. All users would pay either daily or hourly parking.
2C	Adjust parking sales tax to reward parking operators (both publically accessible and privately accessible parking stalls) for eliminating nonhourly (daily or monthly passes) discounts.
2D	Institute a graduated annual per space fee to reward parking operators (both publically accessible and privately accessible parking stalls) for eliminating nonhourly (daily or monthly passes) discounts.
3	Universal parking access fee: All parkers on work and nonwork trips pay a fixed fee each time they go in or out of a parking garage, regardless of whether there is a financial transaction for use of the space; this fee can also be varied by time of day.
4A	Fixed point of sale charge, all day: Each time a vehicle goes in or out of a garage, driver pays a flat fee on top of the existing 25 percent tax.
4B	Fixed point of sale charge, peak-only: This strategy is same as 4A, except it only applies at certain times (to focus on peak congestion).
5A	Redevelop some SFMTA-owned garages and lots to reduce supply.
5B	Constrain future growth of parking supply (not allow the number of spaces to exceed 2015 levels).
5C	Cap and trade (at a certain parking supply level): This could create an incentive for new buildings that are required to build certain number of stalls to "trade" their parking allotment. Surface lots and privately accessible garages would also be incentivized to convert to other land uses.
~~6A~~	Create a "halfpass" product with some days of parking plus some days of transit to help users purchase only as much transportation (transit, parking) as they need.
~~6B~~	"PayGo Flexpass" transit pass with monthly parking purchase, with rebate for days that are not consumed.
7A	Increased enforcement of existing state parking cashout law.
7B	Expand parking cashout to apply to smaller businesses (i.e., less than 50 employees) or larger businesses that are not subject to the law because they do not lease space, both of which are currently exempt from law.
~~8~~	Parking Treaty Agreements. Require commercial privately accessible parking supplies to be made publicly available.
~~9~~	Unbundling commercial parking: parking must be identified as a separate line item on all leases so that potential tenants can more thoroughly weigh the costs and benefits of parking.
~~10~~	Count parking toward FAR limits to incentivize developers to provide less parking.
~~11~~	Require parking be underground.
~~12~~	Prohibit curb cuts for parking on specific streets, or to alleys with parking.
~~13~~	Better enforcement of parking sales tax: Require automated counting, or eliminate nonmachine cash transaction.
~~14~~	Development impact fee imposed for parking (one-time, per-space fee).
~~15~~	Require real-time parking availability data feed to be made available to consumers to more efficiently utilize existing supply.
~~16~~	Establish parking availability target, and require user fee to be adjusted so that availability target are met.
~~17~~	Prohibit reserved parking.

* Greyed-out shaded strategies with strikethrough numbers were screened out. See Appendix A for more details on screening.

Methodology

EVALUATION APPROACH

PSUS sought to evaluate how parking strategies affect congestion through changes in mode share and peak spreading in San Francisco. It focused on parking strategies related to nonresidential, off-street parking. Data collection and analysis, plus the SF-CHAMP[9] travel demand model capabilities, shaped the evaluation approach. Figure 2 shows the different portions of the evaluation process. Ultimately, a combination of SF-CHAMP model outputs and other quantitative and qualitative analyses (informed in part by estimates of parking supply), were used to evaluate the individual parking strategies.

ANALYSIS GEOGRAPHIES AND TIMEFRAMES

This report frequently discusses analysis and results using multiple geographies: the city as a whole, the Northeast Quadrant (or NE SF, for short), and the Study Area. The Northeast Quadrant is defined based on the cordon boundaries that MAPS identified in its top-performing scenario. This area is bounded by Guerrero Street/Laguna Street to the west, 18th Street to the south, and San Francisco Bay to the north and east. Using the same geographic boundaries here in this study offers the opportunity to examine selected differences in transportation performance outcomes between cordon pricing and parking strategies.

9 SF-CHAMP documentation is available on the SFCTA web site: http://www.sfcta.org/modeling-and-travel-forecasting.

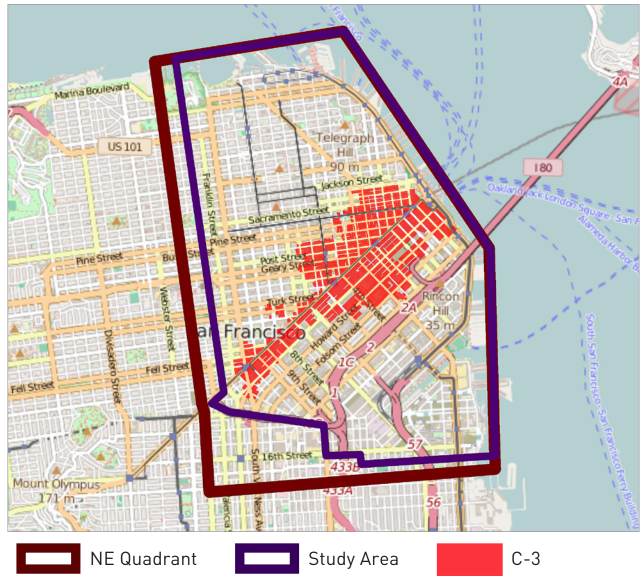
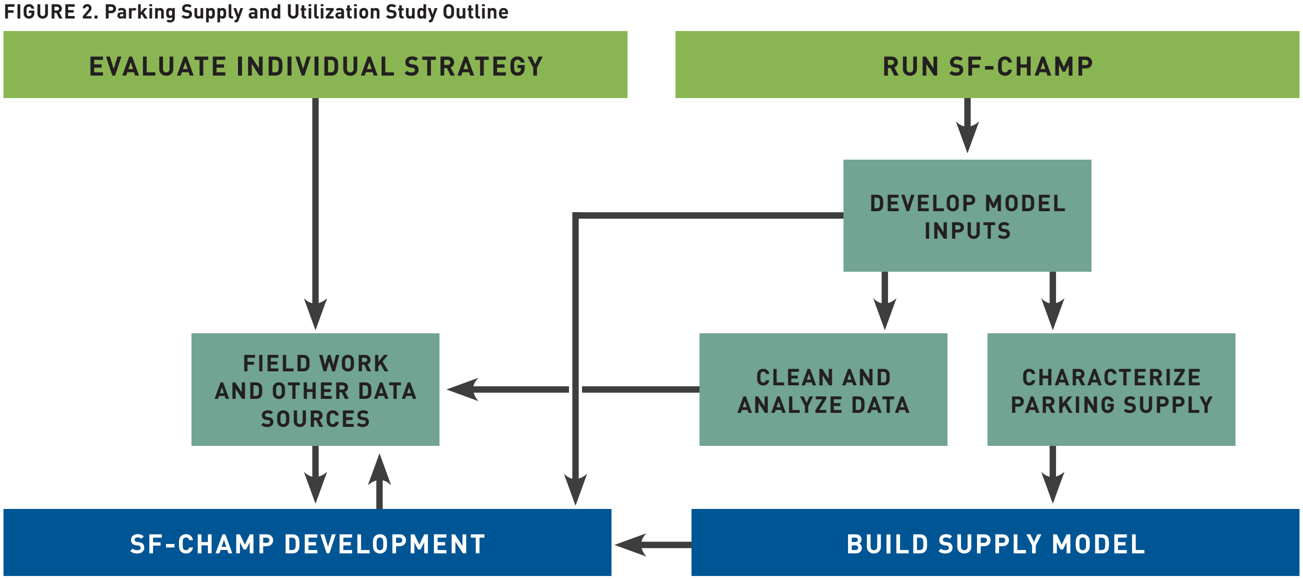


FIGURE 1. Northeast Quadrant and Study Area Boundaries

The term “Study Area” refers to a smaller portion of the city where field work was conducted for the PSUS. A smaller Study Area allowed the field work to focus on neighborhoods with high concentrations of trip destinations, and thus parking facilities. The Study Area is bounded by:

- Gough Street to the west.
- Route 101 to the southwest.
- Potrero Avenue, 16th Street, and Kansas Street to the south central.
- Mariposa Street to the southeast.
- San Francisco Bay to the north and east.

FIGURE 2. Parking Supply and Utilization Study Outline



The report also references the C-3 area. The C-3 District, or Downtown Commercial District, is a Planning Department zoning designation given to many of the highest-density portions of northeastern San Francisco.[10] Figure 1 (previous page) shows the Northeast Quadrant and Study Area boundaries and the C-3 district.

The figures and tables in the Evaluation Findings chapter typically focus on two of these geographies: the Northeast Quadrant and San Francisco as a whole. The report also focuses on two different timeframes: the AM peak, which spans from 6:00 a.m. to 9:00 a.m., and the daily 24-hour total. Four "timeframe-geography pairings" refer to the unique combinations of these two variables. SF-CHAMP includes other timeframes and geographies. However, AM peak and PM peak results were similar; for simplicity purposes, this report discusses AM Peak only as a representation of peak travel rather than showing analysis for both timeframes.

EVALUATION METRICS

The evaluation focused on metrics that reflect the study's goals of 1) shifting trips from drive alone to other modes, including transit, carpool, and active transportation, and 2) reducing congestion. The study emphasized three transportation performance metrics to assess the extent to which parking strategies helped move the City towards its goals: drive-alone trip mode share, vehicle miles traveled (VMT), and vehicle hours of delay (VHD). Mode shifts are described as percentage point changes[11] and VMT and VHD reductions are described as percent changes. All evaluation was conducted in the 2015 base year.

The report discusses mode share as the percentage of trips by mode to, from, and within the Northeast Quadrant or the City of San Francisco. In the AM Peak Northeast Quadrant, SF-CHAMP shows 2015 baseline mode shares at 41 percent transit, 33 percent nonmotorized, 15 percent drive alone, and 11 percent carpool.

VMT measures total automobile travel within a certain area and timeframe and is not only an indicator of the extent of vehicular traffic on the roadway network, but it is a key driver of the transportation sector's greenhouse gas emissions. VHD measures the difference between congested and uncongested travel time, quantifying the excess travel time experienced by motorists.[12] The combination of these three metrics in multiple time periods and geographies provided a picture of performance of each of the strategies in helping to manage congestion while limiting trip suppression (an indicator of reduced economic activity).

The report also discusses parking-related revenue. The report refers to public revenue (i.e., City and County of San Francisco revenues), which include estimated parking tax revenue (i.e., the existing 25% parking sales tax[13]) and fee revenue associated with the evaluated strategies. Baseline revenue refers to the estimated public revenue in the SF-CHAMP baseline scenario; revenue associated with particular strategies are often compared to baseline revenue, and percent change is more important than actual dollar amount. Garage operator revenue refers to the sales generated by privately and publically operated garages; the parking tax revenue constitutes 25% of this amount. The study assumed that all fees associated with an evaluated strategy would first offset the strategy's implementation cost and then fund a transportation expenditure plan. However, the study did not explore the components of these potential expenditure plans.

FIELD WORK AND OTHER DATA SOURCES

The study gathered data from existing sources and field work. Datasets discussed in the report include:

- Field work, which was conducted in the Study Area and consists of three elements:
  - Supply Survey of 500 properties to check whether and how much nonresidential, off-street parking exists at these locations. It was conducted by physical location check.
  - Operator Survey of 74 garages or lots to gather information about parking pricing, supply, occupancy and other information. It was conducted in-person.
- Intercept Survey of 265 individual parkers to gather information on parking subsidies, payment method, historical and hypothetical responses to parking price changes, and other information. It was web-based with windshield flyers distributed at 27 unique locations.
- SFpark Off-Street Parking Census with supply and pricing information on off-street, nonresidential parking in San Francisco. This dataset includes 1,399 records with 166,258 parking spaces.
- Costar private commercial real estate database. Licensed searches of this dataset showed 10,096 non-

10 http://www.sf-planning.org/index.aspx?page=1583

11 A 1.0 percentage point reduction in a 15 percent drive alone mode share is roughly a 6.7 percent reduction.

12 Chapter 1 of the MAPS final report discusses these metrics in greater detail: http://www.sfcta.org/sites/default/files/content/Planning/CongestionPricingFeasibilityStudy/PDFs/MAPS_study_final_lo_res.pdf.

13 SFMTA receives 80 percent of parking tax revenues. These parking tax revenues do not include sales from on-street meters or SFMTA owned/operated garages and lots, the proceeds of which go 100% to the SFMTA operating budget .

residential records with 89,413 spaces in San Francisco. These spaces are not mutually exclusive from the SFpark Off-Street Parking Census. Costar served as the basis for the random sampling drawn for field work and was used as inputs to the supply model.

- SFpark SFMTA Garage Utilization Dataset with pricing and occupancy time series data for several of SFMTA's garages.
- SFpark On-Street Census and Meter Rate Schedule with information on on-street parking supply and prices for metered spaces.
- SF Environment Commuter Survey of 1,831 San Francisco workers, which includes information on employer-subsidized parking.
- SF Environment Employers Survey of 1,850 San Francisco employers, conducted as part of the Commuter Benefits Ordinance (CBO) compliance process, which includes information on parking-related benefits offered to approximately 99,000 San Francisco employees.
- U.S. Census Bureau's County Business Patterns and ZIP Code Business Patterns with data on firm sizes in San Francisco.
- SF Planning Property Database and property GIS layers with building characteristics, zoning boundaries, and other built environment data which were used to augment and validate parking data.

The study cleaned and analyzed the data to 1) produce SF-CHAMP model inputs, 2) evaluate individual parking strategies off-model, and 3) build the parking supply model.[14]

SF-CHAMP MODEL DEVELOPMENT

The study used SF-CHAMP to understand how price changes associated with different parking strategies could affect congestion and mode share. SFCTA refined the SF-CHAMP model to better accommodate the analysis requirements of this study. After the modification, SF-CHAMP was able to incorporate unique parking price inputs for any time period combination at a TAZ level. Accordingly, the study developed new parking pricing model inputs to reflect variations in pricing structure (i.e., monthly, daily, hourly) and time of day for different trip patterns (e.g., early AM to PM peak or AM peak to midday). Finally, the study also updated inputs for the percentage of parkers paying for their own parking (as opposed to employer subsidized) based on survey results. The model updates also allow the assignment of partial costs to workers that otherwise received fully subsidized parking.

STRATEGY-SPECIFIC EVALUATIONS

The study developed an evaluation methodology for each strategy. The methodologies drew on a combination of tools, including SF-CHAMP and off-model analysis. SF-CHAMP can simulate effects of pricing changes on transportation outcomes and was therefore used for many of the strategies that involve price changes. Since SF-CHAMP represents a typical weekday as opposed to multiple days, it cannot explicitly represent the method that people pay for parking if they buy a bulk (e.g., monthly) pass. Therefore, scenarios that changed the method of payment were represented in SF-CHAMP by a requisite change in price (e.g., a scenario that eliminates the ability to buy a monthly parking pass was represented in the model forcing all driver to pay an increased price represented by the daily rate). In addition, the model does not explicitly represent parking supply at this time, so supply strategy methodologies relied more heavily on off-model approaches. The Evaluation Findings chapter describes the strategy-specific methodologies.

14 The supply model estimated the amount of undocumented off-street, nonresidential parking in northeastern San Francisco. The Parking Supply chapter discusses the methodology and results of the supply model.

Parking Supply

INTRODUCTION

PSUS developed a parking supply model to estimate the amount of off-street, nonresidential parking in the Study Area. The model estimated undocumented parking supply that might not be reflected within existing data sets, focusing particularly on privately accessible parking. The existing SFpark Off-Street Census extensively documents publically accessible parking lots and garages plus some privately accessible lots and garages. Costar provides data on commercial properties that could contain parking. The supply model drew on these data, as well as the supply and operator surveys conducted for the PSUS. Table 3 lists data sources (rightmost column) for the types of parking described in the Introduction chapter. The supply model used regression analyses to estimate the number of parking spaces at nonresidential properties in the Study Area based on property characteristics and other available data. Basic assumptions about parking supply in the Study Area are used to extrapolate supply estimates to other parts of the city.

APPROACH

The Costar commercial real estate properties in the Study Area served as the set of locations where undocumented nonresidential, off-street parking could potentially exist. The service covers San Francisco commercial, industrial, and mixed use properties fairly comprehensively, and, therefore, locations within those zones at which parking could occur. SFpark data covers parking that occurs in public zones and other areas that Costar might exclude categorically, therefore filling potential data gaps for this analysis. Costar includes fields for a range of building characteristics, including the number of parking spaces. However, parking is not Costar's primary focus, and many records have parking counts that do not match those in the Off-Street Census or the PSUS supply survey, which were considered more accurate due to recent field validation.

Therefore, the study analyzed the relationships between Costar building characteristics (including number of parking spaces) and the "actual" space counts (according to the Off-Street Census and the PSUS survey work) to estimate how much parking is likely to exist at a commercial property based on its building characteristics. This analysis required extensive data cleaning and processing.

Then, the study ran regression models (i.e., the supply model) with actual parking as the dependent variable and building characteristics as the independent variables. The supply model served more as a predictive tool that seeks to estimate how many undocumented parking spaces exist as accurately as possible rather than an explanatory model that attempts to understand relationships between individual explanatory variables (e.g., building height, floor area, zoning district) and a dependent variable (e.g., actual parking supply) as fully as possible. It randomly separated records with observed parking into either a training dataset for model estimation or a testing dataset for model validation. After regression estimation, the supply model used a simulation to apply the model coefficients to properties without actual parking space counts and generate error terms. The simulation helped quantify the model's uncertainty.

TABLE 3. San Francisco Parking Types

LOCATION	RESIDENTIAL/ NONRESIDENTIAL	OPERATOR/ MANAGER	ACCESS	NAME AND EXAMPLES	PARKING SUPPLY DATA SOURCES
Off-Street	Nonresidential	Private companies	Public	Publically accessible, privately operated parking (e.g., most garages advertising parking to street traffic)	Off-Street Census, Costar, Operator Survey, Supply Survey
Off-Street	Nonresidential	SFMTA	Public	Public parking garages (e.g., SFpark garages/lots)	Off-Street Census
Off-Street	Nonresidential	Private companies	Private/ public	Customer Parking Only (e.g., exclusive parking for retail customers); anyone from public can access these spaces by being a customer	Off-Street Census, Costar, Operator Survey, Supply Survey
Off-Street	Nonresidential	Private companies/ Government agencies	Private	Permit Holder Only (e.g., employee-only parking provided by private- or public-sector employers)	Off-Street Census, Costar, Operator Survey, Supply Survey
Off-Street	Nonresidential	Government agencies	Public	Free off-street parking (e.g., parking at public sites such as beach or parks)	Off-Street Census
Off-Street	Residential	Residences	Private	Residential parking (e.g., parking spaces in driveways or garages in or attached to private homes)	N/A
On-Street	Nonresidential	SFMTA	Public	On-street parking (e.g., metered or unmetered street parking)	On-Street Census, SFpark Meter Database

The study aggregated model results across the Study Area and compared them to aggregate documented parking supply in the Off-Street Census. Then, the study calculated the ratio of modeled (i.e., undocumented) supply to documented supply inside the Study Area. This ratio helped estimate the amount of undocumented supply outside the Study Area in the remainder of San Francisco.

Appendix C discusses the supply model methodology and results in detail.

RESULTS

Preliminary Supply Model Outputs

The model attempted to estimate the number of parking spaces for each Costar record (considered the complete data set of commercial buildings) with complete data for all land use/building variables included in the regression models, but without observed parking data. According to the supply model results, the median, or 50th percentile, number of total parking spaces in the Study Area not already counted in the Census or supply and operator surveys was 1,300 and the median number of nonzero parking locations was 12 out of a possible 3,614 locations.[15] The average number of total parking spaces not accounted for in the Census or operator survey was 2,900, and the average number of nonzero parking locations was 41.

Even though the number of new locations and spaces estimated in the model were a small part of the overall off-street parking supply, the confidence intervals were relatively wide. For total parking spaces not accounted for in the Census or operator survey, the 10th and 90th percentile results were 300 and 6,000 spaces. The 5th and 95th percentile results were 200 and 9,200 spaces. For number of locations with parking spaces, the 10th and 90th percentile results were 3 and 55 locations. The 5th and 95th percentile results were 1 and 82 locations.

Table 4 shows modeled summary statistics for the number of parking spaces, number of locations with parking, number of parking spaces per 1,000 square feet of rentable building area for locations with parking, number of parking spaces per 1,000 square feet of rentable building area for locations with and without parking, number of parking spaces in C-3, and number of parking locations in C-3.

Adjusted Results

The study adjusted the results for missing data. There were 4,106 Costar locations without observed parking data. The simulations addressed 3,614 of these locations, but 492 locations were dropped due to missing data. These missing locations represented a 17 percent increase in potential locations. Therefore, a simple 17 percent increase in parking spaces was added to results as follows in Table 5.[16] These model results represented the estimate of the additional parking in the Study Area. These spaces are over and above the approximately 85,900 off-street, nonresidential spaces that are known to exist within the Study Area based on other data sources (i.e., Census, and supply and operator surveys).

Figure 3 (next page) shows the composition of off-street, nonresidential parking in the Study Area according to the median supply model result. Space counts were rounded to the nearest hundred.

15 Parking supply results are rounded. Some calculation may contain rounding errors.

16 Rounding errors occur.

TABLE 4. Simulation Summary Statistics for Locations without Observed Parking Data

	MEDIAN	MEAN	5TH PERCENTILE	10TH PERCENTILE	90TH PERCENTILE	95TH PERCENTILE
Number of parking spaces	1,300	2,900	200	300	6,000	9,200
Number of parking locations	12	41	1	3	55	82
Parking spaces per 1,000 square feet rentable building area for location with parking	0.280	0.488	0.039	0.067	1.071	1.546
Parking spaces per 1,000 square feet rentable building area for location with and without parking	0.01268	0.02685	0.00142	0.00266	0.05649	0.08677
Number of parking spaces in C-3	100	500	0	0	1,300	2,200
Number of parking locations in C-3	3	8	0	0	13	18

TABLE 5. Final Adjusted Results for Locations without Observed Parking Data

	MEDIAN	MEAN	5TH PERCENTILE	10TH PERCENTILE	90TH PERCENTILE	95TH PERCENTILE
Number of parking spaces	1,600	3,300	200	300	7,000	10,700

The categories included:

- Census paid, publically available (PPA) parking constitutes the majority (79.1 percent) of the total supply;
- Census customer parking only (CPO) (8.5 percent);
- Census permit holder only (PHO) parking (7.4 percent);
- Operator and supply survey additional parking—both public and private (2.0 percent);
- Supply model median expected additional parking (1.8 percent);
- Census commercial/government only (CGO) (0.8 percent);
- Census parking of unknown type (0.2 percent); and
- Census free parking (FPA) (effectively 0 percent in Study Area).

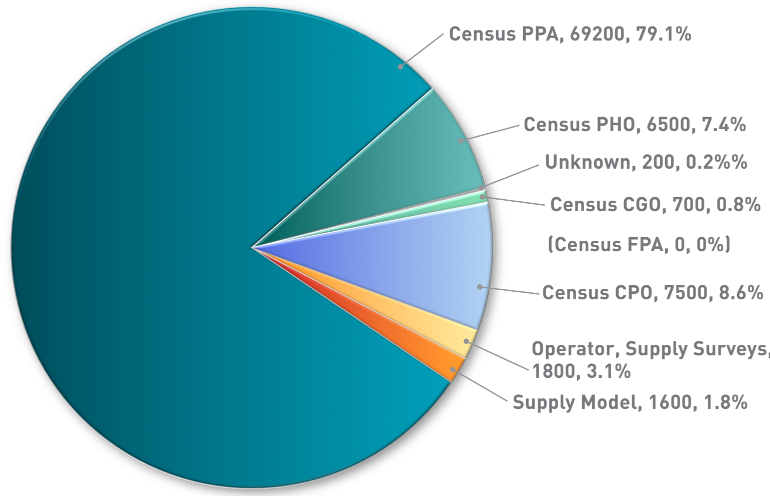


FIGURE 3. Study Area Off-Street, Nonresidential Parking Supply by Type

The study extrapolated results for outside the Study Area. The Census accounts for 81,500 off-street, nonresidential parking spaces outside of the Study Area. Assuming the same percentage increases in total observed parking, the portions of San Francisco outside the Study Area were expected to have 84,600 spaces under the median result. Table 6 shows the estimated number of parking spaces in the Study Area, outside the Study Area, and citywide; it distinguishes between Census documented spaces (96 percent) and undocumented spaces[17] (4 percent). Space counts were rounded to the nearest hundred.

TABLE 6. Estimated Number of Off-Street, Nonresidential Parking Spaces by Geography and Census Status, Median Supply Model Result

	CENSUS	MEDIAN UNDOCUMENTED ESTIMATE	TOTAL
Study Area	84,100	3,300	87,400
Outside Study Area (extrapolated)	81,500	3,100	84,600
Citywide (extrapolated)	165,600	6,400	172,000

17 Undocumented spaces included operator and supply survey additional parking and supply model median additional parking.

SUPPLY MODEL CONCLUSION

The supply model predicted relatively low nonresidential, off-street parking spaces and locations beyond what the extensive Off-Street Census and parking operator survey already documents in the Study Area. This parking is likely to exist at parking garages or lots that are not readily advertised as publically available parking, such as permit holder only or customer only parking.

The supply model and model results reflected available data and resources. Data-related issues that could have substantively affected results are the completeness (e.g., percentage of actual properties included) and accuracy of Costar's commercial property database, and the difficulties matching addresses from different datasets, including Costar and SFpark. Given available data, the supply model was able to estimate the likely range of unobserved parking in the Study Area and can help stakeholders better understand San Francisco's parking supply to more accurately evaluate parking-related policies.

Evaluation Findings

This chapter describes the strategy-specific methodologies and then presents evaluation findings, summarizing results for individual strategies in four groups: parking fee strategies (1B, 3, 4A, and 4B), bulk discount elimination strategies (2A, 2B, 2C, and 2D), parking cashout strategies (7A and 7B), and parking supply strategies (5A, 5B, and 5C). The chapter then compares results across SF-CHAMP scenarios and synthesizes findings. Appendix E provides full evaluation findings with detailed methodologies. As noted in the Methodology chapter, the study evaluated strategies based on their impact on mode share, VMT, and VHD for different time periods and geographies and then determined the resulting changes in parking-related revenues.

STRATEGY-SPECIFIC METHODOLOGIES

This section presents the evaluation approach for each potential strategy, distinguishing between SF-CHAMP evaluation and off-model analysis. Since SF-CHAMP does not differentiate between on-street and off-street parking, all evaluation approaches assume a commensurate change in on-street parking strategy to reinforce any of the scenarios tested.

- **1B. ADD ANNUAL FEE FOR PREPAID PARKING: LANDLORD IS REQUIRED TO PASS ANNUAL FEE TO DRIVER.** This strategy would assess an annual fee for parking providers, based on the number of spaces, and potentially the function of those spaces. The landlord would be required to pass this fee onto drivers, but the exact method likely would be at their discretion.
  - » SF-CHAMP Evaluation: No model run.
  - » Off-Model Analysis: The approach assumes a qualitative comparison to other strategies (e.g., fee based and bulk discount scenarios).
- **2A. ELIMINATE ALL BULK PARKING DISCOUNTS CITYWIDE.** This strategy would eliminate daily and monthly pricing discounts for publically accessible and privately accessible parking stall users. All users would pay hourly parking.[18]
  - » SF-CHAMP Evaluation: Used results from 2B model run.
  - » Off-Model Analysis: The intercept survey was used to determine the proportion of bulk discount parkers who pay for parking on a daily versus monthly basis. The mode shift from the monthly discount elimination model run (see 2B below) was multiplied by the proportion of daily to monthly parkers to estimate possible mode shift for daily discount elimination. The mode shift for daily discount elimination was then combined with the monthly discount elimination estimate from 2B. Information from other SF-CHAMP runs about the relationship between mode share and congestion was used to determine how much this mode shift reduces congestion.
- **2B. ELIMINATE PREPAID MONTHLY PARKING.** This strategy would eliminate monthly parking passes for publically accessible and privately accessible parking stall users. All users would pay either daily or hourly parking.
  - » SF-CHAMP Evaluation: Monthly pricing was eliminated and hourly and daily prices were applied in the model to individuals who pay for parking.[19]
  - » Off-Model Analysis: Model results were supplemented with intercept survey revealed and stated preferences regarding this strategy.
- **2C. ADJUST PARKING SALES TAX TO REWARD PARKING OPERATORS (BOTH PUBLICALLY ACCESSIBLE AND PRIVATELY ACCESSIBLE PARKING STALLS) FOR ELIMINATING NON-HOURLY (DAILY OR MONTHLY PASSES) DISCOUNTS.**
  - » SF-CHAMP Evaluation: Used results from 2B model run.
  - » Off Model Analysis: Mode shift and congestion results from the 2B model run and 2A off-model analysis were used to determine how many daily and monthly parkers would switch modes if they did not purchase parking in bulk, and how this mode shift would affect congestion. Potential revenue loss to garages due to this mode switch was also examined.
- **2D. INSTITUTE A GRADUATED ANNUAL PER SPACE FEE TO REWARD PARKING OPERATORS (BOTH PUBLICALLY ACCESSIBLE AND PRIVATELY ACCESSIBLE PARKING STALLS) FOR ELIMINATING NONHOURLY (DAILY OR MONTHLY PASSES) DISCOUNTS.**
  - » SF-CHAMP Evaluation: Used results from 2B model run.
  - » Off-Model Analysis: Mode shift and congestion results from the 2B model run and 2A off-model analysis were used to determine how many daily and monthly parkers would switch modes if they did not purchase parking in bulk, and how this mode shift would affect congestion. Potential revenue loss to garages due to this mode switch was also examined.

18 This strategy is an expansion of the San Francisco Planning Code section 155(g) to a larger geography and to buildings formerly unaffected by the policy. The Implementation chapter and Regulatory Environment appendix discuss 155(g) in greater detail.

19 Since SF-CHAMP is a 24-hour simulation, it does not actually apply monthly prices in the baseline. Instead, it uses proxies for monthly pricing. Similarly, the model does not distinguish how parking is purchased so the benefit/cost of not being able to purchase a monthly pass is wholly represented in the price of parking for the purposes of this analysis.

- **3. INSTITUTE A UNIVERSAL PARKING ACCESS FEE.** All parkers on work and nonwork trips pay a fixed fee each time they park, regardless of whether there is a financial transaction for use of the space; this fee can also be varied by time of day.
  - » SF-CHAMP Evaluation: Used results from 4B and 7B mode runs.
  - » Off-Model Analysis: Mode shift and congestion results from the 4B and 7B[20] runs (see below) were used to approximate the effects of a peak-hour fee applied to all parkers. Model results were supplemented with intercept survey revealed and stated preferences. Price points from other model runs and survey data were used to determine the relationship between fee amount and the likely transportation performance impacts (i.e., mode shift, congestion reduction).
- **4A. INSTITUTE A FIXED POINT OF SALE CHARGE, ALL DAY.** Each time paid parking is consumed, driver pays a flat fee on top of the existing 25 percent tax.
  - » SF-CHAMP Evaluation: A flat fee was applied in peak periods and midday to work trips not reimbursed by employers,[21] as well as to nonwork trips.
  - » Off-Model Analysis: Model results were supplemented with intercept survey revealed and stated-preferences. Price points from other model runs and survey data were used to determine the relationship between fee amount and the likely transportation performance impacts (i.e., mode shift, congestion reduction).
- **4B. INSTITUTE A FIXED POINT OF SALE CHARGE, PEAK-ONLY.** This strategy is the same as 4A, but only applies in AM and PM peak periods.
  - » SF-CHAMP Evaluation: A flat fee was applied in peak periods to work trips not reimbursed by employers, as well as to nonwork trips.
  - » Off-Model Analysis: Model results were supplemented with intercept survey revealed and stated-preferences. Price points from other model runs and survey data were used to determine the relationship between fee amount and the likely transportation performance impacts (i.e., mode shift, congestion reduction).
- **5A. REDEVELOP SOME SFMTA-OWNED GARAGES AND LOTS TO REDUCE SUPPLY.**
  - » SF-CHAMP Evaluation: No model run.
  - » Off-Model Analysis: Several types of data were examined to roughly estimate maximum potential mode shift: 1) estimated supply of parking spaces in Study Area, 2) rough approximation of average headroom (i.e., available spaces) across these garages using SFMTA usage data, 3) rough approximation of average headroom at similarly located privately operated garages using the operator survey, and 4) breakdown of number publically operated versus privately operated spaces in the high-congestion areas using the supply model. With this information, the number of trips diverted from SFMTA garages was determined and then the amount of these trips that would likely be absorbed by existing private supply was estimated. The trips absorbed by private supply was subtracted from total diverted trips to obtain a maximum mode share estimate. Other SF-CHAMP model runs were used to approximate how this mode shift might affect congestion.
- **5B. CONSTRAIN FUTURE GROWTH OF PARKING SUPPLY (NOT ALLOW THE NUMBER OF SPACES TO EXCEED 2015 LEVELS).**
  - » SF-CHAMP Evaluation: No model run.
  - » Off-Model Analysis: Because evaluation of future horizon years is not part of this study, general assumptions about parking demand growth were made. Calculations from Strategy 5A above were used to determine how much headroom is available in current high-congestion areas. From this, the year headroom will be filled was calculated to estimate the timeframe for when changes in travel behavior would occur.
- **5C. CAP AND TRADE (AT A CERTAIN PARKING SUPPLY LEVEL).** This creates an incentive for new buildings that are required to build a certain number of stalls to "trade" their parking allotment. Surface lots and private garages would also be incentivized to convert to other land uses.
  - » SF-CHAMP Evaluation: No model run.
  - » Off-Model Analysis: The "cap" element was covered in 5A and 5B. The evaluation of the "trade" element was not proposed given lack of detailed projections of construction by building type.

20 7B was used to approximate the fee's impact on subsidized commuters.

21 For 4A and 4B, the model applies the fee to all parkers; but for subsidized parkers, the employers, rather than the parkers, face the cost increase.

- **7A. INCREASE ENFORCEMENT OF EXISTING STATE PARKING CASHOUT LAW.**
  - » SF-CHAMP Evaluation: Since the 7B SF-CHAMP run (below) had limited effects on transportation performance, a separate run was not conducted for 7A.
  - » Off-Model Analysis: U.S. Census County and Zip Code Business Pattern firm size data were used to determine the proportion of employees working at firm sizes greater than 50, one criterion for the state cashout law. Using this ratio, the Study examined the subset of transportation effects from 7B that would also apply to 7A.
- **7B. EXPAND PARKING CASHOUT TO APPLY TO SMALLER BUSINESSES, OR TO LARGER BUSINESS THAT ARE NOT SUBJECT TO THE LAW BECAUSE THEY DO NOT LEASE SPACE.**
  - » SF-CHAMP Evaluation: Individuals who receive subsidized parking in the baseline were assumed to now pay 75 percent of parking cost to simulate the effect of cashout.[22]
  - » Off-Model Analysis: Information from the intercept survey and other data sources was used to characterize potential market size for cashout in San Francisco. Baseline SF-CHAMP trip and tour information was used to supplement the analysis.

22 Formerly subsidized individuals pay 75 percent, rather than 100 percent, since the reduction in parking benefit is equivalent to the pre-tax portion of the benefit, which constitutes most but not all of the benefit. Individuals were assumed to have an average tax rate of 25% based on median HH income for the Metropolitan Statistical Area.

SCENARIO DEVELOPMENT

Based on the strategy-specific methodologies, the study modeled the following scenarios in SF-CHAMP:

- Baseline scenario (no strategies implemented)
- 2B. Eliminate monthly discount in the Northeast Quadrant
- 4A. Flat in/out fee charged during AM peak, midday, and PM peak periods[23] ($3) in the Northeast Quadrant[24]
- 4Bi. Flat in/out fee charged during peak periods ($3) in the Northeast Quadrant
- 4Bii. Flat in/outfee charged during peak periods ($6) in the Northeast Quadrant
- 7B. Elimination of employer-paid parking citywide

Each SF-CHAMP scenario is a specific proposed simulation of one of the parking strategies that can be tested, modeled, quantified, and evaluated. SF-CHAMP applied pricing changes in San Francisco's Northeast Quadrant, except for parking cashout, which was applied citywide. Table 7 summarizes the evaluated strategies by category, indicating whether strategies have their own SF-CHAMP scenario or leverage results from another SF-CHAMP scenario. It lists trip types and time periods affected.

23 SF-CHAMP uses five time periods: Early (3:00 6:00 a.m.), AM Peak (6:00 9:00 a.m.), Midday (9:00 a.m. 3:30 p.m.), PM Peak (3:30 6:30 p.m.), Evening (6:30 p.m. 3:00 a.m.).

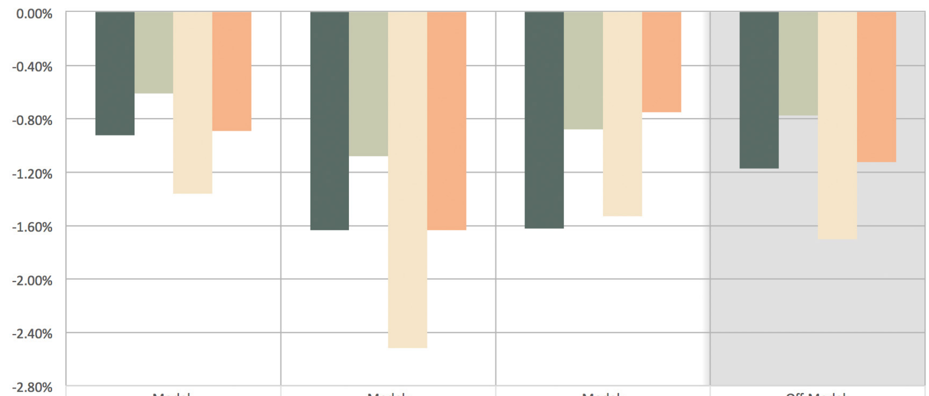
24 Fee amounts are discussed in the Fee-Based Strategies section.

TABLE 7. Strategy Evaluation Reference

CATEGORY	NO.	STRATEGY	SF-CHAMP SCENARIO?	USES OTHER SF-CHAMP SCENARIO?	TRIPS AFFECTED	TIME PERIOD
Fee-Based	1B	Annual parking space fee: fee passed onto driver	No	No	Parkers at Privately Accessible Sites	24-Hour
Fee-Based	3	Universal parking access in/out fee	No	Yes	All	AM/PM Peak or All-Day*
Fee-Based	4A	Flat all-day in/out fee	Yes	–	Unsubsidized work, Nonwork	All-Day
Fee-Based	4B	Flat peak in/out fee	Yes	–	Unsubsidized work, Nonwork	AM/PM Peak
Bulk Discount Elimination	2A	Monthly and hourly discount elimination	No	Yes	Unsubsidized work, Nonwork	24-Hour
Bulk Discount Elimination	2B	Monthly discount elimination	Yes	–	Unsubsidized work, Nonwork	24-Hour
Bulk Discount Elimination	2C	Parking sales tax bulk discount elimination incentive	No	Yes	Unsubsidized work, Nonwork	24-Hour
Bulk Discount Elimination	2D	Parking fee bulk discount elimination incentive	No	Yes	Unsubsidized work, Nonwork	24-Hour
Supply	5A	SFMTA garage redevelopment	No	No	All	24-Hour
Supply	5B	Parking supply cap	No	No	All	24-Hour
Supply	5C	Parking supply cap and trade	No	No	All	24-Hour
Cashout	7A	Increased cashout enforcement	No	Yes	Subsidized work	24-Hour
Cashout	7B	Expanded cashout law	Yes	–	Subsidized work	24-Hour

* The all-day timeframe spans the AM Peak, Midday, and PM Peak (6:00 a.m. 6:30 p.m.).

FIGURE 4. Fee Strategy Comparison: Percentage Point Change in To/From/Within Drive-Alone Trip Mode Share



	Model: Peak $3 Fee (4Bi)	Model: Peak $6 Fee (4Bii)	Model: All-Day $3 Fee (4A)	Off-Model: Univ. Acc. Peak $3 Fee (3)
24-Hour, NE SF	-0.9%	-1.6%	-1.6%	-1.2%
24-Hour, All SF	-0.6%	-1.1%	-0.9%	-0.8%
AM Peak, NE SF	-1.4%	-2.5%	-1.5%	-1.7%
AM Peak, All SF	-0.9%	-1.6%	-0.8%	-1.1%

PARKING FEE STRATEGIES (1B, 3, 4A, 4B)

Introduction

The study evaluated several types of parking fee strategies. Strategy 4A, or the all-day fee, charges a flat fee each time that paid parking is consumed in the Northeast Quadrant during the AM peak, midday, and PM peak periods. Strategy 4B, or the peak fee, charges a flat fee each time that paid parking is consumed in the Northeast Quadrant during only the AM peak and PM peak periods. Strategy 3 charges a universal access fee on all work and nonwork trips in the Northeast Quadrant during the AM peak and PM peak periods. Strategy 1B levies an annual fee for parking spaces and assumes landlords will pass on this fee to drivers. In locations where the 25 percent parking sales tax is applied, fees would be levied in addition to the 25 percent tax.

The study focused on two fee amounts: $3 and $6. Based on past analysis of pricing strategies and the intercept survey results from this study, a $3 fee is likely to be high enough to influence travel behavior at meaningful levels, while still being relatively modest compared to other costs of transportation use. The $6 fee, at twice the level of the $3 fee, represents a high book-end estimate of how parking fees could influence transportation performance.

Results

Peak, All-Day, and Universal Access Fee Results (3, 4A, 4B)

Figure 4 charts drive-alone trip mode share reduction for the 3 SF-CHAMP modeled fee scenarios plus the unmodeled universal access fee scenario, shaded in gray. Predictably, the peak $6 fee caused more mode shift than the other three scenarios that had lower fee levels. It reduces drive-alone mode share by 2.5 percentage points for trips to, from, and within the Northeast Quadrant for the AM peak. Baseline drive alone mode share was 15 percent, compared to 41 percent transit, 33 percent nonmotorized, and 11 percent carpool. The $3 fee variations performed similarly to each other, with the universal access fee reducing drive-alone mode share by 1.7 percentage points, the all-day fee reducing by 1.5 percentage points, and the peak fee reducing by 1.4 percentage points. As expected, the all-day fee reduced 24-hour drive-alone mode share more effectively than the peak fee in both the Northeast Quadrant and entire city. For the 24-hour results within the Northeast Quadrant, the $3 all-day fee and $6 peak fee produced nearly the same mode shift.

Whereas the peak fees incentivized a portion of commuters to shift their travel out of peak periods, the all-day fee appeared to incentivize more drivers to shift modes altogether. For VMT and VHD reduction (see Figures 11 and 12 later in the chapter), the results were similar to those seen for reductions in drive-alone mode share. As before, the $3 universal access fee and $3 all-day fee perform more effectively than the $3 peak fee in the AM peak in the Northeast Quadrant.

> Increasing the cost to park influenced some drivers to choose alternative modes and/or travel times. Results varied depending on fee level, as well as the traveler population(s) and time(s) of day affected by the change.

Fee Amounts and Revenue Results

Unsurprisingly, performance of each of the fee strategies depended heavily on fee amounts. Larger fees achieved more congestion reduction and auto mode shift, but the results indicated that larger fee increases have somewhat diminishing returns in terms of transportation outcomes. For instance, doubling the $3 peak fee to $6 less than doubled mode shift.[25]

> At the $3 fee level, the all-day fee (peak and midday) performed more effectively than the peak fee for daily metrics and some AM peak metrics.

The peak, all-day, and universal access fees captured significant additional revenue for the City and County of San Francisco that could be used to improve the transportation system and make non-auto mode options more attractive for system users. Predictably, the $6 peak fee captured more revenue than the $3 fees. According to SF-CHAMP (see Figure 13 later in the chapter), it would increase public revenue by 131 percent. The $3 all-day fee would increase baseline revenue by 118 percent, significantly more than the $3 peak fee, which showed a 71 percent increase. SF-CHAMP projected parking transactions and the existing parking tax revenues to decrease between 5 and 10 percent, depending on the fee scenario.

A universal access fee applied to the peaks and midday is expected to slightly outperform the all-day fee at the same amount, because it applies the same fee structure to more individuals. Likewise a universal access fee applied to the peaks is expected to slightly outperform the peak fee at the same amount because it affects more people. However, universal access fees would be more challenging to implement from a technology perspective (see Roadmap Implementation chapter).

Annual Parking Space Fee Results (1B)

This fee is intended to be charged based on the number of parking spaces at a facility, and could be based on the nature of the spaces (e.g., prepaid reserved parking for daily or monthly parkers). The manner in which the fee is passed on to consumers (for this strategy a requirement) could be dictated in the regulation or be up to the individual facility operator. It is likely that the fee, if left to the operator, would be passed on to all parkers, though the way in which it would be passed on would be based on how each operator could maximize profit.

In order to have drivers experience a similar increase in parking cost as the $3 peak or all day fee, landlords would need to be charged $800-$1,600 per spaces, depending on turnover of spaces and which particular parkers are required to pay for the fee. In this way, Scenario 1B could achieve goals similar to other strategies, but the fee and its administration is not tied directly to transportation goals, and is not directly under the public control. It is less targeted and, therefore, likely less effective than strategies such as 3, although a larger population would be affected than, for example, peak-only strategies 3 or 4B.

> The supply model and other data parking supply data sources suggest that four fifths of the off-street, nonresidential parking in the Study Area is publically available. Thus, strategies that target privately available parking are unlikely to markedly affect overall transportation system performance.

BULK DISCOUNT ELIMINATION STRATEGIES (2A, 2B, 2C, 2D)

Introduction

Several potential strategies involve eliminating daily and/or monthly parking discounts so that individuals pay hourly rates for parking. On an individual basis, the ability to purchase parking in “bulk” (either for the whole day or month at a time) could encourage more driving, because parking expenses become perceived as a sunk cost, with the effect that the incremental cost of each driving trip being reduced as compared to other travel options. When drivers have to pay incrementally for their parking usage, the mode choice decision better reflects the true costs to the traveler for that trip.[26]

Strategy 2A eliminates both monthly and daily discounts, and Strategy 2B eliminates monthly discounts only; both strategies would likely use a regulatory prohibition to ensure that garage operators did not offer their customers the discontinued pricing, although operators may reduce pricing for shorter term parking in order to maximize profits (not explicitly accounted for in the analysis). In contrast, Strategies 2C and 2D incentivize rather than require privately operated parking garages to eliminate bulk discounts. 2C adjusts the parking sales tax to reward operators for eliminating discounts, and 2D institutes an annual per-space fee that is set in such a way as to discourage discounted parking. Based on the current structure of model inputs to SF-CHAMP, Strategy 2B was best represented in the model. For 2C and 2D, the strategies' transportation performance is assumed to be the same as 2A at

25 Similar to MAPS, fees were capped at twice the single charge. In other words, for the $3 all day fee scenario, a driver who enters and leaves twice would only be charged $6, not $12.

26 The transportation performance results assume that hourly pricing remains the same after discount elimination. In reality, garage operators might be able to maximize revenue by lowering hourly rates in order to attract more customers, though this section's findings suggest that this might not necessarily be the case.

certain incentive levels, but the three strategies perform differently from revenue and political feasibility perspectives. This chapter discusses the former, and the Roadmap to Implementation chapter discusses the latter.

Results

Required Elimination Results (2A, 2B)

According to this study's intercept survey of 265 unique parkers in the Study Area, 50 percent of parkers pay for their spaces on a monthly basis (see Figure 5). Another 29 percent pay daily, meaning nearly four fifths buy bulk parking. The remaining 21 percent pay hourly. Respondent trip purposes were split 88 percent work, 5 percent home, and 7 percent other. Using this information, the study extrapolated results for 2A from the 2B scenario model run.

The combined discount elimination (2A) performed similarly to the monthly discount elimination (2B). The monthly elimination decreased drive-alone mode share by 1.0 percentage point in the AM peak in the Northeast Quadrant and 0.7 percentage points over the 24-hour period in the Northeast Quadrant. The combined discount reduced these shares by 1.5 and 1.1 percentage points, respectively (see Figure 9 later in the chapter). VMT and VHD reduction figures were similar (see Figures 11 and 12 later in the chapter). The combined discount elimination reduced AM peak Northeast Quadrant VMT by 3.3 percent and VHD by 5.7 percent.

Incentivized Elimination Results (2C, 2D)

Conceptually, it should be possible to design tax-incentivized discount elimination (2C) and fee-incentivized discount elimination (2D) that would be able to achieve the same mode shift and congestion reduction as required elimination (2A). The implementation issues inherent in-designing an appropriate tax or fee structure are discussed in the Roadmap to Implementation chapter; the remainder of this discussion focuses on the scale of incentivizes that might be required in order to achieve positive transportation outcomes by implementing either strategy 2C or 2D.

The revenue increase under 2A and 2B suggested that operators would benefit from the required discount elimination. Such an incentive does not exist in the voluntary scenario; if one garage eliminated bulk discounts, then its discount parkers would likely look for better deals at neighboring garages. Requiring discount elimination for all garages (as in strategies 2A and 2B) prevents this slippage phenomenon.[27] Without a regulatory requirement, financial incentives can help encourage industry-wide conversion, helping to mitigate slippage.

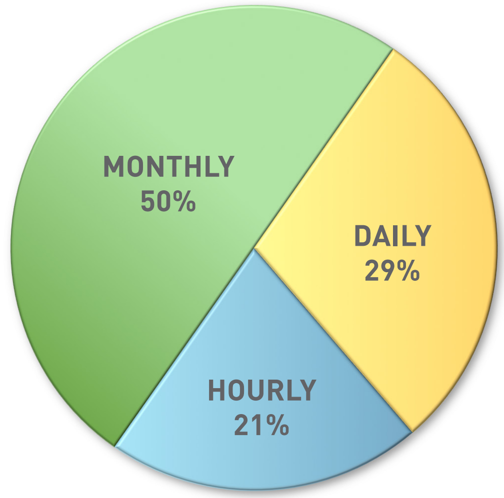


FIGURE 5. Intercept Survey Parking Payment Basis

The monthly discount elimination scenario (2B) reduced Northeast Quadrant daily parking transactions by 14,800. Assuming daily discount elimination reduces transactions proportionally (based on the percentage of monthly and daily parkers), combined discount elimination (2A) reduced daily parking transactions by 23,400 transactions. The average pre-tax revenue per parking transaction in the Northeast Quadrant was $4.39. Thus, in aggregate, these operators stand to lose up to $102,800 per day due to mode shift by those who will not be willing to pay higher (i.e., non-discounted) prices. However, actual net revenue loss is likely to be considerably lower for several reasons. First, under a voluntary program, it is unlikely that all parking operators would change their pricing at once, so many garages and drivers would be unaffected; some individual garages might even see increased business relative to the baseline. And, for those parking operators who do eliminate discounts, while some of their customers would switch modes, revenue from remaining parkers would increase (parkers who purchased discount parking in the baseline would be paying undiscounted hourly rates).

Some form of first-mover bonus might be required to convince garages to change their pricing voluntarily. To incentivize discount elimination, operators could be offered some amount of compensation (in the form of lower fees or lower parking taxes) if they chose to eliminate discounts. The incentive amount could be set based on the net revenue performance of the first-mover garages compared to their peers, so that there is a competitive advantage to making the shift right away. The initial incentives paid out would likely be much lower than $102,800 per day, because

27 Working with garage operators to better understand and evaluate this revenue result would be an important step in implementing the strategy.

only a subset of garages would choose to adopt early. Also, using this relative approach means that as more garages switch, the differential is reduced and the need for incentives declines over time.

From a revenue perspective, the city would receive more revenue from the required elimination strategy than the voluntary elimination. Although individual garages might lose some customers after eliminating discounts, it is likely that many lost customers would utilize other available facilities, leading to little change in sales tax revenues in the aggregate. However, the incentives paid out as part of a voluntary discount elimination strategy would reduce overall public revenues. Under voluntary elimination, revenue would likely be lower than in the baseline.[28]

It is difficult to predict how parkers and operators would react under incentivized elimination in the long term. Thus, achieving the same transportation performance as required elimination would require a careful implementation with close monitoring of parking consumption by bulk versus hourly payment structure and a flexible incentive structure.

CASHOUT STRATEGIES (7A, 7B)

Introduction

The study examined two strategies involving parking cashout, which is the practice whereby employers that subsidize employee parking offer these employees the option of taking a cash subsidy in lieu of a parking space. Strategy 7A entails a broader enforcement of the existing California cashout law. Strategy 7B examines the idea of extending the cashout requirements to firms not currently covered by the law.

The State of California enacted a law in 1992 intended to reduce auto commute trips by requiring firms to offer employees parking cashout. Firms that meet all of the following criteria are subject to the cashout law:[29]

- Employ at least 50 persons (regardless of how many worksites)
- Have worksites in an air basin designated nonattainment for any state air quality standard
- Subsidize employee parking that they do not own
- Can calculate the out-of-pocket expense of the parking subsidies they provide
- Can reduce the number of parking spaces without penalty in any lease agreements.

While violations are subject to civil penalties of up to $500 per vehicle per civil action, the California Air Resources Board has announced its intention to "facilitate compliance before seeking civil penalties." In San Francisco, the law is self-implemented; there are no reporting requirements that would identify firms who failed to comply.[30]

The SF-CHAMP model does not include enough sensitivity to simulate all of the aspects of workers being offered cashout. While SF-CHAMP does include information on the percentage of individuals who pay for their own parking during work trips (i.e., do not receive subsidized parking), the model cannot assign a subsidy policy to certain individual travelers based on their attributes (e.g., travelers who drive to work and work at firms with over 50 people that lease rather than own parking). Since parking subsidies are often provided in San Francisco to relatively less price-sensitive travelers (i.e., high income employees who are likely to drive regardless of cost), SF-CHAMP results likely reflect a larger shift than would be anticipated if it was able to account for these traveler attributes as part of the subsidy function.

Subsidized Parking

Cashout's potential effect on overall transportation system performance depends heavily on how many people it influences—the number of individuals who receive subsidized work parking as a proportion of overall travelers. The study examined several employer and commuter surveys to characterize this proportion. Generally, the information showed that a limited proportion of Study Area parkers receive subsidized parking:

- Of parking commuters in this study's intercept survey, 72 percent received no parking subsidy, 10 percent received a partial parking subsidy, and 18 percent received a full parking subsidy. 35 percent of partially or fully subsidized parkers indicated that their employers offer alternative transportation benefits, such as transit passes.
- The SF Environment Commuter Survey reported that less than 25 percent of employees receive any parking related benefits: 13 percent receive pre-tax deductions, 8 percent receive free or subsidized parking, and 1 percent receive cashout options.
- Of the firms in the SF Environment Employer survey, few provided parking benefits: 6 percent offer pre-tax deductions, 10 percent offer free or subsidized park-

28 In SF-CHAMP scenario 2B (monthly elimination), the city captured received $45,600 more per day than in the baseline. This number plus any revenue increases from daily elimination (approximately $72,000) would likely be less than the amount that the city would need to incentivize monthly and daily elimination (up to $102,800).

29 California's Parking Cash Out Program, http://www.arb.ca.gov/planning/tsaq/cashout/cashout_guide_0809.pdf.

30 Appendix B discusses parking cashout in greater detail.

ing to some employees, and less than 1 percent offer cashout. At select firms that provided location and San Francisco-based employee sizes (1,596 respondents), 4 percent of employees receive free or subsidized parking from their employers.

According to the SF-CHAMP baseline scenario, which contained parking subsidy information derived from the surveys, there were approximately 618,000 daily tours with destinations in the Northeast Quadrant. Of these, roughly 244,000 represented work tours. Drive-alone work tours were at roughly 33,000 and carpool work tours were at roughly 14,000. Approximately 13,300 of these tours did not pay for parking. Thus, in SF-CHAMP, subsidized parkers represented about 2 percent of total tours, 5 percent of work tours, and 28 percent of drive alone and carpool work tours. Figure 6 shows baseline scenario maps of the percent of work tours with subsidized parking. The left map shows subsidized tours as a percent of all work tours, and the right map shows subsidized tours as a percent of auto only tours.

Results

Expanded Cashout Model Results (7B)

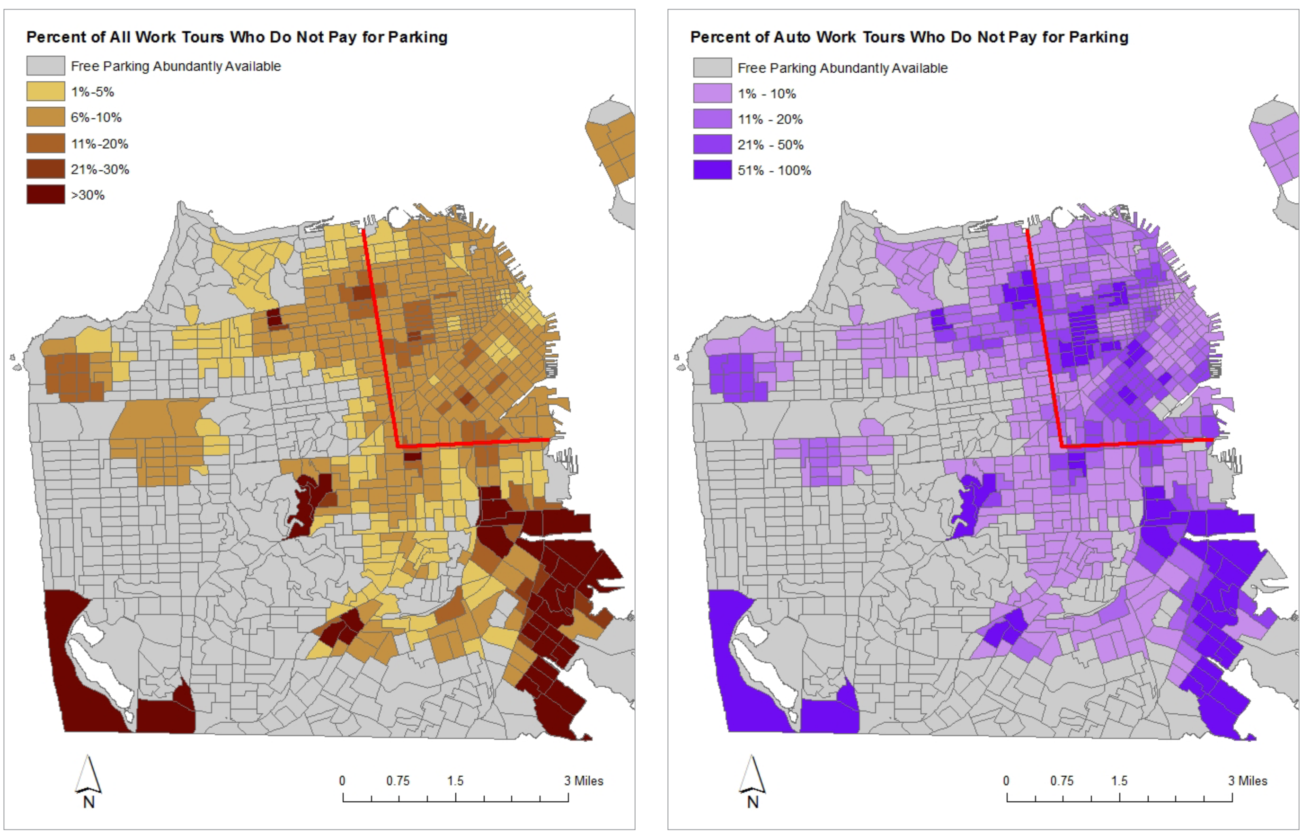
The study used an SF-CHAMP scenario where all commuters paid for their own parking to approximate expanded cashout (7B). Expanded cashout showed little change in transportation system performance versus the baseline. Eliminating employer-paid parking reduced drive-alone mode share by 0.2 or 0.3 percentage points in each timeframe-geography pairing. For AM peak Northeast Quadrant VMT and VHD, expanded cashout shows 0.4 and 0.7 percent reductions, respectively.

Relatively few Study Area parkers receive employer-subsidized parking. Therefore, parking cashout affected overall transportation system performance minimally.

Enforcing Existing Cashout (7A)

Evaluating existing cashout (7A) required understanding how the affected population compares to 7B, which applies to all subsidized parkers. Enforcing existing cashout (7A) applies to fewer subsidized parkers than 7B, so transportation performance is assumed to fall between the baseline

FIGURE 6. SF-CHAMP Baseline Scenario: Percent of Work Tours with Subsidized Parking (All Modes and Auto Only)



and 7B scenario results. Firm size distributions in several downtown San Francisco zip codes[31] from the U.S. Census Bureau's County Business Patterns and ZIP Code Business Patterns[32] helped roughly estimate the proportion of the 7B subsidized commuters that are eligible for cashout under the existing law (7A). Using several simplifying assumptions, the study estimated the number of employees working at establishments with 50 or more employees to be 62 percent of total employees. Thus, assuming a similar distribution of subsidized workers by firm size, 7A likely affects no more than 62 percent of the individuals touched by 7B.

This percentage represents a high end estimate of those who meet the firm size criterion of the current cashout law. The number of individuals who work at firms who subsidize their parking, fall into this size category, and meet the other cashout requirements is limited. Since the 7B results showed little change in mode share and congestion, 7A is likely to affect these measures marginally. But cashout may still be an important piece of a broader travel demand management portfolio and is likely less costly and politically challenging to implement than many other evaluated strategies.

SUPPLY STRATEGIES (5A, 5B, 5C)

Introduction

While the other strategies focus on managing parking demand through direct manipulations of price, this set of strategies would attempt to manage travel demand by changing the available parking supply in San Francisco. It may be challenging to affect a significant amount of parking supply to equal the breadth of demand strategies which easily encompass a large share of existing parking spaces. In addition, the the Transportation Sustainability Program's Transportation Demand Management effort (tsp.sfplanning.org; Shift) was presumed to encompass San Francisco's strategy for managing parking supply in future development.

Nevertheless, some supply based strategies would result in significantly fewer spaces available relative to total demand, thereby raising the market rate cost to park—and thus to drive—influencing mode choice and congestion management performance. Strategy 5A redevelops SFMTA parking facilities to directly reduce supply from current levels. Strategy 5B caps parking supply at 2015 levels so that it does not grow in future years. Strategy 5C caps supply at 2015 levels and then allows buildings to trade parking spaces among themselves.

Parking Occupancy

The analytical approach for supply-based strategies relied on an understanding of current parking occupancy at existing garages and lots. Parking occupancy varies based on time of day, day of week, season, weather, location, and special events, so it is difficult to generalize about availability and utilization without detailed data sets. At the same time, private garage operators are reluctant to provide detailed occupancy data to public agencies, because other operators could analyze these data to obtain a competitive advantage. As a result, data availability and simplicity dictated the evaluation approach for these strategies.

The SFpark pilot project gathered garage occupancy data for SFMTA public garages, and a subset of these data were used for the study. This subset contained average occupancy for each weekday hour, disaggregated by month over the period from May 2011 to December 2013 for each garage. The study identified the maximum occupancy hour for each garage and took the inter-monthly average of the occupancy figures for the maximum occupancy hour at each garage. The maximum occupancy times tended to occur during the midday, between 11:00 a.m. and 1:00 p.m. The study compared occupancy to total capacity at each garage.

Figure 7 shows average occupancy as a proportion of total capacity at the garages within the Study Area. The weighted average maximum occupancy across all of these garages was 69 percent of total capacity.[33] SFpark's occupancy target of 40 to 80 percent for off-street SFMTA sites corroborate this estimate.

The operator survey was able to gather some information on if and when garages in the Study Area typically fill during weekdays. Most operators did not provide exact percentages, but their responses could be grouped into three categories: 1) sites that typically fill up, 2) sites are mostly

31 Selected zip codes included 94102 (Tenderloin), 94103 (SoMa), 94108 (Chinatown), 94105 (Embarcadero South), 94104 (Financial District), and 94111 (Embarcadero North).

32 United States Census County Business Patterns, retrieved in March 2014, http://www.census.gov/econ/cbp/.

33 This average is weighted by number of parking spaces.

full or occasionally full, and 3) sites that are rarely or never full. Table 8 shows how the responding sites and number of parking spaces at those sites fall into these three categories.[34]

Two-thirds of the 51 survey respondents that provided some occupancy information indicated that their garages or lots usually fill. These 67 percent of respondents account for 71 percent of the parking spaces managed at these 51 sites. Ten percent indicated that their garages are mostly full at peak occupancy and/or occasionally fill; 24 percent indicated their garages rarely or never fill. The study did not find a clear spatial pattern between these categories; there were some full garages far outside of the busiest areas, such as the C-3 district, and some rarely full garages in the C-3 district. Some of the privately operated garages reached peak capacity earlier in the day than the SFMTA garages, but this varied by location. Less than half of the regularly full privately operated garages reached capacity before 10:00 a.m.

34 Figures are rounded in this section, so calculations may include some rounding error.

To quantify headroom[35] at these privately operated garages, the study made headroom assumptions for each capacity category. At peak occupancy, the "usually fills up" category was assumed to be 100 percent full,[36] the "mostly/occasionally full" category was assumed to be 85 percent full, and the "never/rarely full" category was assumed to 69 percent full. The latter number was chosen to correspond with the SFMTA average occupancy at peak. The three assumed headroom rates were multiplied by the number of spaces within each category, to compute total available spaces. Total available spaces as a percentage of total capacity—or estimated total weighted headroom—was 8 percent, a much lower value than the SFMTA garages. This figure varies based on the assumed category percentages; for instance, a 75 percent peak occupancy rate at the "never/rarely full" level results in a total weighted headroom of 6 percent. The difference between headroom at privately operated and SFMTA garages is unsurprising:

35 The difference between capacity and occupancy.

36 Garage operators are unlikely to allow parking sites to become completely full but will instead raise prices as their facilities become fuller to maximize revenue. 100 percent was used as a simplifying assumption.

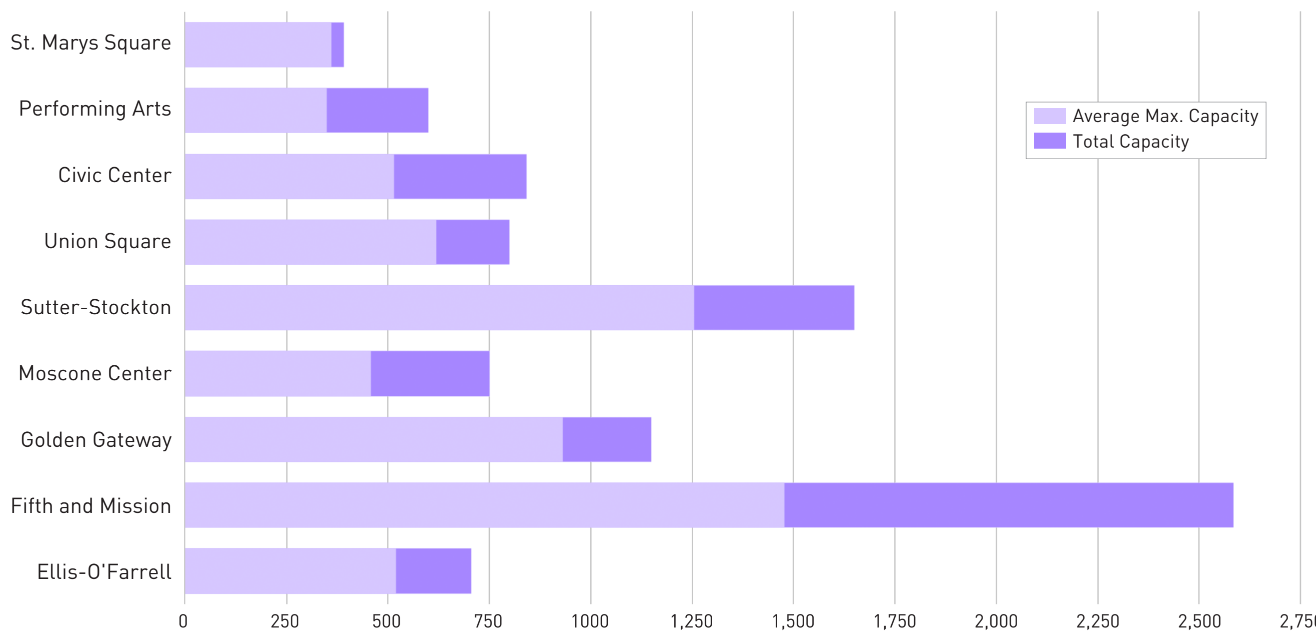


FIGURE 7. Average Occupied Parking Spaces during Maximum Occupancy Hour at SFMTA Operated Garage in Study Area, 5/2011 12/2013

TABLE 8. Operator Survey Responses by Occupancy Category, Privately Operated Parking Facilities

CATEGORY	NUMBER OF RESPONSES	PERCENTAGE OF RESPONSES	TOTAL SPACES	PERCENTAGE OF SPACES
Never/rarely full	12	24%	2,700	21%
Mostly/occasionally full	5	10%	1,000	8%
Usually fills up	34	67%	9,200	71%
TOTAL	**51**	**100%**	**12,900**	**100%**

SFMTA sets occupancy targets of 40 to 80 percent whereas private operators maximize profits and are likely to do so by utilizing all or nearly all of their parking capacity.

The study applied these respective headroom estimates to the total number of privately and publically operated parking spaces. Privately operated parking constitutes a much larger portion of overall supply than the SFMTA (i.e., publically operated) garages. Figure 8 shows SFMTA off-street supply in relation to total estimated supply (according to the supply model in the Northeast Quadrant, Study Area, and three high-congestion neighborhoods: the Financial District, Eastern SoMa, and Union Square ("FiDi/E SoMa/ Union Sq" in the chart). Total supply was assumed to fluctuate in proportion to the number of SFpark Census parking spaces in each of these three areas. The SFMTA off-street supply is equivalent to 12 percent of the total supply in the Northeast Quadrant, 13 percent of the total supply in the Study Area, and 23 percent of total supply in the Financial District, Eastern SoMa, and Union Square.

Results

SFMTA Garage Redevelopment (5A)

If the SFMTA were to redevelop all nine garages in the Study Area, it would eliminate 11,500 spaces, which house, at a peak occupancy of 69 percent, an estimated maximum of 8,000 trips. The Study Area contains an estimated 87,400 nonresidential, off-street spaces, 75,900 of which are privately operated (i.e., separate from SFMTA garages). At an estimated headroom rate of 8 percent, this privately operated supply could absorb an additional 5,900 trips during peak occupancy time. If these driving trips were absorbed, there would be an extra 2,100 unabsorbed driving trips in the Study Area. Assuming a similar ratio of SFMTA parking to private parking outside the Study Area, the study used the ratio of Census sites in the Study Area versus Northeast Quadrant to estimate that there would be approximately 2,200 unabsorbed driving trips in the Northeast Quadrant. Each of these unabsorbed trips would either 1) switch modes (e.g., carpool, transit); 2) adjust trip timing to arrive when more parking is available; or 3) adjust trip destination to places with available parking.

In the baseline scenario, there are 1,900,800 trips made daily across all modes and tour purposes from, to, and within the Northeast Quadrant. 292,600, or 15.4 percent, of these are drive-alone trips. In the unlikely event that all 2,200 unabsorbed Northeast Quadrant driving trips switched modes while maintaining the same travel times and destinations, it would change daily Northeast Quadrant drive-alone mode share by 0.1 percentage points. Even with this maximum assumed mode shift, congestion would be affected minimally.

This mode share shift is relatively insensitive to the specific occupancy rate assumptions for private garages described in the previous section. For example, if the assumed peak occupancy rate for "never/rarely full" privately operated garages was 60 percent (resulting in a total weighted headroom of 10 percent), all diverted trips could be absorbed by private supply. If this rate were 75 percent (resulting in a total weighted headroom of 6 percent), 3,500 driving trips would be unabsorbed in the Northeast Quadrant, raising maximum estimated mode shift from 0.1 percentage points to 0.2 percentage points.

On the other hand, these calculations relied on many simplifying assumptions and do not account for different peak occupancy times at different locations, precise privately operated garage occupancy data, different years and seasons of collected occupancy data, how former SFMTAparkers would react (i.e., switch parking location, time of day, or mode) to being diverted, and how operators would adjust prices given supply changes. Overall, the transportation improvements associated with 5A are likely limited. Reductions in SFMTA garages would probably be most ef-

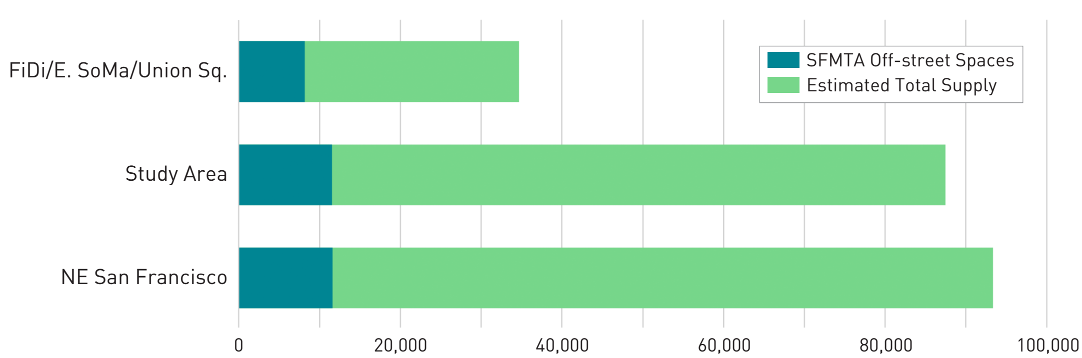


FIGURE 8. SFMTA Off-Street Spaces and Supply Model Estimated Total Spaces by Geography

fective in the Financial District, Eastern SoMa, and Union Square area, or other areas where SFMTA garages represent a comparatively high proportion of overall parking supply.

Strategy 5A would explicitly eliminate a revenue stream currently collected by the City, because SFMTA would no longer collect parking costs or the related taxes for redeveloped garages that are removed from the market. At the same time, there would almost certainly be an increase in parking sales tax at private garages as drivers relocated to other facilities in the city. Depending on the private garage operators' pricing responses to the elimination of SFMTA-owned supply and the revenues generated from redeveloped properties, the net change in revenues received by the City could be either positive or negative.

Parking Supply Cap, and Cap and Trade (5B, 5C)

The parking supply cap (5B) and cap-and-trade (5C) strategies differ from the other evaluated strategies because they do not affect changes currently.[37] These strategies would only accrue benefits in future years and would not have an immediate impact. They are also likely to affect how growth occurs where they are applied; new development in these areas is more likely to attract residents and businesses that require more limited parking.

For the parking supply cap strategy (5B), the study examined how different parking demand growth rates would influence the time when current total capacity is reached. Current peak occupancy across SFMTA and privately operated garages was compared to total capacity in the Study Area: 78,000 current occupants at peak time and 87,400 total capacity.

> Parking supply strategies, such as capping parking supply at current levels, are unlikely to influence mode share and congestion in the next few years but could play an important role in the long term.

The State of California Employment Development Department published a 2012 to 2022 annual average growth in occupational employment of 1.2 percent for San Francisco, Marin, and San Mateo Counties.[38] If parking demand grows at the same 1.2 percent rate, peak occupancy will equal total capacity in 10 years.[39] Again, additional drivers may not necessarily switch modes once capacity is reached (they could adjust trip time or destination instead), but this strategy would likely start leading to changes in travel behavior at this point. Under a slower demand growth rate of 0.5 percent, peak occupancy would equal capacity in 23 years. Under a faster rate of 4 percent, peak occupancy would equal capacity in 3 years. Thus, the strategy's timeframe depends heavily on the actual growth rate.

The direction and magnitude of future parking revenues for 5B are uncertain. Potential revenues would be lost from spaces that would have been built had the cap not existed. But a higher pricing of constrained supply could drive revenues upward.

Strategy 5C is a cap-and-trade approach, so its transportation performance results will be similar to 5B. However, parking space allocations from less congested areas might be traded to properties in more congested downtown areas, where garages can charge higher rates. This phenomenon could dampen the transportation effects of the strategy, but could also be counteracted by a policy implementation that weighs parking space allocations in higher congestion area more heavily. Revenue results will depend on the implementation of the trading scheme.

SYNTHESIS

SF-CHAMP Model Results

This section compares results between the SF-CHAMP modeled scenarios. Across the different strategy types, the parking scenario model results showed modest performance improvement of a relatively similar amount. Figure 9 shows the percentage point change[40] in drive-alone trip mode share by scenario versus the baseline, with two off-model scenarios shaded grey. The $6 peak period parking fee captured slightly more mode share than other scenarios during the AM peak period. Eliminating employer-paid parking (expanded cashout) had the smallest effect, reducing drive-alone mode share by 0.2 or 0.3 percentage points in each timeframe-geography pairing.

In general, the results were less significant outside of the study area for the rest of San Francisco, even for approaches like expanded cashout which would be applied citywide. This is because SF-CHAMP calculates the relationship between the price of parking and demand for parking, but commuters consider other factors besides the cost of parking. The generalized cost of driving also includes travel time, tolls, additional frustration due to congestion or variable travel times, vehicle operating and maintenance costs, etc. Response to changes in cost of parking (elastic-

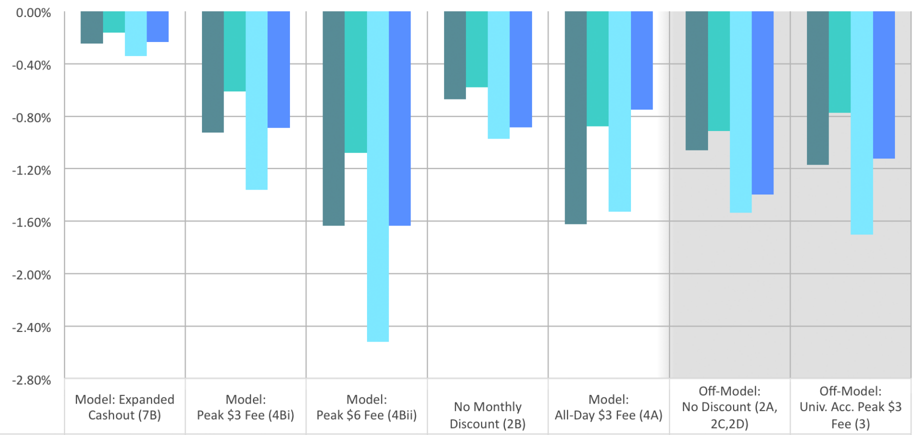
37 As discussed in the Strategy-Specific Methodologies section, the Study did not examine future conditions for other strategies. The SF-CHAMP model scenarios were run for current rather than future years.

38 *2012-2022 Occupational Employment Projections (Marin, San Francisco, and San Mateo Counties).* State of California Employment Development Division, Labor Market Information Division, 2014.

39 Employment growth is used as a proxy for overall travel demand growth. Travel demand includes trips aside from commuting, such as shopping and school trips.

40 This report describes mode shifts as percentage point changes rather than percent changes. A 1.0 percentage point reduction in a 15 percent drive alone mode share is roughly a 6.7 percent reduction.

FIGURE 9. Percentage Point Change in To/From/Within Drive-Alone Trip Mode Share



	Model: Expanded Cashout (7B)	Model: Peak $3 Fee (4Bi)	Model: Peak $6 Fee (4Bii)	No Monthly Discount (2B)	Model: All-Day $3 Fee (4A)	Off-Model: No Discount (2A, 2C,2D)	Off-Model: Univ. Acc. Peak $3 Fee (3)
24-Hour, NE SF	-0.2%	-0.9%	-1.6%	-0.7%	-1.6%	-1.1%	-1.2%
24-Hour, All SF	-0.2%	-0.6%	-1.1%	-0.6%	-0.9%	-0.9%	-0.8%
AM Peak, NE SF	-0.3%	-1.4%	-2.5%	-1.0%	-1.5%	-1.5%	-1.7%
AM Peak, All SF	-0.2%	-0.9%	-1.6%	-0.9%	-0.8%	-1.4%	-1.1%

ity) outside of the study area is low because parking costs constitute a small share of the overall cost of driving. Even a large percentage change in parking costs has a small impact on the generalized cost of driving and thus a small impact on demand for parking.

Figure 10 depicts the overall mode splits for each scenario, including the baseline, during the AM Peak in the Northeast Quadrant. Transit and nonmotorized modes dominated the mode profile in the northeastern portion of the city. Across the scenarios, 41 to 44 percent of AM peak trips used transit in the Northeast Quadrant. Another 33 to 35 percent used nonmotorized modes, including walking and biking. Auto accounted for the remaining trips, with 12 to 15 percent drive alone and 9 to 11 percent carpool.

The bars in Figure 9 show how reduced drive-alone trips redistribute among remaining modes. In the $6 peak fee scenario, for instance, drive-alone and carpool trips decreased by 2.5 and 0.7 percentage points whereas transit and nonmotorized trips increased by 2.2 and 1.0 percentage points. Under the strategy scenarios, carpool trips tended to decrease along with drive-alone trips rather than absorb them.

> The travel demand model results showed that driver response to parking scenarios was somewhat modest. Price changes alone may be insufficient to compensate for underlying trends in congestion and delay. But they may be important strategies in managing congestion.

Transit tended to absorb more reduced auto trips than nonmotorized.

Figure 11 (next page) shows percent change in VMT, and Figure 12 (next page) shows percent change in VHD. The results indicated that changes in VMT and VHD. are proportional; for a given scenario,VMT reduction performance

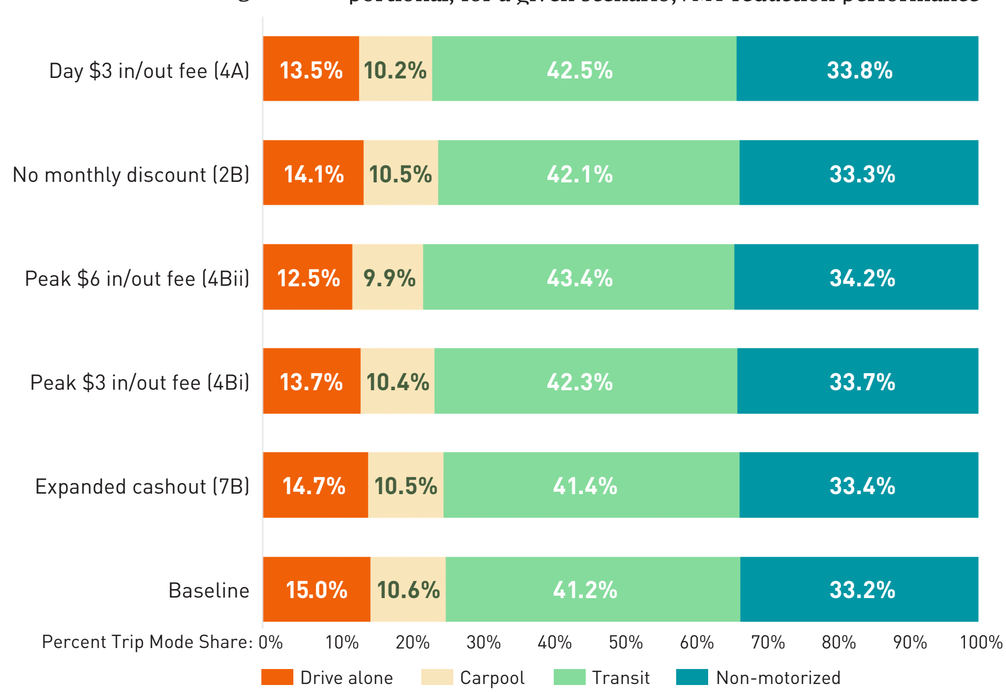
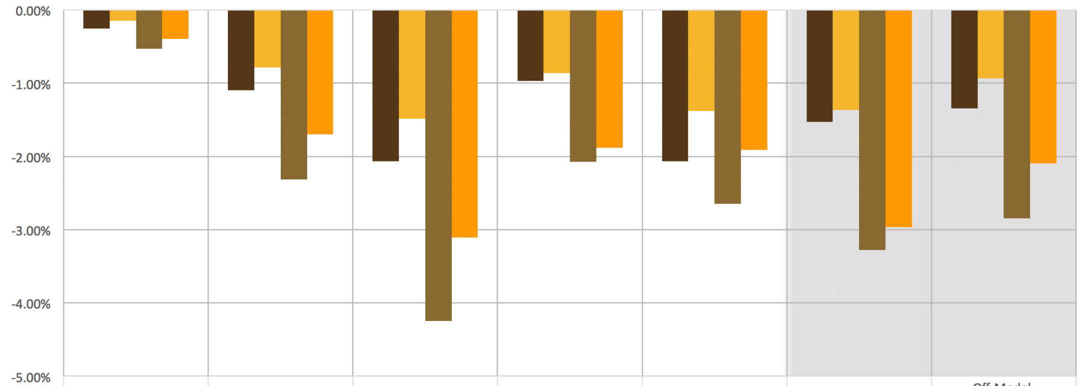


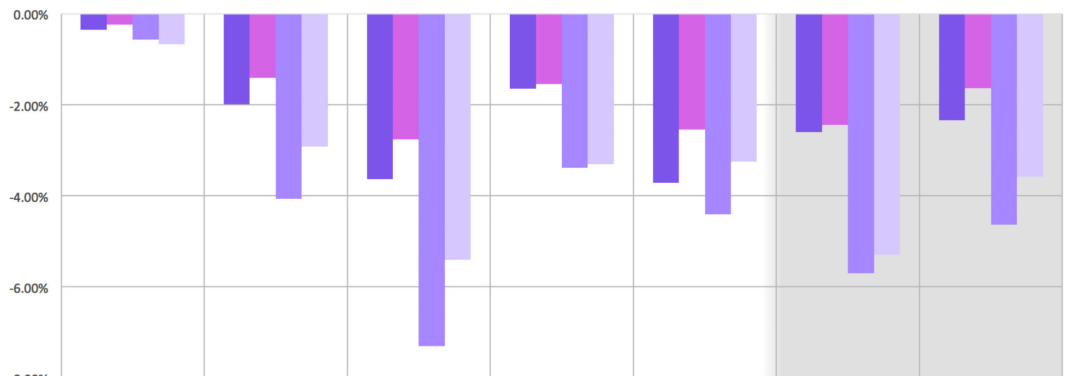
FIGURE 10. AM Peak, To/From/Within Northeast Quadrant Trip Mode Share by Scenario

FIGURE 11. Percent Change in VMT



	Model: Expanded Cashout (7B)	Model: Peak $3 Fee (4Bi)	Model: Peak $6 Fee (4Bii)	No Monthly Discount (2B)	Model: All-Day $3 Fee (4A)	Off-Model: No Discount (2A,2C,2D)	Off-Model: Univ. Acc. Peak $3 Fee (3)
24-Hour, NE SF	-0.3%	-1.1%	-2.1%	-1.0%	-2.1%	-1.5%	-1.3%
24-Hour, All SF	-0.1%	-0.8%	-1.5%	-0.9%	-1.4%	-1.4%	-0.9%
AM Peak, NE SF	-0.5%	-2.3%	-4.2%	-2.1%	-2.6%	-3.3%	-2.8%
AM Peak, All SF	-0.4%	-1.7%	-3.1%	-1.9%	-1.9%	-3.0%	-2.1%

FIGURE 12. Percent Change in VHD



	Model: Cashout (7B)	Model: Peak $3 Fee (4Bi)	Model: Peak $6 Fee (4Bii)	Model: No Monthly Discount (2B)	Model: All-Day $3 Fee (4A)	Off-Model: No Discount (2A,2C,2D)	Off-Model: Univ. Acc. Peak $3 Fee (3)
24-Hour, NE SF	-0.3%	-2.0%	-3.6%	-1.6%	-3.7%	-2.6%	-2.3%
24-Hour, All SF	-0.2%	-1.4%	-2.8%	-1.5%	-2.5%	-2.4%	-1.6%
AM Peak, NE SF	-0.6%	-4.1%	-7.3%	-3.4%	-4.4%	-5.7%	-4.6%
AM Peak, All SF	-0.7%	-2.9%	-5.4%	-3.3%	-3.2%	-5.3%	-3.6%

relative to other scenarios tended to be the same as VHD. performance relative to other scenarios. Congestion results tended to be proportional to mode shift results for each scenario. The $6 peak fee reduced VMT by 4.2 percent and VHD. by 7.3 percent in the Northeast Quadrant during the AM peak, higher than the other scenarios.

Figure 13 (next page) compares City and County of San Francisco revenues for each scenario in two components:

> The combined monthly and daily bulk discount elimination achieved mode shift and congestion reductions that rival or exceed those of the $3 fees in some timeframe-geography pairings. Furthermore, the discount elimination was the only modeled strategy to show revenue increases for garage operators and the existing 25 percent parking sales tax.

the existing 25 percent parking sales tax and parking fees associated with the scenarios. The three parking fee scenarios would substantially increase public revenue. Predictably, the $6 peak fee captured more revenue than the $3 fees, increasing baseline public revenue by 131 percent. The $3 all-day fee would increase baseline public revenue by 118 percent, significantly more than the $3 peak fee, which showed a 71 percent increase. For most of the scenarios, existing parking tax revenue decreased slightly as individuals shift modes or timeframes. However, the no monthly discount scenario increased tax revenue compared to the baseline (again, SF-CHAMP does not account for parking operators changing the cost of hourly/daily parking to maximize profits; this would minimize the effect of increased revenues in this scenario).

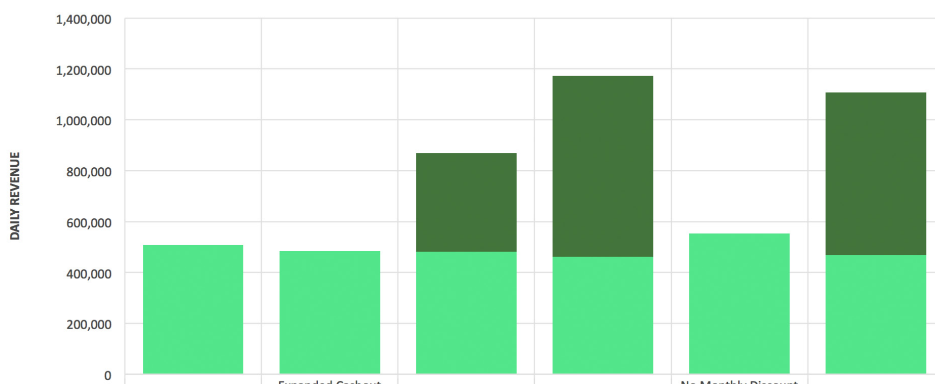
Comparison of Cordon Pricing versus Parking Pricing

Comparing the parking strategies to the MAPS preferred scenarios is challenging since the modeled cordon pricing scenarios had significant transportation investments, which made alternative modes more attractive than the baseline. However, the study team did analyze the performance of a cordon pricing scenario ($3 peak fee for autos crossing the cordon during the AM and PM peak periods, $6 max per day.) without the transportation investments in order to compare the performance of a cordon based approach versus a parking fee based approach. The results indicate that cordon based pricing would likely be significantly more effective (more than twice) in reducing VMT and VHD as well as having a greater influence over mode shift for fees of a similar amount (i.e., Strategy 4B). The higher effectiveness of cordon based strategies can be explained by the fact that the downtown parking strategies do not apply directly to the approximately 110,000 daily vehicle through trips with origins and destinations outside the pricing or policy area (close to 50,000 of which occur during the AM and PM peak periods, representing approximately 16% of all driving trips. In addition, those pass-through driving trips may be more sensitive to price changes since they are not paying the higher parking costs typical for downtown destinations. Therefore, from a technical standpoint, a cordon-based pricing tool may be more effective than a parking based pricing approach.

Conclusion

The PSUS evaluation found that many of the strategies perform similarly and there is not a clear top performer. However, some of the strategies could be part of the city and region's larger congestion management efforts (i.e., as a complement to cordon-based pricing, transit incentives, or freeway tolling).

FIGURE 13. City and County of San Francisco Daily Revenue by Scenario



	Baseline	Expanded Cashout (7B)	Peak $3 Fee (4Bi)	Peak $6 Fee (4Bii)	No Monthly Discount (2B)	All-Day $3 Fee (4A)
Fee	0	0	$386,387	$711,413	0	$640,889
25% Parking Tax	$508,078	$483,064	$482,895	$462,019	$553,664	$467,353

Roadmap to Implementation

INTRODUCTION

This chapter includes implementation steps and challenges for some of the study's better-performing strategies, based on the results in the Evaluation Results chapter: it focuses on flat fees and combined bulk discount elimination. The chapter does not address cashout and supply policies, because these strategies had limited effect on current mode share and congestion compared to other strategies. Also, the Transportation Sustainability Program's Travel Demand Management effort (tsp.sfplanning.org; Shift) is presumed to be the City's primary approach for managing parking supply for future land use development.

The chapter addresses technical feasibility and political feasibility, and briefly discusses implementation steps. The first section discusses flat fees (4A, 4B), including differences in implementation between flat fees and universal access fees. The second section covers the combined bulk discount eliminations, distinguishing between required elimination (2A) and voluntary, incentivized elimination (2C, 2D). The final section synthesizes implementation findings and compares the strategy types.

FLAT FEES (4A, 4B)

Technical Feasibility

These strategies involve charging an additional flat fee to travelers who already pay for parking, effectively increasing the cost of parking from current levels. As the affected parking facilities already have equipment in place to charge parkers and track parking sales tax receipts, and because processes already exist within city government to collect and distribute parking revenues[41], minimal additional effort and equipment would be needed to implement these fees. The same enforcement process used for the existing parking tax could be applied to the flat fees. Some additional labor would be required to monitor the fee's effects.

From a transportation performance perspective, the universal access fee performs marginally better than a flat fee of the same amount during the same timeframe, but it would likely require considerably more resources to implement because the strategy presumes the ability to have the fee passed onto drivers even if they do not currently pay for parking (e.g., employer subsidized parking). One approach would be to install license plate recognition cameras at curb cuts (driveways) affected by the strategy. According to one vendor, license plate technology prices currently range between $650 and $3000 per camera.[42] In the study area, if $2,000 worth of equipment were needed for every 50 off-street non-residential parking spaces of the approximately 87,400 spaces total, the equipment cost would be roughly $3.5 million. This cost could vary widely based on the number of locations and equipment costs.[43] Some large parking garages and lots would need multiple sets of monitoring equipment. Several full-time staff in addition to existing tax collection staff would also be needed to maintain this equipment and oversee the fee collection process. Data management and billing systems would also need to be installed at locations that do not charge for parking today. A database of registered license plates with addresses would need to be maintained for billing purposes.

It may be possible to reduce equipment and maintenance costs by requiring all affected locations to impose the universal access fee themselves, rather than using city-owned technology in the public right of way. Some paid, publically available parking sites with tax collection systems already in place might not need any additional equipment for the universal access fee. The City would need to dedicate staff resources to auditing and compliance in order to enforce the fee. These examples show how costly and complex it could be to pursue a universal access fee strategy; a flat fee approach is more technically feasible.

Political Feasibility

San Francisco has experienced challenges implementing parking price increases over the past decade due to public and political opposition. A ballot initiative to increase the city's parking tax from 25% to 35% in 2006 (Proposition E) garnered less than one-third of the popular vote in the city-wide election.[44] In the 2014 State of the City Address, Mayor Ed Lee called on the SFMTA to suspend payment at parking meters on Sunday, citing public opposition.[45] Later that year, SFMTA made most of the city's meters free on Sundays.[46] Parking fees have faced pushback in other cities too. In Vancouver, Canada, for instance, the city had

41 For instance, under the Revenue Control Equipment Ordinance 234-06, all parking stations must have equipment that records each transaction. The ordinance states that operators shall not have access to the equipment or its software so that they cannot manipulate transaction data. http://sftreasurer.org/sites/sftreasurer.org/files/migrated/ftp/uploadedfiles/tax/FAQ%20Article22.pdf.

42 http://www.cctvcamerapros.com/License-Plate-Capture-Cameras-s/283.htm.

43 Implementation of the universal access fees would also require determination of specific locations within the strategy area to monitor; these could include the set of off-street sites with confirmed non-residential parking, the set of off-street sites with confirmed mixed parking (with a process to separate residential from non-residential parking utilization), or all non-residential curb cuts.

44 http://sfpl.org/pdf/main/gic/elections/November7_2006.pdf.

45 http://sfmayor.org/index.aspx?page=983.

46 http://ww2.kqed.org/news/2014/07/04/San-Francisco-Sunday-Parking-Meters.

to modify its annual parking fee in 2007 after the policy change drew outspoken criticism from constituents.[47]

Nevertheless, there are advocacy groups and other stakeholders in support of pricing parking in a way that reflects its true costs, including those to society (e.g., congestion, pollution, safety-reductions, etc.). These groups would likely support increases in fees, particularly if increased revenues were invested in better performing transit and other alternatives to driving.

The PSUS flat fee strategy would likely face some similar opposition, but there are constituencies that could support it. Some drivers who expect to experience out-of-pocket cost increases because of the fee might oppose it while others who might benefit from a faster and more reliable travel time could support it. As opposed to cordon based pricing, parking strategies could appear more arbitrary since some people on congested roadways may be charged (e.g., people with destinations within the pricing zone) while others would not (e.g., pass-through trips) Parking garage operators would likely oppose the fees, because higher parking costs could discourage potential customers. Some businesses might cite similar concerns, especially since pass-through trips would not be charged. To the extent that fees are applied in geographic areas with good alternatives to driving, these concerns could be somewhat mitigated. Despite cost increases for some travelers, many others would indirectly benefit from the strategy, since it would reduce congestion—thereby increasing travel speeds and reliability for both drivers and transit operating in mixed traffic lanes—and associated externalities, such as air pollution. The significant revenue increases from the fee could be reinvested to improve the transportation system, which could garner support if the potential benefits were clearly communicated to the public and stakeholders. Transit and environmental advocates that have supported parking price increases in the past (e.g., Sunday metering[48]) might support the flat fee strategies too. Politically, flat fees are likelier more feasible than universal access fees; the license plate capture and ubiquitous nature of the latter strategy are likely to draw more privacy concerns than the flat fees.

It should be noted that the analysis does not account for operator adjustment to new prices in order to maximize profit. In other words, if a fee-based approach reduced the number of drivers using parking garages, those operators would likely adjust their prices in order to increase the number of parkers and maximize profits, thereby reducing the effects of such strategies.

47 Karlin-Resnik, Josh. "Pricing and Supply Strategies—Previous or Potential Application." Nelson\Nygaard Consulting Associates. October 2015.

48 http://archives.sfexaminer.com/sanfrancisco/last-ditch-effort-to-save-sunday-parking-meters-opposed-by-supervisors/Content?oid=2824259.

Implementation Roadmap

Implementation would likely involve several key steps. The timeframe would depend heavily on political support and would likely take at least a year. The steps include:

- Interested City and County officials would need to organize an implementation team made of one or more partnering agencies. The partnering agencies would need to take the flat fee strategy and design the basic features of a policy to implement the strategy, including timing, fee amount (including adjustments for inflation and/or market rate of pricing), geography, revenue collection, and enforcement.
- After initial policy design, the partnering agencies would need to conduct outreach to the general public and stakeholders. The outreach process would need to clearly communicate the benefits of the process and gauge opposition. Input would help refine the policy.
- Partnering agencies would then draft the appropriate legal language for the policy. The flat fee policies would need to amend to the San Francisco Municipal Code (in particular, the Business and Tax Regulations Code), and thus would take the form of an ordinance sponsored by the San Francisco Board of Supervisors. Partnering agencies would need to work with the San Francisco Treasurer & Tax Collector's Office to draft such an ordinance. The Board of Supervisors would then need to approve amendments to the code to allow for these parking policies.
- An alternative method would be to institute the policy through the ballot initiative process. In order to qualify for the ballot, proponents of an initiative must gather the number of signatures equal to five percent of the total individuals who voted for Mayor in the previous mayoral election (in the most recent 2015 city election, this number was 9,711), or obtain supporting signatures from four or more members of the Board of Supervisors.[49, 50]
- After passage of the ordinance by the Board of Supervisors or a successful ballot proposition, the partnering agencies would work with the San Francisco Treasurer & Tax Collector's Office to conduct an awareness campaign to inform parking structure owners about the changes to the City's tax structure. Proponents might draw from the awareness campaign for Proposition E from 2012, which instituted a gross receipts tax and business registration fee.[51] Despite representing a significant change to the tax code, many busi-

49 http://voterguide.sfelections.org/en/mission-rock.

50 http://sfpl.org/pdf/main/gic/elections/November7_2006.pdf.

51 http://sfgov.org/sf/sites/sfgov.org.sf/files/BTAG%20Summary%20Report_140730.pdf.

nesses lack the staff and support to monitor tax law changes. The awareness campaign would help ensure compliance with the new parking policies.

- While the flat fee would rely largely on the existing parking tax enforcement procedures, some initial auditing might be required to ensure fee implementation. An auditor/auditing function carried out by the Treasurer & Tax Collector's Office would help ensure the appropriate fees are collected by the City and assess penalties for noncompliance.

COMBINED BULK DISCOUNT ELIMINATION (2A, 2C, 2D)

Technical Feasibility

The bulk discount elimination strategies affect parkers who already pay for parking and change the pricing structure of parking payments. Since the affected parking facilities already have equipment in place to charge parkers and track parking sales tax receipts, minimal additional equipment would be needed to implement the required elimination of daily and monthly rates (2A). For enforcement, additional labor would be needed to audit the garages' rates and to monitor the effects of bulk discount required elimination. Tax filing forms might need to be revised to capture more detailed information on price and utilization.

Results from the SF-CHAMP model showed how drivers might change behavior with the implementation of bulk discount elimination assuming that existing hourly prices remained intact, but the analysis did not account for how operators themselves might react. Operators might respond by lowering hourly rates, to keep the overall costs for drivers who wish to park all day more in line with existing bulk prices. This might entice more people to park for a longer time than was observed in the SF-CHAMP model run, dampening the transportation performance improvements associated with the strategy. Thus, a bulk discount elimination policy would need to be carefully designed; it might need to restrict how much hourly rates could be lowered. Ideally, this restriction would still give operators the flexibility to adjust prices based on existing demand fluctuations due to day, season, events, or other temporal aspects. However, the policy would benefit if it were adjustable based on garage operator revenue and transportation performance, both of which would be continuously evaluated using the pricing and utilization data collected from tax receipts. This adjustability could make the policy more challenging politically (see Political Feasibility).

An incentivized discount elimination could also rely on existing equipment but would require even more effort and data to monitor and enforce, including any subsequent incentive adjustment. It is difficult to predict how drivers and operators would react under incentivized elimination in the long term, and how much parking revenue the city would forego to incentivize operators. Thus, achieving the same transportation performance as a required bulk discount elimination strategy through voluntary elimination would require a careful implementation with close monitoring of parking consumption by bulk versus hourly payment. Any implementation would need to consider offering higher incentives for early adopters to encourage operators to switch to hourly rates. It would need to specify incentive amounts, which might vary by geography. It would need to mitigate "slippage", which entails parkers leaving a site that has voluntarily eliminated bulk discounts and parking at another site that continues to offer daily or monthly discounts. Like required elimination, an incentivized policy might need to set restrictions on how much hourly rates could be lowered to prevent adverse policy affects, such as higher congestion due to increased turnover. Alternatively, a voluntary policy could periodically modify the incentive structure in order to encourage more garage operators to offer competitive prices that achieve desired transportation performance.

An effective voluntary policy would need to be able to refine incentive amounts and structure over relatively short timeframes without delayed feedback. Since parking sales tax is collected each time parking is consumed, it would be more effective to adjust the tax[52] (2C) than to adjust the graduated fee (2D), which is collected annually, so 2C is more promising than 2D from an implementation perspective. For voluntary elimination, ticket machines might need to be reprogrammed to distinguish between hourly versus bulk rates, which would be moderately more costly than required elimination. Similar to required elimination, auditing would be required to ensure compliance.

Political Feasibility

San Francisco has implemented a bulk discount elimination in certain areas. The prohibition is in section 155(g) of the San Francisco Planning Code:

> *In order to discourage long-term commuter parking, any off-street parking spaces provided for a structure or use other than residential or hotel in a C-3, C-M, DTR, SLR, SSO, SPD, MUG, WMUG, MUR, WMUO, or MUO District, whether classified as an accessory or conditional use, which are otherwise available for use for long-term*

52 Adjusting the tax would involve reducing the tax rate from 25 percent to a lower rate for garages charging hourly rather than monthly or daily rates.

parking by downtown workers shall maintain a rate or fee structure for their use such that the rate charge for four hours of parking duration is no more than four times the rate charge for the first hour, and the rate charge for eight or more hours of parking duration is no less than 10 times the rate charge for the first hour.[53] *Additionally, no discounted parking rate shall be permitted for weekly, monthly or similar time-specific periods.*[54]

The code, including 155(g), is enforced by complaint basis only. The San Francisco Planning Department has the resources to address about 700 complaints a year. Thus, policies implemented through the Planning Code that rely heavily on enforcement risk underperforming. If the Planning Department were to share enforcement responsibilities with SFMTA by making the regulations part of the Transportation Code, SFMTA would then be able to enforce and penalize violations with fines. Right now, cease and desist orders, rather than fines, are the Planning Department's response to infractions. Any properties with outstanding enforcement actions cannot obtain new permits, which affects larger property owners more. Sometimes, the city attorney addresses cases of persistent non-compliance.[55] Implementing the required or voluntary bulk discount elimination strategies studied by PSUS would entail stronger enforcement and auditing and an expanded geography beyond what the Planning Code currently covers to achieve transportation performance similar to the results presented in the Evaluation Findings chapter. During a previous effort to integrate the regulation into the Transportation Code, outreach revealed garage operator opposition; operators lobbied strongly against the effort, preventing a vote from occurring.

The study was unable to identify implemented bulk discount elimination or regulation policies in areas outside of San Francisco. Since required bulk discount elimination would increase the out-of-pocket travel cost for individuals, it is expected to draw similar support and opposition as the flat fee strategy (see previous section). Individuals facing cost increases and affected businesses would be potential opponents, and indirect beneficiaries (from congestion and air pollution reduction) and transit and environmental advocacy groups would be potential proponents. In addition, the complicated nature of this policy and rather downstream benefits would be challenging to communicate to both public and garage operator stakeholders, thereby making it more challenging to gather widespread support.

If garage operators were to oppose required bulk discount elimination (2A) even after an outreach effort to explain the anticipated revenue outcomes, then voluntary elimination (2C, 2D) could be a more politically viable option since it involves less market interference. Voluntary elimination would likely still draw pushback from individuals experiencing travel cost increases and businesses affected by resulting changes in travel behavior. It would likely draw support similar to the required discount elimination.

Implementation Roadmap

Implementation would likely involve several key steps. The timeframe would depend heavily on political support and would likely take at least a year. The steps include:

- Interested City and County officials would need to organize an implementation team made of one or more partnering agencies. The partnering agencies would need to take the bulk discount elimination strategy and design the basic features of a policy to implement the strategy, including timing, geography, revenue collection, and enforcement.
- After initial policy design, the partnering agencies would need to conduct outreach to the general public and stakeholders. The outreach process would need to clearly communicate the benefits of the process and gauge opposition. Communicating bulk discount's projected revenue increase would be an important piece of the effort. Input would help determine whether a required elimination would be politically viable and help refine the chosen policy, whether it be required or voluntary elimination.
- Partnering agencies would then draft the legal language for the policy before obtaining the appropriate policy approval. This step would likely be different for required versus voluntary bulk discount elimination.
    - » Section 155(g) exists in the Planning Code. The Planning Code could be amended to apply the required discount elimination to a wider geography. The amendment could also include restrictions on how much hourly rates could be lowered and enforcement procedures. Planning Commission approval would be required. The partnering agencies would need to determine how to handle enforcement; the Planning Director could instruct the code enforcement team to issue fines to violators, or the Code could specify that SFMTA would be responsible for enforcement and fines for noncompliance. Depending on the policy details, the latter option might require approval from the SFMTA Board of Directors as well.

53 C-3 denotes Downtown Commercial Districts (shown in Figure 1 of the Methodology chapter), C-M denotes the Heavy Commercial District, and the other abbreviations denote various zones in the South of Market Mixes Use Districts and Eastern Neighborhoods Mixed Use Districts, which are located near the downtown area.

54 http://library.amlegal.com/nxt/gateway.dll/California/planning/planningcode?f=templates$fn=default.htm$3.0$vid=amlegal:sanfrancisco_ca$sync=1.

55 The study thanks Josh Switzky from the San Francisco Planning Department for insight regarding the Planning Code.

- » Partnering agencies would need to work with the San Francisco Treasurer & Tax Collector's Office to draft such an ordinance. As any of the bulk discount elimination policies (2A, 2C, and 2D) would represent a significant change to the San Francisco Planning Code — especially any change to the geographical provisions — they would also require both Planning Commission and Board of Supervisors approval. The Planning Commission would first need to recommend the amendment for adoption, rejection, or adoption with modifications to the Board of Supervisors.
- » The voluntary bulk discount eliminations entail adjusting the parking tax (2C) or annual per-space fee (2D). They thus would need to amend to the San Francisco Municipal Code (in particular, the Business and Tax Regulations Code) in the form of an ordinance sponsored by the San Francisco Board of Supervisors. Partnering agencies would need to work with the San Francisco Treasurer & Tax Collector's Office to draft such an ordinance. The Board of Supervisors would then need to approve amendments to the code to allow for these parking policies. One potential implementation would involve amending the Planning Code section 155(g) through Planning Commission approval, and then modifying the Municipal Code through Board of Supervisors approval. However, it might be simpler to enact the entire voluntary elimination policy through the Municipal Code and Board of Supervisors.
- » As is the case with flat fees, ballot initiatives represent an alternative method for enacting required or voluntary bulk discount elimination policies.

- After passage of bulk discount elimination, the partnering agencies would work with the implementing agency—likely the San Francisco Treasurer & Tax Collector's Office for voluntary elimination and the Planning Commission or SFMTA for the required elimination—to conduct an awareness campaign to inform parking structure owners about the changes to the City's tax structure. Proponents might draw from the awareness campaign for Proposition E from 2012, which instituted a gross receipts tax and business registration fee.[56] Despite representing a significant change to the tax code, many businesses lack the staff and support to monitor tax law changes. The awareness campaign would help ensure compliance with the new parking policies.
- The implementing agency would establish staff and procedures for implementing the bulk discount elimination policy. The procedures would include enforcement and the monitoring tasks described in the previous Technical Feasibility subsection. Voluntary elimination would also include procedures for adjusting incentive amounts based on consumption data.

56 http://sfgov.org/sf/sites/sfgov.org.sf/files/BTAG%20Summary%20Report_140730.pdf.

SYNTHESIS

From a technical perspective, flat fees (4A, 4B) are easier to implement than bulk discount eliminations, which involve more uncertainties. The required elimination (2A) is a considerably easier technical implementation than the voluntary elimination. Of the voluntary eliminations, the parking tax (2C) incentive is a more viable option than the annual per-space fee (2D) incentive.

From a political perspective, all of the strategies could face significant challenges, but clear communication of policy benefits could help garner support. Based on past reactions, the flat fee may garner opposition, as would required discount elimination. Garage operators might be more amenable to the policy if their potential revenue increases under required elimination are clearly understood and reliably realizable; but other aspects of the policy (e.g., hourly rate lowering restrictions) could still face resistance, especially if not well understood. Voluntary elimination is likely easier to implement politically than required elimination or the flat fee.

Implementation timelines could vary widely based on political climate. A required bulk discount elimination that only requires amending the Planning Code would likely be faster than either a flat fee or voluntary discount elimination requiring Board of Supervisors approval, but a policy implemented through the Planning Code could be difficult to enforce. Compared to the other strategies, the voluntary discount elimination would require more effort for policy design before approval and establishment of enforcement, monitoring, and incentive adjustment procedures after approval.

PSUS found that the evaluated parking strategies perform modestly in mitigating area-wide congestion, particularly compared to cordon pricing schemes examined by MAPS. This may, in part, be a reflection on the off-street parking environment in downtown San Francisco. Parking is already priced high due to market demands, made even more expensive by a 25% parking tax. As a result, much of the impact on demand that could be made using off-street parking pricing has already happened. While some of these strategies could be part of a larger congestion management effort within a changed political context, this study recommends continued support of parking related initiatives, including the Residential Parking Permit Evaluation and Reform Project and implementation of the Transportation Demand Management (TDM) Ordinance as part of the Transportation Sustainability Program. The latter program requires land use developers to include onsite demand management measure to reduce VMT and project related transportation impacts by offering alternatives to single occupancy driving. The most effective measure (and therefore the most incentivized) is to reduce on-site parking. However, as part of the larger TDM approach, the changes to parking are likely to be even more effective.

Applying Results to Other Contexts

This chapter examines how the evaluation's findings apply to other geographies. It also provides examples of previous and current applications of the parking strategies explored in the PSUS. As described in the Evaluation Findings chapter, the 11 strategies subjected to detailed evaluation were grouped into four categories: 1) fee-based, 2) bulk discount elimination, 3) parking cashout, and 4) supply-based (see Table 3). This chapter covers each of these four strategy groupings before summarizing findings.

Ultimately, high density, high parking costs, high transit and active transportation mode shares, and a low percentage of subsidized parking are unique features of San Francisco from a parking supply and utilization standpoint. This chapter identifies how these characteristics might affect the PSUS evaluation results and serves as a comparison for practitioners to use when applying the study's results to different geographies.

FEE-BASED STRATEGIES

Applying Results to Other Contexts

Each evaluated fee-based strategy was proposed as a fixed price change for all affected drivers, regardless of the underlying market price for parking in each neighborhood in the Study Area. These strategies would likely be felt most in areas with lower parking prices, as a flat fee would only be marginal relative to the rates charged in the most expensive parking facilities.

The flat daily fee (4A) and flat peak fee (4B) apply only to those drivers who already face the full cost of parking (i.e., are unsubsidized). These fees achieve modest transportation performance results in the Northeast Quadrant of San Francisco.

According to one 2012 report, the median cost of unreserved parking in San Francisco is $29 per day and $375 per month, lower than only New York ($41 per day and $562 per month) and Boston ($34 per day and $405 per month).[57] The same report estimates average monthly U.S. median unreserved parking rate to be $166. This study's intercept survey represents existing daytime parkers in the Northeast Quadrant of San Francisco; the survey showed that for this population of existing parkers, demand for parking is relatively inelastic. Cost increases in areas similar to those covered by the intercept survey are likely to have modest impacts on mode share and congestion. These impacts depend on fee structure. San Francisco's high parking cost and relatively inelastic current parkers probably dampen the fees' transportation impacts. Areas that have similar portions of individuals facing the market rate of parking but have lower parking costs are more likely to experience mode shift and reduced congestion with flat fees of a similar rate.

The universal access fee (3) achieves similar results in San Francisco as the flat fees described above. Given its implementation challenges (see Chapter 5), the universal access fee is less attractive compared to the flat fees in this context. As it applies to all parking, however, the universal access fee would have greater impact in regions with higher portions of privately accessible parking, where parkers do not currently directly face market rates. This fee would also increase prices for those with subsidized parking of any kind from their employers, exerting downward pressure on demand.

Current Applications

The study did not identify examples of cities charging a flat fee in addition to standard parking taxes. Some cities, such as Philadelphia and Seattle, apply point-of-sale fees, but they tend to be applied as a percentage of price rather than as flat amounts.[58] The study did not find any examples of municipalities charging a universal parking access fee.

Policies akin to 1B, the fee on privately accessible parking, appear to be used more widely than most of the other strategies studied. However, some of these other implementations do not require fees to be passed from landlords to parkers, whereas strategy 1B does. Municipalities applying this strategy include Perth, Australia; Sydney, Australia; and Melbourne, Australia:

- Perth levies a fee on parking owners that is not explicitly required to be passed on to drivers. The city ad-

57 http://www.lexpark.org/sites/default/files/pdf/ColliersParkingRateSurvey2012.pdf. New York price provided for Midtown. New York—Downtown prices also those in exceed Boston and San Francisco.

58 http://www.phila.gov/Revenue/businesses/taxes/Pages/ParkingTax.aspx.

ministers the fee program through its parking license requirement; space owners must register their spaces and pay the fee for each space annually. The scheme imposes different fees on short- and long-term parking facilities and residential tenant parking.[59] Mode shares went from 50 percent drive-alone/35 percent public transit before the program was implemented to 50 percent public transit/35 percent drive-alone after.

- Sydney's Parking Space Levy was first introduced in 1992 to discourage car use in commercial districts. The policy applies only to privately owned, nonresidential, off-street parking, and rates reflect the level of congestion and the size of the business districts.[60] The tax is adjusted annually based on the consumer price index. Facilities which have excessive unused parking or small facilities with five parking spaces or less are not exempt, in contrast to parking tax policies in other Australian cities.[61] Revenues must be applied toward public transportation and transit facilities through the Transport Infrastructure Fund.[62]

  The Office of State Revenue (OSR) sends a parking license registration to all nonresidential property owners within the business area boundary. Owners must register as soon as they become owners of a taxable parking space and are required to survey and report on their registration and tax return the number of marked parking spaces, plus unmarked land use areas for motor vehicle parking.

  The levy has not dramatically affected the parking supply as much as it works to curb car usage.[63] There are dramatic drop-offs in car usage at times when the fee is increased significantly, as was the case when the fee more doubled between 2008 and 2009 for highest density areas, and increased by about 50 percent for other high-density areas.

- The congestion levy (Long Stay Car Park Levy) applies to off street private and public car parking spaces in inner Melbourne, Australia. For private car parks, the owner of the premises pays the levy. For public car parks, the owner and the operator of the car park are jointly liable to pay the levy. The fee does not have to be passed through to drivers. The fee applies to long-term and permanently leased parking spaces to create more short-term parking options for shoppers and visitors. A 2010 review had concluded that it was moderately successful at shifting long- to short-term parking and reducing traffic congestion.[64]

BULK DISCOUNT ELIMINATION

Applying Results to Other Contexts

Similar to the fee-based strategies, daily and monthly bulk discount eliminations achieve modest transportation performance gains, with combined daily and monthly discount elimination (2A, 2C, 2D) achieving more mode-shift and congestion reduction than only monthly discount elimination (2B).[65] This strategy group would be expected to have more influence in areas with higher portions of bulk-discounted supply and consumption and less influence in areas with lower portions of bulk-discount supply and consumption. According to the intercept survey, nearly 80 percent of parkers in the Study Area purchase bulk discount parking, split between monthly (50 percent of total) and daily (29 percent of total).

San Francisco is a special case in that its downtown area already has a bulk discount elimination law in place, although the policy is not enforced.

Current Applications

San Francisco has implemented an elimination of bulk discount parking in certain areas. The prohibition is in section 155(g) of the San Francisco Zoning Code:

> *In order to discourage long-term commuter parking, any off-street parking spaces provided for a structure or use other than residential or hotel in a C-3, C-M, DTR, SLR, SSO, SPD, MUG, WMUG, MUR, WMUO, or MUO District, whether classified as an accessory or conditional use, which are otherwise available for use for long-term parking by downtown workers shall maintain a rate or fee structure for their use such that the rate charge for four hours of parking duration is no more than four times the rate charge for the first hour, and the rate charge for eight or more hours of parking duration is no less than 10 times the rate charge for the first hour. Additionally, no discounted parking rate shall be permitted for weekly, monthly or similar time-specific periods.*[66]

The policy is not actively enforced, and most off-street facilities in the affected areas still offer bulk discounts. The

59 http://www.britishparking.co.uk/write/Documents/Library/International/Extracting%20maximum%20benefit%20from%20parking%20policy-%2010%20years%20experience%20in%20Perth%20Austrailia.pdf.

60 http://www.osr.nsw.gov.au/taxes/parking/rates/.

61 http://www.osr.nsw.gov.au/lib/doc/factsheets/ofs_lev01.pdf.

62 Personal communication with Kelvin Bannan, City of Sydney, Transportation Policy Analyst, on January 24, 2012.

63 Personal communication with Rod Bradbury, NSW Office of State Revenue, Senior Technical Advisor, February 6, 2012.

64 http://www.vtpi.org/parking_tax.pdf.

65 Unlike 2B, strategy 2A was not modeled directly in SF-CHAMP. The 2A evaluation relied on 2B model results and intercept survey data.

66 City of San Francisco. Planning Code, Article 1.5, Section 155(g). Retrieved from http://library.amlegal.com/nxt/gateway.dll/California/planning/planningcode?f=templates$fn=default.htm$3.0$vid=amlegal:sanfrancisco_ca$sync=1 on 10/13/15.

study did not identify any implementations of bulk discount elimination or regulation policies in other geographies outside of San Francisco.

PARKING CASHOUT

Applying Results to Other Contexts

The model results for parking cashout showed limited transportation system impacts due in part to the Northeast Quadrant of San Francisco's low levels of employer subsidized parking (2 percent of total tours, 5 percent of work tours, and 28 percent of drive-alone and carpool work tours are subsidized).[67] Cities where higher ratios of employees currently receive subsidized or free parking are more likely to experience mode shift and congestion reduction with cashout implementation. In the Washington, D.C. region, for instance, free on-site employee parking was available to a much higher percentage of employees—63 percent (plus an additional 2 percent of employees with regional off-site parking) in both 2003 and 2010.[68] A 2007 survey of Manhattan Central Business District driving commuters found that 53 percent did not have to pay for their own parking, though New York City's drive mode share is lower than San Francisco's.[69] Of the 53 percent, 34 percent were employee subsidized (slightly higher than the San Francisco's 28 percent) and 19 percent found unmetered street parking. An FHWA primer estimated that overall, "95 percent of commuters receive free parking at work."[70]

Cashout's effectiveness relies in part on the availability of transportation alternatives. Places with ample transit networks and reliable transit service are better candidates for cashout. Cashout also would likely work better in places where parking demand is more elastic than in San Francisco.[71]

The results described above for San Francisco may be due in part to the fact that California already has a cashout law in place. When applying lessons from these results to other locations within California, the results will depend, in part, on the number of businesses that meet the current law's criteria, including having greater than 50 employees, leasing rather than owning their workspaces, and residing in nonattainment air basins. According to data from the U.S. Census Bureau's County Business Patterns and ZIP Code Business Patterns, downtown San Francisco likely has a lower percentage of employees working at firms with greater than 50 employees compared to national and California figures.[72] California cities with higher percentages of employees working at 50-plus person firms are likelier to experience stronger transportation performance under the existing cashout law.

Current Applications

Santa Monica, California actively enforces the State's cashout law. The City's trip-management law requires that employers report trip-generation statistics and TDM program elements to the City annually. Thus, the City has been able to monitor whether large employers comply with the law.[73] The City fines firms $5 per day for non-compliance with either the state ordinance or a set of local parking-related ordinances.[74]

SUPPLY-BASED STRATEGIES

Applying Results to Other Contexts

The evaluation found that strategies that regulate parking supply might not reduce drive alone mode share and congestion now, but they could be helpful tools for managing the transportation system in the future. The supply strategies were difficult to evaluate quantitatively. The study examined how many existing driving trips might be affected by changes in or restrictions to parking supply, but it did not determine how these trips would be distributed between mode shift, temporal shift, and parking location shift.

The garage redevelopment strategy (5A) proposed redeveloping City-owned garages into other land uses besides parking. SFMTA operates nine public parking garages in downtown areas: these facilities represent a small but not insignificant share of the overall parking supply (23 percent in the Financial District/Eastern Soma/Union Square area and 13 percent in the larger Study Area). Central areas with higher portions of publically operated garages that have low headroom (underutilized supply) are likely to experience more transportation effects under the pub-

67 Figures from SF-CHAMP. SF-CHAMP inputs draw on several surveys of San Francisco employees and employers, which are described in the Cashout Strategies section of the Evaluation Findings chapter and Appendix E.

68 http://www.mwcog.org/uploads/pub-documents/pV5bX1o20140916131635.pdf.

69 https://www.dot.ny.gov/programs/repository/Tech%20Memo%20on_Parking.pdf.

70 http://ops.fhwa.dot.gov/publications/fhwahop12026/sec_4.htm.

71 The Fee-Based Strategies section of the Evaluation Findings chapter and Appendix E discuss elasticity in detail.

72 This study estimated that in certain northeastern San Francisco zip codes (Tenderloin, Chinatown, Embarcadero North, Embarcadero South, and Financial District), approximately 62 percent of employees (172,100) work at establishments with 50 or more employees. According to the U.S. Census Bureau 2012 Statistics of U.S. Businesses (http://www.census.gov/content/dam/Census/library/publications/2015/econ/g12-susb.pdf), roughly two-thirds of all U.S. employees were employed by large (more than 500 employees) or medium (100 to 499 employees) enterprises, with another 17 percent employed by small (20 to 99 employees) enterprises and 14 percent employed by medium enterprises (100 to 499 employees). According to the 2011 U.S. Small Business Administration Business Dynamics Statistics (https://www.sba.gov/advocacy/firm-size-data), 70 percent of California private sector employees work at firm sizes of 50 or more, compared to 71 percent nationwide.

73 Karlin-Resnick, Joshua. "Cash-Out Pilots – Lessons to Learn." Draft Memorandum. June 18, 2013.

74 City of Santa Monica – Employers and Ordinance 1604 http://www.smgov.net/Departments/PCD/Transportation/Employers/.

lic garage redevelopment strategy, assuming restrictions would be enacted to prevent private developers from adding parking supply after redevelopment.

The parking supply cap (5B) and parking supply cap and trade (5C) affect trips in future years. The number of trips affected depends on the growth rate of travel demand. As growing demand fills up excess supply,[75] garages will raise prices, causing the most elastic of the remaining parkers to change travel behaviors. Supply caps are more likely to be effective sooner in fast-growing cities; population and economic growth produces more travel demand, and—absent radical shifts in travel behavior—the related auto trips will fill up excess parking supply. The trade element of 5C would work better in locations with readily adaptable urban form. Otherwise, trading parking supply between existing buildings would be infeasible and could only readily occur before buildings were built.

Current Applications

Many cities have redeveloped parking supply to transform downtown areas. In Ann Arbor, Michigan, for example, the conversion of accessory lots into denser developments and lack of parking minimums has encouraged more people to travel by transit, bike, or on foot.[76]

Boston, Massachusetts and Portland, Oregon have implemented some form of parking cap and trade policy. Each of them did so to comply with Clean Air Act-related regulatory requirements.

Boston's parking supply freeze was established in 1976 and is administered by the Air Pollution Control Commission (APCC) to curb the growth of vehicle travel to key neighborhoods to reach Clean Air Act-related emissions targets.[77] It applies to the city's downtown, a land-constrained neighborhood nearby, and the area around the city's airport. The APCC has capped the number of spaces allowed in each neighborhood at 35,000 spaces in downtown and 27,600 spaces in South Boston. It has established a "bank" of spaces based on the difference between current inventories and the caps, and developers must apply to the APCC to draw on the bank. The policy is mainly enforced based on the honor system. The commission conducts periodic inventories of regulated areas to make sure developers are in compliance with the cap, but the commission does not take punitive action in cases of noncompliance.

75 Garage operators are unlikely to allow parking sites to become completely full but will instead raise prices as their facilities become fuller to maximize revenue.

76 Canepa, Brian and Joshua Karlin-Resnick. "Releasing the Parking Brake on Economic Development: Cities flourish with reduced parking requirements." Planning Magazine. May 2015.

77 New York City Department of City Planning. "Parking Best Practices: A Review of Zoning Regulations and Policies in Select U.S. and International Cities." 2011.

Portland has implemented a cap and trade program. The City capped downtown parking spaces at roughly 40,000. The cap decreased the downtown parking ratio from 3.4 long-term parking spaces per 1,000 square feet of office space in 1973 to 1.5 in 1990. The limit increased to 44,000 in the 1980s and slightly more in the 1990s to adjust for economic growth. The limits are imposed through parking maximums and zoning regulations. The City views the parking maximum as an entitlement. New developments can either build up to the maximum amount of parking they are entitled to, or they can transfer the right to build those spaces to another development. When new development elects to transfer its rights, it can do so at a rate of 0.7 spaces per 1,000 square feet, or 70 percent of the parking maximum entitled to new development. A new development that elects not to build parking can transfer its rights at any time.

Transferred rights are generally not sold, but are granted under certain rules of contract that include the following:

- Project X transfers its parking entitlement to Project Y and Project Y pays for parking construction.
- Project X retains the right to use its entitled number of spaces to lease to tenants or customers, but must pay market rate to Project Y.
- If Project X does not use its spaces Project Y may sell the spaces for its own revenue.
- Project X must give Project Y 60 days notice if it wants to reclaim use of its spaces (i.e., sell to a new tenant).

City officials credit these limits with helping to increase transit mode split from about 20 percent in the early 1970s to 48 percent in the mid-1990s. An estimate of the emission reduction benefits of the Portland policy found that VMT reduced due to the policy, in 1995, totaled between 50,960 and 92,000 miles per day. This VMT reduction resulted in a drop in fuel consumption of between 2,610 to 4,730 gallons per day, and a greenhouse gas reduction of 2,400 to 4,400 metric tons of carbon equivalent per year.[78]

GENERAL FINDINGS AND SUMMARY OF APPLYING TO OTHER CONTEXTS

All of the strategy groupings except the supply-based strategies affect parking demand by adjusting the price of parking in one way or another. Generally, the evaluation demonstrated that strategies that increase the cost of parking can influence some drivers to choose alternative modes or travel times. These types of parking strategies led to modest drive alone mode share reductions and conges-

78 http://yosemite.epa.gov.

tion reductions in the analysis, on the order of one to two percentage points or less.

Key observations that could affect implementation of similar strategies in other geographies include:

- Parking costs in northeastern San Francisco are among the highest in the country. Areas with lower parking costs are more likely to experience mode shift and reduced congestion with flat fees of a similar rate.
- Bulk discount elimination strategies are expected to have more influence in areas with higher portions of bulk-discounted supply and consumption compared to San Francisco's Northeast Quadrant, where approximately four fifths of parking is consumed on a daily or monthly basis.
- A low proportion of commuters to the Northeast Quadrant of San Francisco receive parking subsidies or free parking from employers. Strategies applied to subsidized parkers, such as parking cashout, are likely to affect mode share and congestion marginally in areas with low proportions of subsidies, such as the Northeast Quadrant of San Francisco.[79] These strategies are more promising in geographies where more parkers are subsidized.

The supply-based strategies manipulate the supply of parking, either by actively reducing City-owned supply or by managing private supply in new ways. Based on the analysis, these strategies are not anticipated to markedly impact drive alone mode share or congestion currently. In the long term, the magnitude of these transportation results will be proportional to the extent that constrained supply in the marketplace results in higher prices. However, the specific magnitudes of the price changes and resulting impacts cannot be estimated at this time. Key observations include:

- In locations with a higher proportion of publically operated parking sites and limited headroom, garage development is likely to be more effective for managing congestion.
- Supply cap and cap-and-trade will be more effective in faster growing cities with limited headroom.

The study primarily focused on parking strategies to help manage congestion in San Francisco, which is particularly acute during commute periods in downtown and adjacent areas in the Northeast Quadrant of the City. As a result, most parking strategies tested in this study were targeted at trips with non-home destinations in the Northeast Quadrant of San Francisco. None of the 11 strategies affect through trips, and a number of the strategies that were tested did not apply to trips from the area to destinations outside the area, or trips to home destinations within the area. Thus, these strategies inherently affect only a fraction of overall trips. The strategies' transportation impacts in other regions would depend on the proportion of through trips occurring in these regions and the proportion of non-home destinations within the area in which the strategy is applied. Regions with lower proportions of through trips and/or higher proportions of nonresidential[80] land usages would expect these strategies to reduce drive alone mode share and congestion more readily.

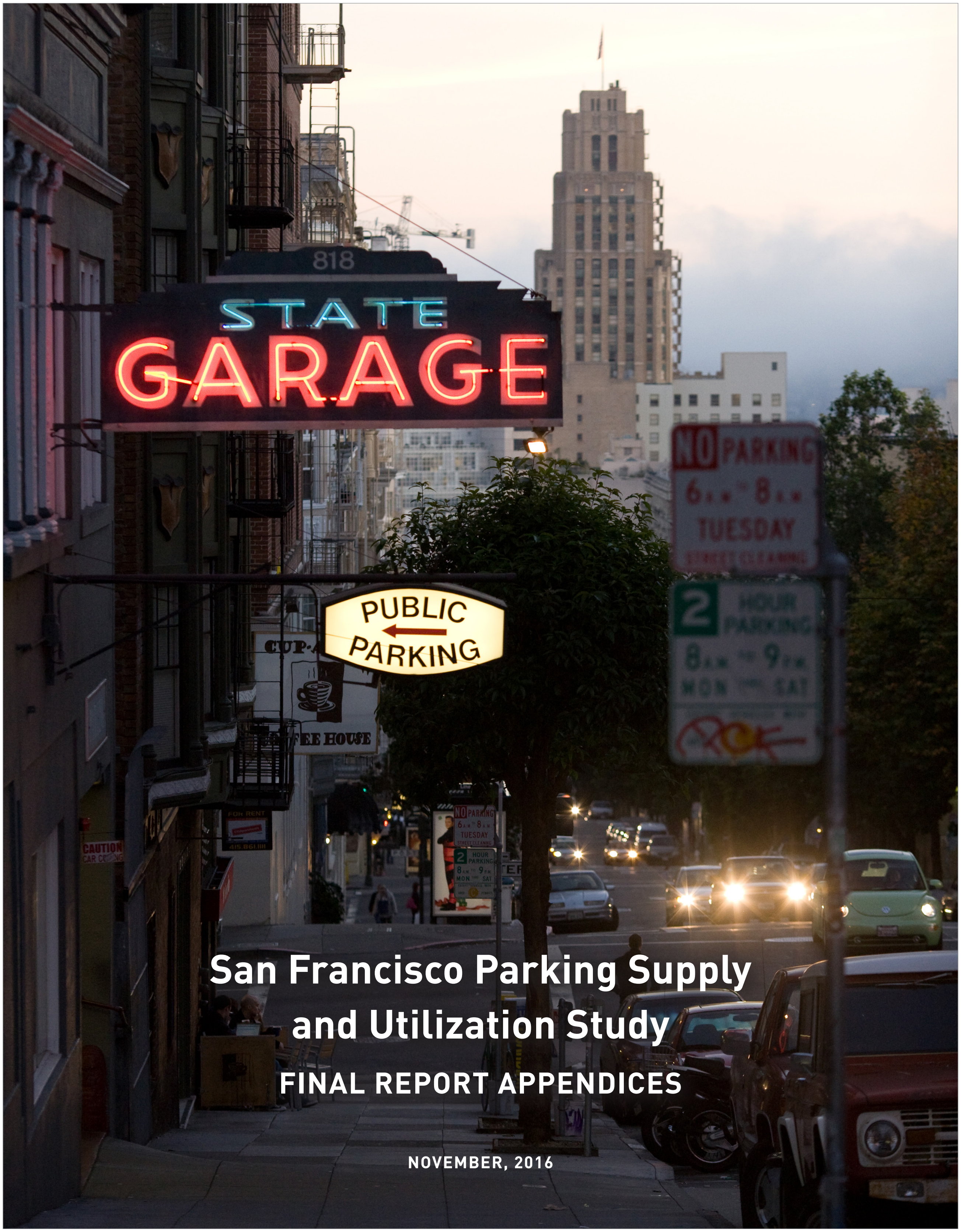
San Francisco has relatively high transit and active transportation mode shares (41 percent and 33 percent, respectively, in the AM peak for all trips from, to, and within the Northeast Quadrant) compared to most other North American cities. According to 2012 American Community Survey data, San Francisco has the fourth highest non-drive commute mode share (bike, walk, and transit) of the 60 largest U.S. cities.[81] The parking strategies target drivers, who constitute only 26 percent of the AM peak Northeast Quadrant transportation market (15 percent drive alone and 11 percent carpool). San Francisco's current mode profile is partly due to the fact that travelers in this region enjoy an abundance of driving alternatives, including multiple transit providers and relatively mild weather that encourages year-round walking and bicycling. Critically, the attractiveness of transit as an alternative to driving depends on transit travel time, cost, system capacity, and reliability. Parking strategies are most likely to affect drive alone mode share and congestion in regions where alternative modes are physically available, are reliably time and cost competitive, and have enough capacity to absorb travelers who switch modes. San Francisco's density also contributes to its high transit and active transportation mode shares; of Census incorporated places with over 200,000 people, its population density is second highest.[82] Its unique geography could also affect mode profile and the performance of the evaluated parking strategies; San Francisco is surrounded by water on three sides, with relatively few regional roads leading into and out of the physically constrained city.

79 The study evaluated cashout applied citywide rather than only to the Northeast Quadrant. The study focused more on results within the Northeast Quadrant, where congestion is most substantial, though the Evaluation Findings chapter also shows citywide results.

80 This assumes that residential land usages have available parking.

81 http://iqc.ou.edu/2013/10/23/modeshare2012/.

82 http://www.census.gov/2010census/.



San Francisco Parking Supply and Utilization Study

FINAL REPORT APPENDICES

NOVEMBER, 2016

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Appendix A. Candidate Screening

To inform the formal data collection plan and a detailed evaluation methodology, the study compiled a list of candidate strategies that might be considered and evaluated during this study. The list was initially generated at a meeting between SFCTA and SFMTA and then expanded based on discussions with other City agency staff and the study's technical consultants. This first stage was a brainstorming exercise focused on exploring the full range of concepts for influencing parking demand, and generated more than 20 different conceptual ideas, including multiple variants.

Next, the team reviewed the list to identify which strategies to screen out strategies not appropriate for further analysis. Two primary criteria were used for this screening step:

- **Effectiveness –** Does the strategy meaningfully impact the two primary goals of the study: reducing congestion and shifting travel to non-auto modes?
- **Evaluation –** Do we have existing tools (computer models, analytical best practices) that can measure the impacts and benefits of the strategy, and will we be able to able to collect sufficient and appropriate data to support those tools and related analyses of the strategy?

The preliminary screening reduced the list of options to 13 unique variants that have been grouped into four categories (and are further described in subsequent pages). See Table A.1.

The rest of this document: provides additional description of each strategy, documents the rationale for strategies that were considered but have been screened out, as well as provides additional comments regarding implementation challenges or complexities that would need to be addressed. Please note that the list below includes some variants of a primary strategy shaded in gray. For example, "1" is just a roll-up category for variants 1A and 1B.

During the preliminary screening effort documented in this appendix, the team reviewed a number of complementary research studies and pilot projects that are currently active in San Francisco and the greater Bay Area. Many of these efforts could provide additional information about the potential success of parking cashout strategies. For example, the SF Department of the Environment is currently conducting surveys of commuters and employers to gather data on existing travel behaviors and commuting alternatives. Also, SFCTA and the San Francisco Department of the Environment (SFE) are involved in a TDM Partnership program which is actively working to develop a pilot program to expand the use of parking cashout. As a result, we are recommending that we await additional findings from these efforts before expending significant study resources on cashout.

Table A.1 Preliminary Screening Categories and Strategies

Category	Strategy
Rules/Incentives for How Operators are Allowed to Price/ Sell Parking	• Eliminate all bulk parking discounts citywide • Eliminate pre-paid monthly parking • Adjust parking sales tax to reward good management such as eliminating bulk parking discounts • Institute a flat annual per-space fee that parking operators must pass on to drivers • Institute a graduated annual per-space fee to reward good management such as eliminating bulk parking discounts
Policies that Target Driver at the Point of Parking Consumption	• Institute a curb cut fee paid by motorists at every entrance/exit into an off-street garage or surface parking lot • Assess an additional fixed point of sale charge each time parking is consumed • Assess a peak hour parking surcharge each time parking is consumed during peak hours
Policies that Limit Future Parking Supply	• Remove SFMTA lots/garages from parking supply • Constrain future growth of parking supply at a certain level • Constrain future growth of parking supply at a certain level and allow a cap-and-trade mechanism for parking owners to buy/sell spaces within the capped limit
Policies that Affect How Employers Subsidize Parking	• Increased enforcement of existing parking cashout law • Expansion of existing parking cashout law

The team is now developing the evaluation methods and data required for each of the remaining strategies as well as a detailed data collection plan. The data collected will provide the team with a better understanding of the total supply of off-street, non-residential parking; the method of consumption of that supply; and therefore the potential market for each of the candidate strategies. Based on the findings of the supply analysis, the team may further screen the candidate list of strategies to arrive at a final list of alternatives to evaluate. The evaluation methodology and final list of strategies to be evaluated will be approved by Transportation Authority and SFMTA management, as well as FHWA. See Table A.2.

Table A.2 Strategies Considered and Screening Rationale

#	Strategy name	Additional details	Comments
1	Annual Per-Space Fee	Regulatory use or impact fee, assessed annually on a per space basis for non-residential off-street parking.	(see variants below)
1.a	Landlord is not required to pass along to driver	Would only require a single count of parking supply at a building. Still, this would require a major inventory effort, and would require regular updating. Would capture all spaces, free and paid.	Filtered out due to concerns about effectiveness: ➢ Example from Melbourne CBD where congestion fee assessed only on facility owners/operators had minimal impact on travel demand
1.b[1]	Landlord is required to pass along to driver	This version of the strategy would have drivers pay more of the marginal cost of each trip, thus reducing demand for parking.	Carry forward Compared to 1.a, this is more technically challenging to implement, because the city would need to enforce landlord compliance on a per-space basis. Unlike 1.a, this would require landlords to keep track of trips/users.
2	Restrictions on discounted/ bulk parking	Already prohibited in parts of San Francisco, such as C-3 zones downtown. Elsewhere in the city, discounted/bulk parking is generally legal. Currently governed by Planning Code Section 155(g).	(see variants below)
2.a[*]	Eliminate all bulk discounts citywide	Shift 155(g) language from Planning Code to Transportation Code. Simplify pricing language to prohibit daily and monthly parking discounts. Allow garages/lots to offer off-peak discounts (times and total discount parameters set by SFMTA). Enforcement by SFMTA.	Carry forward
2.b[2]	Eliminate pre-paid monthly parking	As with 2.a, it would only capture parking spaces that are already paid. However, by prohibiting the sale of monthly passes (even undiscounted monthly passes), it would make it more difficult for employers to directly subsidize monthly parking permits for employees. This might increase employees' awareness of the marginal cost of parking every day.	Carry forward For political acceptance, may consider option of pay-per-day up to a monthly pass cost after a certain # of days, e.g., pay $15 per day until you get up to $200 for a month. Or, could allow garages to sell multi-day parking passes (e.g., 10-day) instead of full month in advance.

[1] Carried forward for further study

[2] Carried forward for further study

#	Strategy name	Additional details	Comments
2.c*	Adjust parking sales tax to reward good management	This strategy would provide incentives through the parking tax code for garage operators that implement good parking pricing policies that reduce demand such as eliminated bulk discounts.	Carry forward Original idea suggested rewarding pricing that reduces long-term stays and increases turnover to achieve occupancy targets. (e.g., the parking tax could be higher for each additional hour a car is parked in a garage). However, to achieve nexus with roadway congestion, details of fee structure would need to focus on reducing demand not increasing turnover.
2.d*	Institute a graduated annual per-space fee to reward good management such as eliminating bulk parking discounts	Example: no annual fee for operators who charge by the hour, above a certain base, meet availability target, etc.	Carry forward Details of fee structure would need to focus on reducing demand not increasing turnover.
3[3]	Curb cut fee	Driver pays when crossing a curb cut to park their vehicle; likely only assessed within congested areas; can be varied by time of day. This strategy would be effective at capturing all parking sessions, free or paid. It would require installing sensors at all curb cuts to determine parking sessions, including at garages that are currently free for employees or customers.	Carry forward for study. Team members noted that this is technologically more complicated than achieving the same the outcome through a parking surcharge (strategy 4.a or 4.b) and would be legislatively challenging. However, this strategy could theoretically ensure parking sessions are charged *without* having to explicitly monitor parking inventory and activity inside facilities. Some curb cut fee scenarios were evaluated in prior studies, so extensive analysis may not be required.
4	User Fee	Point of sale charge at point of parking consumption.	(see variants below)
4.a*	Fixed point of sale charge each time parking is consumed	Every time you park you pay $x. This would be relatively straightforward to implement in paid garages – it is essentially an additional flat fee on top of the existing 25% tax.	Carry forward Expanding this to free parking spaces would require far more enforcement, technology investment by garages, and legislative change. Precedent: CPMC peak period rates
4.b*	Parking surcharge based on time of day	Same as 4.a but only applies at certain times (to focus on peak congestion times).	Carry forward Need to somehow assess entry and exit time of day. Precedent: as proposed in Chicago ~2011.

[3] Carried forward for further study

#	Strategy name	Additional details	Comments
5	Restrict/ convert parking supply	Converting existing private parking garages could be encouraged through zoning provisions that make it easier to bring parking uses up to code as residential or commercial uses. The city could encourage the conversion of parking lots to other uses by placing a heavier tax on parking receipts in surface lots. Long term, the city could also reduce surface parking lots by switching to a tax on land value instead of property value (if Prop 13 et al permit).	(see variants below)
5.a*	Redevelop some SFMTA-owned garages and lots to reduce supply.	The team would evaluate the current net value of its garages compared to potential development value. This strategy would be legislatively and technically simple to implement. Would likely increase rates at remaining supply, and which also reduces auto trips.	Carry forward The major challenge would likely be political (merchants and residents may want to keep garage supply).
5.b[4]	Constrain future growth of supply (e.g., not allow # of spaces to exceed 2015 levels)	Could be accomplished through straightforward amendments to the zoning code parking caps.	Carry forward Some cities, such as Boston, have an absolute cap for the number of spaces in the downtown. A benefit of this strategy is that it does not require a complete census of private parking supply – it simply requires the city to keep track of supply added and reduced in the future. Could take into account loss of on-street supply (i.e., if some spaces on-street are lost, then more off-street would be allowed in that area).
5.c*	Cap and trade (at a certain level of parking supply)	This could create an effective incentive for garages that are free to residents or customers to gradually reduce supply because the payout may be more valuable to them if they sell of the space. Surface lots and private garages would have additional incentive to convert to other land uses because they could sell of their stall allowances to new buildings.	Carry forward

[4] Carried forward for further study

#	Strategy name	Additional details	Comments
6	Halfpass	New “products” to help users purchase only as much transportation (transit, parking) as they need.	(see variants below)
6.a	Create a pass with some days of parking + some days of transit	This strategy creates good incentives to take transit, but is mostly effective for employers – it is not clear if City could implement it, except at its garages or for its own employees. The City could encourage employers/TMAs to implement this.	Filtered out due to concerns about evaluation: ➢ Difficult to model interaction between modes ➢ Day-to-day variability could be significant Note: idea of promoting different parking pass products has been added to 2.b (e.g., can only park up to 10 days in each month) Strategy 6.b is likely more effective, because it encourages the pass holder to consider transit every day, whereas 6.a comes with a certain number of days of parking built in. Alternate variation: pay for parking only but no transit pass bundled in
6.b	“PayGo Flexpass” transit pass with your monthly parking purchase, with rebate for days you do not consume either	Similar to 6.a, this strategy creates good incentives to take transit, but is mostly effective for employers.	Filtered out due to concerns about effectiveness: ➢ 2010-11 Minnesota case study suggests parking cashout portion of program was key driver of travel behavior change. See Appendix A for summary. Study will carry forward cashout strategies (see Strategies 7a and 7b). ➢ Issue with garage operators reselling unused spaces Note: Not clear if city could implement, except at its own garages or for its own employees. City could encourage employers/TMAs to implement. Rebates more complex.

#	Strategy name	Additional details	Comments
7	Parking-cashout	Already required for employers that have more than 50 employees and who lease their spaces.	(see variants below)
7.a5	Increased enforcement of existing state Cashout law	Need to determine implementation approach. Candidate agencies include Department of Building Inspection, Planning Department, and Tax Collector. May be able to leverage ongoing work under a number of other regional efforts that relate to cashout. The SFCTA and SFE are currently piloting a program to assist employers in developing a cashout program through the TDM Partnership Project. If successful, the pilot may lay the groundwork for improved compliance and/or expansion. Similarly, the BAAQMD and MTC recently adopted a requirement that large Bay Area employers have a Commuter Benefits program to provide alternative travel options to employees, potentially including transit and ride-sharing incentives. These elements could complement cashout programs, encourage compliance, and generate more interest in TDM across the region. In addition, both of these programs include surveys that could provide data on the potential market size of a cashout strategy.	Carry forward, pending results of TDM Partnership Project surveys (described at left). Appendix B documents existing findings from these efforts. See Appendix C for proposed evaluation and data collection approach in coordination with ongoing parallel efforts. However, potential issue with garage operators reselling unused spaces if approach is truly flexible/dynamic.

5 Carried forward for further study

#	Strategy name	Additional details	Comments
7.b6	Expand cashout to apply to smaller businesses or larger businesses that are not subject to the law because they do not lease space.	Could be expanded to more employers, though it might require legislative action at the state level. This strategy could be effective at capturing both free and paid parking, if the legislation is expanded to cover all spaces, not just leased spaces, and not just for larger employers. May be able to leverage ongoing work under a number of other regional efforts that relate to cashout. The SFCTA and SFE are currently piloting a program assist employers in developing a cashout program through the TDM Partnership Project. If successful, the pilot may lay the groundwork for improved compliance and/or expansion. Similarly, the BAAQMD and MTC recently adopted a requirement that large Bay Area employers have a Commuter Benefits program to provide alternative travel options to employees, potentially including transit and ride-sharing incentives. These elements could complement cashout programs, encourage compliance, and generate more interest in TDM across the region. In addition, both of these programs include surveys that could provide data on the potential market size of a cashout strategy.	Carry forward, pending results of TDM Partnership Project surveys (described at left). Appendix B documents existing findings from these efforts. See Appendix C for proposed evaluation and data collection approach in coordination with ongoing parallel efforts. However, potential issue with garage operators reselling unused spaces if approach is truly flexible/dynamic.

6 Carried forward for further study

#	Strategy name	Additional details	Comments
8	Parking Treaty Agreements – require commercial private parking supplies to be made publicly available	Consider in context of newly considered project – rather than having a development build its own supply, this would make it easier to make agreements with other parking owners to share supply.	Filtered out due to concerns about effectiveness: ➢ This strategy would serve to increase effective supply. Note: This strategy could end up being a method to increase political palatability of other ideas such as parking cap and trade. Implementing this strategy would be legislatively challenging, and may require changes at the state level. It may not be legal to require property owners to make existing parking supply available to the public, though this could be a condition of development for future construction. As with strategy 3.a, evaluation would require a major inventory effort, and management would require regular updating.
9	Unbundling commercial parking	Example where this has been implemented: Bellevue, Washington requires downtown office buildings of more than 50,000 square feet to identify the cost of parking as a separate line item in all leases, with the minimum monthly rate per space not less than the price of a two-zone bus pass. This strategy would likely be effective in providing an incentive for potential tenants to more thoroughly weigh the costs vs. benefits of parking. It could also be implemented in conjunction with a requirement that commercial parking supply be made available to the public (strategy 8). Unbundled price should reflect real cost of parking.	Filtered out due to concerns about both effectiveness and evaluation: ➢ Unlike residential unbundling, payment for commercial parking typically flows through many intermediate parties. Thus, it is harder to achieve the nexus between parking policy and behavior of drivers. ➢ Also difficult to model the impact to the travel network if policy has uneven results across population depending on varied relationships between building owners, tenants, workers, etc.
10	Count parking toward FAR limits	By including parking space in the gross floor area of a building for purposes of calculating FAR, the city could provide an incentive for developers to provide less parking. Developers would have to weigh the financial merits of whether space should be used for parking or living/ commercial space. Could be implemented through a straightforward amendment to the planning/zoning code.	Filtered out due to concerns about both effectiveness and evaluation: ➢ This approach would target future development, not current supply ➢ Strategy is only one of many considerations developers must balance, so challenging to compute how parking supply would be affected. ➢ Also, no clear mechanism to show whether or how costs would be passed on to drivers. ➢ Given modest amount of surface parking in congested downtown area, impact on travel behavior would likely be negligible. Note: This strategy may be moot for structured parking because it may already be included in FAR limits (i.e., the strategy may only apply to parking lots).

#	Strategy name	Additional details	Comments
11	Require parking be underground	This strategy would improve the urban design of buildings and would increase the cost of including parking in a building, thereby reducing the incentive for developers to provide it. Could be implemented through a relatively straightforward amendment to the zoning/planning code.	Filtered out due to concerns about both effectiveness and evaluation: ➢ This approach would target future development, not current supply. ➢ Strategy is only one of many considerations developers must balance, so challenging to compute how parking supply would be affected. ➢ Also, no clear mechanism to show whether or how costs would be passed on to drivers. ➢ Most parking downtown is already underground and likely will continue to be, so impact on travel behavior would likely be negligible.
12	Forbid curb cuts on specific streets, or where alley is provided	This is already implemented on some transit/commercial oriented streets, such as Market Street. Could be expanded to many more streets, especially where alleys are common.	Filtered out due to concerns about effectiveness: ➢ This approach would necessarily have to focus on future developments, not current buildings, leading to very limited application in built-up downtown core. ➢ Moreover, strategy only affects *access* to parking, not quantity supplied. Note: Downside of putting all curb cuts in alleys is that it reduces the potential to later turn an alley into a "living alley" without auto traffic.
13	Better enforcement of parking sales tax	Require automated counting, or eliminate non-machine cash transactions (there is a lot of parking that does not pay its sales tax because there is no audit trail). This would lead to much better compliance with the parking tax, which would increase revenue from garages while also leading to higher prices (base price plus tax) to park at these garages, thereby reducing parking demand. It could have the long term impact of making these garages/lots less financially viable, which could lead to a reduction in supply. Automated counting might be supported by the larger garage operators, who probably already have such technology installed.	Filtered out due to concerns about both effectiveness and evaluation: ➢ Data collection could be complex and labor-intensive, requiring monitoring of individual transactions and matching to taxes paid to establish likely "fraud" rate. ➢ Increased enforcement may not lead to changes in price paid by drivers, because price is dictated by overall market. Thus, nexus with congestion reduction is minimal.

#	Strategy name	Additional details	Comments
14	Development impact fee imposed on developer (one-time, per-space fee)	This would operate similar to existing development impact fees, except it targets parking stalls. Could be accomplished through an amendment to the planning/zoning code; may require a nexus study first. Much simpler to implement than an ongoing per-use fee or an annual stall fee. Could also be effective at reducing the incentive to build parking in the first place.	Filtered out due to concerns about both effectiveness and evaluation: ➢ Unlikely that one-time fees would be passed on to drivers. ➢ This approach would target future development, not current supply. ➢ Also, some efforts in this vein already underway as part of TSF-TIDF reform, so difficult to establish baseline and incremental benefit. (Consultant should document current status in description of regulatory environment.)
15	Require real-time availability data feed (that would be communicated to customers)	Could allow for much better management of existing supply and reduce demand for future parking supply because fewer parking spaces would be underutilized due to obscurity. Would likely require Board of Supervisors/Mayoral approval. Alternatively, could be opt-in, similar to Seattle. Operators would have an incentive to participate because the data feed could be published online and improve their visibility.	Filtered out due to concerns about effectiveness: ➢ This strategy would serve to increase effective supply.
16	Establish availability target, and require user fee to be raised to meet target	This strategy could be implemented in conjunction with strategies 3.a, 3.b, or 4.a. The strategy is similar to strategy 2.c, except this version is structured as a penalty for too-high occupancy instead of a reward for optimum occupancy. The city could survey operators on their target occupancies to determine if this is necessary. Monitoring/adjustment could happen quarterly	Not a distinct strategy, re-package into other strategies as appropriate Note: This strategy may not have a major impact if operators are already attempting to maintain 5-15% occupancy through pricing as means of maximizing revenue.
17	Forbid reserved parking	This strategy would make all commercial parking spaces subject to market competition, and might reduce the incentive to drive/park for people who currently have reserved spaces. Existing supply could also be used more efficiently, thereby reducing the need for new supply. Could be implemented through an amendment to Section 155.	Filtered out due to concerns about effectiveness: ➢ Even if parking spaces were not strictly reserved, employers could still decide to subsidize costs, so limited effect on market price and attenuated impact to travel behavior.

Appendix B. Parking Cashout Policy

This appendix outlines strategies for collecting data to evaluate parking cashout policy in San Francisco, if this strategy is pursued for further analysis. Given that there is already a state cash-out law that applies to San Francisco, a study should first evaluate the effectiveness of fully enforcing this law and then examine the relative effectiveness of expanding the law. Given budget constraints within the existing SFCTA Parking Study, we recommend using existing surveys to collect data, along with planned intercept surveys for parkers, which can subsequently be used to evaluate both the current law and the potential impact of expanding this law to firms not covered by the current state law.

B.1 Background

The State of California enacted a law in 1992 intended to reduce auto commute trips by requiring firms to offer employees "parking cashout." Under this law, certain firms providing subsidized parking to employees are required offer a cash allowance to these employees in lieu of a parking space.

Firms that meet all of the following criteria are subject to the cash-out law[7]:

- "Employ at least 50 persons (regardless of how many worksites);
- Have worksites in an air basin designated nonattainment for any state air quality standard;
- Subsidize employee parking that they do not own;
- Can calculate the out-of-pocket expense of the parking subsidies they provide; and
- Can reduce the number of parking spaces without penalty in any lease agreements."

While violations of the policy are subject to civil penalties of up to $500 per vehicle per civil action, the California Air Resources Board has announced its intention to "facilitate compliance before seeking civil penalties." In San Francisco, the law is self-implemented; there are no reporting requirements that would identify firms who failed to comply. Santa Monica is an example of a city that implements that law more strictly; it fines firms $5 per day for non-compliance with either the state ordinance or a set of local parking-related ordinances.[8]

How can the efficacy of fully enforcing parking cashout policy in encouraging people not to drive to work in the downtown Study Area be evaluated? Since parking cashout is presumed to be currently offered by some employers, we attempted to frame the evaluation method in the following manner: *To determine the number of additional employees that the cashout policy*

7 California's Parking Cashout Program http://www.arb.ca.gov/planning/tsaq/cashout/cashout_guide_0809.pdf

8 City of Santa Monica – Employers and Ordinance 1604 http://www.smgov.net/Departments/PCD/Transportation/Employers/

could target – "Target Participants" – we would want to know the number of current participants and the number of total eligible participants.

We can estimate Target Participants as follows:

Number of Eligible Cashout Participants in the Study Area
<u>Existing Number of Cashout Participants in the Study Area</u>
Target Participants

Note that "eligible participants" can refer to either those employees covered by the current parking cashout law or those covered by a hypothetical expanded parking cashout law.

B.2 Resources for Estimating the Number of Existing and Eligible Cashout Participants in the Study Area

We could estimate the number of potential and existing participants with varying degrees of accuracy depending on available resources. For instance, using a total employee count in the downtown area as an estimate would be low-cost but would over predict the number of potential participants. More refined estimates would examine firm size, building ownership, and or existence of parking subsidies. Note that to be eligible for cashout, employees must drive to work and receive some form of parking subsidy. This section specifies the possible data sources and steps to make refined estimates.

B.2.1 Existing Data

The following resources refer to previously obtained data that would be relevant in estimating eligible cashout participants in the Study Area.

Preliminary Analysis of U.S. Census Zip Code Business Patterns for Study Area Firm Size

Data from the 2011 U.S. Census Bureau's County Business Patterns and ZIP Code Business Patterns [9] provides an overview of firm size distribution. As an example, C-3 districts, the zoning designation for the highest density commercial districts in San Francisco, were analyzed as they constitute a major part of the Study Area. Downtown zip codes that contain C-3 districts were selected using a San Francisco zip code map[10] and zoning map[11]. The selection aims to provide a snapshot of firm characteristics in the downtown area and is not meant to be a comprehensive inclusion of all zip codes that contain C-3 districts; conversely, some of these zip codes contain considerable land areas that are not zoned C-3. As the underlying Census

[9] United States Census County Business Patterns
http://www.census.gov/econ/cbp/

[10] Zipmap from John Coryat – U.S. Naviguide
http://www.zipmap.net/California/San_Francisco_County/Z_Downtown.htm

[11] San Francisco Zoning Maps
http://www.amlegal.com/nxt/gateway.dll/California/zoningmaps/zoningmaps?f=templates$fn=default.htm$3.0$vid=amlegal:sanfrancisco_ca$anc=JD_ZoningMaps

Business Register is confidential, this tool can only be used for aggregated analysis and not to locate and survey individual firms.

Table B.1 displays aggregated data across all employment sectors for the zip codes we queried. Each successive column shows the number of business establishments broken down by number of employees. For example, there are 820 businesses with 1-4 employees in the 94102 zip code. The aggregated number of total employees working in these zip codes is 264,418.

Table B.1 Firms by Firm Size in Selected Downtown SF Zip Codes from U.S. County Zip Patterns

Zip	Downtown Area	'1-4'	'5-9'	'10-19'	'20-49'	'50-99'	'100-249'	'250-499'	'500-999'	'1000 or more'	Paid Employees	Total Establishments
94102	Tenderloin	820	289	230	163	55	25	10	4	2	26,662	1,598
94103	SoMa	1,283	528	394	258	82	46	17	11	2	47,796	2,621
94108	Chinatown	886	349	213	140	50	32	10	2	-	24,313	1,682
94105	Embarc. (S)	886	347	320	269	120	72	19	16	13	80,414	2,062
94104	Financial District	1,051	340	250	209	71	50	13	4	2	35,868	1,990
94111	Embarc. (N)	1,155	457	357	319	118	64	19	4	2	49,365	2,495
Total		**6,081**	**2,310**	**1,764**	**1,358**	**496**	**289**	**88**	**41**	**21**	**264,418**	**12,448**

While the County Business Patterns database provides total paid employees in the selected zip codes, it does not provide data on how many total employees fall into each employer size bucket. A rough estimate of the number of employees in each bucket can be made by calculating the midpoint of each bucket range. For example, the midpoint for the 10-19 employees bucket would be (10+19)/2=14.5. This midpoint is then multiplied with the number of firms in that bucket to produce an employee count (Table B.2). Assumptions limiting the effectiveness of this method include: 1) average firm size in a bucket is equal to the midpoint, 2) firms in "1,000 or more" bucket only have 1000 employees, and 3) quality and date of the underling census data. This method slightly overestimates the total number of employees. The last column tallies the estimates from all buckets for a total of 275,870, which is modestly larger than the County Business Patterns' estimate (264,418).

The :Estimated Employees at Firms" column in Table B.2 sums up the employee totals at the firms with 50 or more employees, since these firms are subject to California's parking cash-out law. By this method and in these zip codes, we estimate the total number of employees working at establishments with 50 or more employees to be approximately 172,068. This figure could be used, with qualification, as a rough estimate of the number of potential cashout participants within these zip codes under the current California law. This rough estimate would likely err on the higher side in estimating eligible participants, since it does not account for whether these firms meet other parking cashout criteria such as building ownership and parking subsidies, which are addressed in latter sections. The number of firms in the 20-49 range is 1,358 and the number of projected employees at those firms is 46,851. The figures for the 20-49 bucket help us quantify the number of additional people that might be affected by an expansion of the cashout policy to firms with 20 or more people, instead of the current 50 or more employees.

Table B.2 Estimated Employees by Firm Size in Selected Downtown SF Zip Codes

Zip	Downtown Area	'1-4'	'5-9'	'10-19'	'20-49'	'50-99'	'100-249'	'250-499'	'500-999'	'1000 or more'	Estimated Employees at Firms: 50 or more	Total Employees Check
94102	Tenderloin	2,050	2,023	3,335	5,624	4,098	4,363	3,745	2,998	2,000	17,203	30,235
94103	SoMa	3,208	3,696	5,713	8,901	6,109	8,027	6,367	8,245	2,000	30,747	52,265
94108	Chinatown	2,215	2,443	3,089	4,830	3,725	5,584	3,745	1,499	-	14,553	27,130
94105	Embarc. (S)	2,215	2,429	4,640	9,281	8,940	12,564	7,116	11,992	13,000	53,612	72,176
94104	Financial District	2,628	2,380	3,625	7,211	5,290	8,725	4,869	2,998	2,000	23,881	39,724
94111	Embarc. (N)	2,888	3,199	5,177	11,006	8,791	11,168	7,116	2,998	2,000	32,073	54,341
Total		**15,203**	**16,170**	**25,578**	**46,851**	**36,952**	**50,431**	**32,956**	**30,730**	**21,000**	**172,068**	**275,870**

Building Ownership

Determining whether employers' buildings are tenant owned can be done by comparing a city business registry with a property ownership database (i.e., firms that are both registered and own property at the same address within the Study Area are tenant owners). Registered businesses are listed on San Francisco's open data site with addresses and coordinates[12]. Property ownership data is also listed openly on the San Francisco Property Information Map[13]. It can be supplemented by the Costar commercial database being used as part of this study.

This analysis would produce a list of registered firms in the Study Area that do not own the buildings in which they reside. However, it would not discern how many workers these individual firms employ. The San Francisco Department of Environment (SFE) employer database could help determine this information (see below).

B.2.2 Existing Surveys and Parallel Efforts

The following resources refer to existing surveys that would be relevant in estimating eligible and existing cashout participants in the Study Area.

Commuter Benefits Ordinance

Eligible Participants

The Commuter Benefits Ordinance (CBO) is an SF law, passed in 2008, that requires employers with 20 or more employees nationwide to offer one of three types of alternatives to driving alone to work. The CBO does not explicitly require parking cash-out. However, the

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[12] Businesses Registered in San Francisco – Active https://data.sfgov.org/Business-and-Economic-Development/Businesses-Registered-in-San-Francisco-Active/funx-qxxn

[13] San Francisco Property Information Map http://propertymap.sfplanning.org/

existence of the CBO implies that a 20-employee cut-off point might be a reasonable size to which to expand cash-out requirements to more firms through municipal ordinance.

In the past, the SFE has sent an annual CBO compliance audit to firms with over 20 employees. In 2014 SFE sent the audit to firms with 20-49 employees because the Metropolitan Transportation Commission (MTC) will administer the CBO compliance for firms with 50 or more employees, as described in the next section. According to SFE's 2012 CBO Report, there are 5,900 San Francisco firms with over 20 employees in the database[14]. In the Zip Code Business Patterns analysis in the previous section, the six examined zip codes had a total of 2,350 firms with over 20 employees. As expected, the SFE database figure is larger given that it includes all SF zip codes, but not significantly larger given that SF businesses are highly concentrated in these downtown zip codes.

This SFE database, if it can be obtained for this study, should therefore help to identify employers by size. The SFE database draws on information from the SF Office of Treasurer and Tax Collector. Combined with the building ownership analysis described above, these data can help determine employers with over 50 employees that do not own their own buildings.

Existing Participants

The final piece of information is the percent of employers who comply with the parking cashout ordinance. Since the existing CBO audit does not ask for cashout compliance, a straightforward way to obtain this final piece of information would be to ask the firms submitting the audits to describe parking subsidies provided. Employers already filling out the CBO audit form would be unlikely to withhold this information because they would perceive reporting these subsidies as contributing positively to their compliance with the Commuter Benefits ordinance. With 3,400 out of 5,900 submitting compliance forms on time, we expect the SFE audit to be a more effective avenue for obtaining relevant information from employers than conducting an independent survey, to which the employers would have little incentive to respond. That said, we would want to examine the audit distribution method and responses to try to determine why certain firms did not submit audits.

This year, the form will be sent by the end of March with responses due April 30 and results produced one to two months later. Although only employers with 20-49 employees will submit the form to DOE this year as MTC will handle reporting function or employers with over 50 employees, the survey can still be used to estimate cash-out eligibility and participation. We were able to include the following questions on the survey:

- How many employees do you provide free parking or parking subsidies to?
- For these employees, what is the average subsidy amount per month?

[14] San Francisco Commuter Benefits Ordinance http://www.sfenvironment.org/sites/default/files/editor-uploads/transportation_commute/pdf/sfe_tr_cbo_annual_report_2012.pdf

- How many of these employees do you offer cash to in exchange for choosing not to have parking spaces (i.e., parking cash-out)?
- If you do offer parking cash-out, how many employees "cash-out" and choose not to have parking spaces?

Bay Area Commuter Benefits Program

A recent State Senate Bill (SB 1339) authorizes the Bay Area Air Quality Management District (BAAQMD) and MTC to jointly adopt and implement a regional "effort to reduce GHG emissions from the transportation sector, reduce traffic congestion and improve air quality."[15] BAAQMD and MTC have jointly developed a draft regulation (Regulation 14: Mobile Source Emissions Reduction Measures, Rule 1: Bay Area Commuter Benefits Program)[16] that would require all firms with more than 50 employees to offer one of four benefits to their employees; the benefit options closely parallel the San Francisco CBO, so compliance with the CBO is consistent with the requirements of the Bay Area CBP. Going forward, employers will submit information on their compliance with both the San Francisco CBO and the regional CBP to MTC and the Bay Area Air Quality Management District via a regionwide survey.[17]

To implement the initial survey, MTC bought a bulk address database from Dunn and Bradstreet and will send the survey to employers with over 50 employees. Details of the program, including the methodology for conducting the survey, will go in front of the BAAQMD Board in March, and the survey is expected to go live in April. Businesses will have six months to respond. MTC may conduct follow-up surveys to employees, though this would not occur until fall and winter of 2014 at the earliest. However, it is uncertain how many San Francisco-based firms will be contacted from the MTC's employer database, particularly since this is a regionwide survey. Also, the initial survey does not contain many cashout-related questions.

Note that if we were able to append questions to this joint regionwide survey by BAAQMD and MTC, we would be able to collect data on both **eligible** and **existing** cash-out participants.

TDM Parking Benefit Survey

In August of 2013, the Citywide Transportation Demand Management (TDM) partnership conducted a survey of San Francisco employers' benefit offerings. The results of this TDM benefits survey can be used as an additional check or data point in determining the percentage of firms that offer parking subsidies. See Appendix B of the Strategies Memo, "TDM Partnership Memo on Summary of Findings to date from Parking Cash-Out Pilot Program," for more information on the survey.

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[15] http://www.onebayarea.org/news/story/ba_commuter_benefits.html

[16] The draft final rule was released on 21-Jan-2014 and is scheduled for hearings and adoption later this year.

[17] SF DOE will retain responsibility for CBO compliance for firms with 20-49 employees.

DOE 2014 San Francisco Commuter Survey

SFE sent a commuter survey this year to individuals in its commuter databases. The commuter survey asked employees whether they receive free parking or parking subsidies. Individuals are incentivized to respond with potential gift cards and other rewards. Regardless of whether this survey yields useful data, the employee databases' sources and characteristics (e.g., employees' firm type and size) can be useful, and could be used for other surveys.[18] The survey was sent to mixture of employees that are on SFE's contact list due to some form of participation in current SFE programs. Given the sample, there may be some degree of positive bias towards participation in TDM programs such as cashout. The survey will close by March 14, 2014, and results will be processed by the end of May. SFE added cash-out questions to this survey, including a checkbox asking a commuter whether or not they receive a parking cash-out, and questions regarding employer eligibility (e.g., building ownership, and employer size) for cash-out.

B.2.3 Independent Surveys

Several independent surveys could also be employed to pursue data on **existing** and **eligible** participants.

Independent Survey of Employers

If field work is required to determine the number of existing and eligible cash-out participants, it would likely not be able to be included with other SFCTA parking study field work as part of the SFCTA Parking Study. This field work includes interviews with building owners and parking managers, whereas cash-out eligible employers typically do not own their buildings. We do not see designing and conducting an independent survey of San Francisco employers as a cost-effective method for estimating eligible or existing cash-out participants.

Independent Survey of Employees

CS could also design and administer a survey of employees working in downtown SF. Employees could be offered incentives (e.g., Muni Fast Pass, gift card, etc.) to participate, as they would have little reason to respond otherwise. The survey would cover the cash-out policy as well as other parking characteristics relevant to the SFCTA parking study. Our team would likely only pursue this route if existing sources, such as the SFE commuter and MTC audits, provided an inadequate sample due to size and/or sample bias. The survey team could use the SFE commuter database to begin to build a list of employees who will be asked to complete the survey, provided it offered a representative sample of employee distribution (this could be cross-checked with County Business Patterns).

[18] 2014 San Francisco Commuter Survey https://sfetoxicsreduction.wufoo.com/forms/q10z07vw0li2m80/

Intercept Survey of Parkers

The study team will conduct limited intercept surveys of parkers. The survey instrument can contain questions relating to their use of parking, trip purpose (i.e., are they parking to go to work), cashout incentives, and related questions.

B.3 Estimation Method(s) in Lieu of Data

B.3.1 Sensitivity Analysis

It is challenging to estimate the number of firms who comply with the cashout policy and the number of employees who participate. An alternative sketch level calculation is to provide a range of additional employees who could participate in the program by altering three parameters: existing level of participation, percentage of firms who offer cashout, and percentage of employees who participate in the cashout. Table B.3 presents a sketch of this sensitivity.

Table B.3 Example of Potential Sensitivity Analysis

		Percentage of Firms Complying -50%					Percentage of Firms Complying -60%				
		Percentage of Employees Participating	50%	60%	70%	80%	Percentage of Employees Participating	50%	60%	70%	80%
Existing Level of Participation	50%										
	60%										
	70%										
	80%										
	90%										

B.4 Cost/Synergies with Evaluation of Other Strategies

Augmenting SFE's commuter database with more commuter records, if necessary, would be costly and beyond the resources of this study. It would require contacting employers and requesting to get in touch with their respective employees; contacting residences, which would have low hit rate for downtown San Francisco-based workers, particularly in residences outside of the city; and intercepting employees on the street. Alternatively, a social media campaign could target employees in the San Francisco area to recruit survey responders. This approach could be coupled with field interviews in the Study Area.

However, the planned data collection and evaluation efforts as part of the SFCTA Parking Study will focus mostly on surveying building owners, with some intercepts of parkers. Some data can be gathered from the parker intercepts, but overall there are limited synergies in data gathering and evaluation between the cashout strategies and the other strategies, and thus any resources expended on this strategy would reduce resources available to evaluate the other strategies.

B.5 Recommendation

Within the SFCTA Parking Study resources, the most cost effective way to evaluate cashout strategies is using existing survey tools to gather data on existing and potential parking cashout participants. Though limited in scale, the SFE surveys of employers (via the CBO compliance audit) and employees (through the commuter survey) may still provide some insights into the size of the current and future market for cash-out under existing law and potential expansions. Once the scale of potential participation is known, evaluation of the effects on mode share and congestion can be estimated much more easily during that phase of the study. This can be supplemented by limited data gathered through the intercept surveys of parkers done as part of the market research efforts in this study. Additional data collection for evaluating cashout strategies will likely not be possible within the study resources, and there are limited synergies in data and evaluation with other strategies.

Appendix C. Supply Model Methodology and Results

C.1 Introduction

In San Francisco, parking occurs across different location, property, manager, and access types. Table C.1 describes common forms of parking in San Francisco and data sources with information on the supply of these types of parking.

Table C.1 San Francisco Parking Types

Location	Residential Non-Residential	Operator Manager	Access	Name and Examples	Parking Supply Data Sources
Off-Street	Non-Residential	Private companies	Public	Publically accessible, privately operated parking (e.g., most garages advertising parking to street traffic)	Off-Street Census, Costar, Operator Survey, Supply Survey
Off-Street	Non-Residential	SFMTA	Public	Public parking garages (e.g., SFpark garages/ lots)	Off-Street Census
Off-Street	Non-Residential	Private companies	Private	Customer Parking Only (e.g., exclusive parking for retail customers)	Off-Street Census, Costar, Operator Survey, Supply Survey
Off-Street	Non-Residential	Private companies/ Government agencies	Private	Permit Holder Only (e.g., employee-only parking provided by private or public sector employers)	Off-Street Census, Costar, Operator Survey, Supply Survey
Off-Street	Non-Residential	Government agencies	Public	Free off-street parking (e.g., parking at public sites such as beach or parks)	Off-Street Census
Off-Street	Residential	Residencies	Private	Residential parking (e.g., parking spaces in driveways or garages in or attached to private homes)	N/A
On-Street	Non-Residential	SFMTA	Public	On-street parking (e.g., metered or unmetered street parking)	On-Street Census, SFpark Meter Database

The parking supply model is intended to estimate the amount of off-street, non-residential parking (i.e., the first, third, and fourth rows of Table C.1) the Study Area. It attempts to quantify undocumented parking supply. The existing SFpark Off-Street Census extensively documents publically accessible parking lots and garages and some privately accessible lots and garages. Costar provides data on commercial properties that could contain parking. The supply model draws on these data, as well as the supply and operator surveys conducted for the PSUS.[19] The model focuses on the PSUS Study Area, which covers the northeast portion of

[19] The Methodology chapter describes these datasets in greater detail.

San Francisco.[20] The supply model uses regression analyses to estimate the number of parking spaces at non-residential properties in the Study Area based on property characteristics and other available data. Basic assumptions about parking supply in the Study Area are used to extrapolate supply estimates to other parts of the city.

The supply model results show a median 1.8% increase in the total observed number of non-residential, off-street parking spaces within the Study Area, for a total of 87,400 spaces.[21] The 10th and 90th percentile results correspond with 0.4% and 8.2% increases in total observed parking.

This document describes the supply model methodology, including the processes used for data cleaning and processing as well as the actual model estimation and accompanying analysis. It summarizes the supply model results and implications.

C.2 Methodology

The Costar commercial real estate properties in the Study Area served as the set of locations where undocumented non-residential, off-street parking could potentially exist. The service covers San Francisco commercial, industrial, and mixed use properties fairly comprehensively, and, therefore, locations within those zones at which parking could occur. SFpark data covers parking that occurs in public zones and other areas that Costar might exclude categorically, therefore filling potential data gaps for this analysis. Costar includes fields for a range of building characteristics, including the number of parking spaces. However, parking is not Costar's primary focus, and many records have parking counts that do not match those in the Off-Street Census or the PSUS supply survey.

Therefore, the study analyzed the relationships between Costar building characteristics (including number of parking spaces) and the "actual" space counts (according to the Off-Street Census and the PSUS survey work) to estimate how much parking is likely to exist at a commercial property based on its building characteristics. Specifically, the study ran regression models with actual parking as the dependent variable and building characteristics as the independent variables. Then, it used a simulation to apply the model coefficients to properties without actual counts. Model results were aggregated across the Study Area and compared to aggregate documented parking supply in the Off-Street Census. The ratio of modeled (i.e., undocumented) supply to documented supply inside the Study Area was calculated. Then, this ratio was used to estimate the amount of undocumented supply outside the Study Area.

C.2.1 Data Cleaning and Processing

The study cleaned and processed the Costar data obtained from licensed searches and used addresses and spatial coordinates to match it with the Off-Street Census. First, the Costar

[20] The Methodology chapter describes the study area boundaries.

[21] Counts are rounded, so calculations may include rounding error.

records were limited to non-residential properties in the Study Area. A handful of duplicate Costar addresses were removed as well. The resulting dataset had 4,782 records. The dataset was narrowed to include only potentially relevant fields with reasonably comprehensive data (i.e., few missing data points). These fields included number of parking spaces, parcel acreage, rentable building area, and year built, among others. Many of the fields required cleaning, such as removing non-numeric values or applying consistent formatting. The address field, which was needed to match Costar records to Census records, required extensive cleaning.

The study also confined the Off-Street Census records to the Study Area, resulting in 601 records. After cleaning address fields in Costar and the Census, 218 records matched exactly based on address. Then, the study used the site coordinates from both datasets to identify additional matches spatially. A San Francisco parcel shapefile was used for this process. The shapefile was dissolved into "map block lots," determined to be the best unit for grouping Costar and Census sites together spatially. GIS was used to find overlapping map block lots for each site in Off-Street Census and Costar datasets.

This process isolated 240 more potential matches, which were then manually reviewed. Of these, 100 were determined to be legitimate matches. Some of these matches were easily discernable, such two buildings with the same address with slightly different nomenclatures (e.g., "South Van Ness" vs. "S Van Ness"); many other overlaps were ambiguous. When two lots had very close addresses (i.e., two to ten numbers apart), similar parking space counts, and were on the same parcel, they were typically assumed to be matching. Supply survey results were used to augment these matches. However, when addresses were different and parking space counts were relatively disparate, addresses were assumed to be non-matching despite map block lot overlap.

Thus, 318 matches were found between Costar and the Census. The remaining 283 Census sites included surface lots and facilities, such as public buildings, that are relatively obvious parking locations not likely to be captured in Costar. These sites were included in the aggregate results as part of total documented supply, but they were not used to model undocumented supply.

The study employed a similar process for matching operator survey results to Costar. Most of the operator locations either had Costar IDs or were easy to correspond to Costar records. Parking space counts for 67 of 75 operator locations were included in the supply model. [22]

The supply survey was critical for filling in gaps in the Off-Street Census and helping to reduce bias toward parking-heavy locations in the model. 490 supply checks were conducted; most of these sites did not have any non-residential parking. Of the 145 that did have non-residential parking, physical counts were taken at 24 (an additional number of locations were included in the operator survey). Access restrictions and lack of visibility made it impossible to perform counts at the other locations. However, many of the uncounted locations did have parking

[22] Most of the 8 excluded records had matches in the Off-Street Census but not in Costar.

space counts in the Census. 51 locations had no corresponding counts despite being verified as having some form of non-residential parking in the Census.

The study used a San Francisco zoning districts shapefile to assign simplified zoning categories to each location in the supply model. These were considered as categorical variables for the regressions.

A binary categorical variable was added to indicate whether or not the record was included in the Off-Street Census. This was used in the regression to reflect that properties excluded from the Census are much less likely to have parking spaces.

Overall, 676 of 4,782 Costar records had actual counts from either the Census, operator survey, or supply survey. For each of these records, a single actual count was assigned, with priority given first to the operator survey, then the Census, and finally the supply survey, which focused more on determining whether or not sites had spaces than on counting spaces.

C.2.2 Analysis

After data processing, the study calculated summary statistics for each potential variable and examined bivariate relationships to determine which variables to include in the regressions and which functional forms to use for these variables. The study ran regression models with actual parking as the dependent variable and building characteristics as the independent variables. R, the open-source programming language and software environment, was used for the analysis.

Since the dependent variable includes excess zeroes (i.e., properties with zero parking spaces), the study used a two-step, or hurdle, regression model. First, a logit model was used to estimate the likelihood that a property includes at least some non-residential parking. Then, an ordinary least squares (OLS) model was used to estimate the number of parking spaces at these non-zero locations.

To help evaluate the model's accuracy, the study divided the 676 complete records into a training dataset for actual estimation (70% of records) and a testing dataset (30% of records). The training and testing errors (differences between modeled and actual parking space counts) and other regression diagnostics were used to help characterize the model's performance.

After model estimation with observed records, the study applied the models to the unobserved records (i.e., records with building characteristics but without parking space counts), obtaining probabilities that these records included at least some non-residential, off-street parking and the estimated number of non-residential, off-street parking spaces at each record. Then, a bootstrap simulation of the models was used to characterize results. The simulation included the following steps:

1. Generate error terms for each location's probability of having non-zero parking. These numbers are generated by randomly sampling a normal distribution with the mean,

standard deviation, and skewness of the testing dataset's logit model error distribution. Add error terms to estimated number of parking spaces at each record.

2. Subset records classified as having non-zero parking in Step 1 (i.e., probabilities greater than .5), and generate error terms for number of parking spaces. These numbers are generated by randomly sampling a normal distribution with the mean, standard deviation, and skewness of the testing dataset's linear model error distribution. Add error terms to estimated number of parking spaces at each record. Ensure that all records have at least 0 spaces.

3. Aggregate the total number of spaces across all incomplete records.

4. Repeat simulation for 10,000 iterations.

5. Calculate median and mean number of parking spaces across iterations. Calculate 10^{th} and 90^{th} percentile results, and 5^{th} and 95^{th} percentile results across iterations.

Results were compared to Census totals to help estimate total non-residential, off-street parking supply in the area and the average number of spaces per record. Extrapolations were made for Costar records that were dropped due to missing data. The study also calculated the proportion of undocumented supply versus documented supply. The study used this ratio and total documented supply outside the Study Area to extrapolate undocumented supply in the rest of San Francisco. Finally, citywide totals were combined.

C.3 Results

C.3.1 Initial Analysis

Potential explanatory variables were selected based on data availability, completeness of available data, and plausible relationship with the dependent variables (i.e., binary categorical variable indicating existence of parking spaces and continuous variable indicating number of parking spaces). Table C.2 lists these variables and provides their summary statistics for records with observed parking information. The explanatory variables include the Costar parking space count and a binary categorical variable indicating whether a record is included in the Off-Street Census. Size-related building characteristics included parcel acreage, number of stories, rentable building area, and typical floor size. Other characteristics include the walking time to the closest transit stop, percent of the property that is leased, and year built.

Table C.3 lists the simplified zoning categories created as potential binary categorical variables. Ultimately, C-3 was the only binary categorical included in further analysis (i.e., variable indicating whether or not a property is in the C-3 district). C-3 locations had a higher average number of parking spaces compared to other simplified zones. While the Public locations had the highest average parking space count, there were only 13 Public locations in the Study Area, and the non-zero Public locations corresponded to SFpark garages, which are already documented in the Off-Street Census.

Table C.2 Study Area Summary Statistics for Observed Records

	Minimum	1st Quartile	Median	Mean	3rd Quartile	Maximum
Observed Parking Spaces	0.00	0.00	7.00	73.50	80.00	2,585.00
In Census?	0.00	0.00	0.00	0.47	1.00	1.00
Costar Parking Spaces	0.00	0.00	3.00	64.36	50.00	2,585.00
Closest Transit Stop Walk Time (mins)	0.00	1.00	3.00	4.00	6.00	16.00
Acreage	0.01	0.12	0.30	0.73	0.82	45.00
Number of Stories	1.00	2.00	3.00	5.92	5.00	52.00
Percent Leased	0.00	91.00	100.00	81.91	100.00	100.00
Rentable Building Area (square feet)	1.00	6,644.00	21,240.00	105,160.00	100,000.00	2,166,000.00
Typical Floor Size (square feet)	1.00	3,288.00	8,840.00	15,772.00	19,000.00	212,000.00
Year Built	1,881.00	1,912.00	1,935.00	1,943.00	1,973.00	2,013.00

Table C.3 Simplified Zoning Categories in Study Area for Observed Records

Simplified Zoning Category	Count of Observed Records in Study Area	Average of Observed Parking Space Count	Standard Deviation of Observed Parking Space Count
C-2	79	74	112
C-3	170	115	154
Industrial/Light Industrial/ Production/Heavy Commercial	80	43	132
Mixed Use	231	63	127
Neighborhood Commercial	103	17	34
Public	13	343	719

The study iteratively used bivariate scatter plots, correlation matrices, histograms, skewness measures, bivariate regression results, and multivariate regression results to determine whether to transform variables to different functional forms (e.g., linear, logarithmic, polynomial), which functional forms to use in these transformations, and which variables to include in the actual supply model.

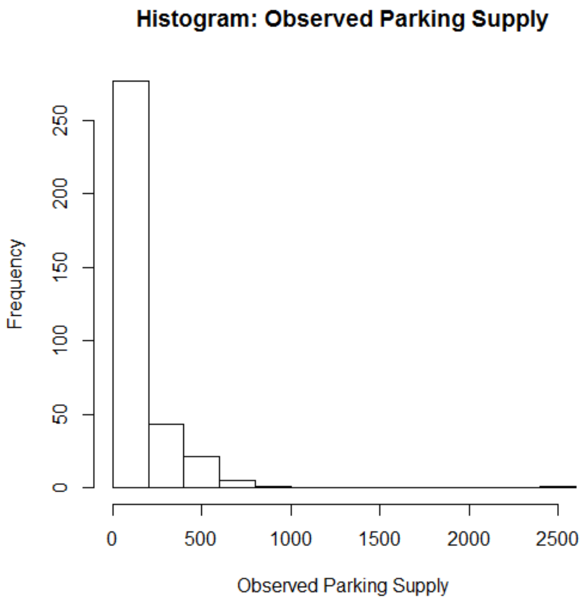
Generally, variables were transformed so that their skewness ratings fell between -1 and 1. For example, Figure C.1 shows histograms of the continuous dependent variable in linear and log forms. The log form, which had -0.142 skewness, is relatively evenly and normally distributed compared to the linear form, which had 5.697 skewness. Thus, the log form was used for this variable.

Variables that contributed to overall multivariate regression performance were included, and other variables were dropped. The Regression Analysis section discusses multivariate regression performance in detail.

Figure C.2 and Figure C.3 show correlation matrices for transformed variables. Some transformations involve taking the natural log of the untransformed values plus one; these transformations avoid having to take the natural log of 0, which is undefined. Other transformations involved raising untransformed values to a fractional exponent. Figure C.2 contains correlations across all observed parking data and includes the categorical dependent variable. Figure C.3 contains correlations across observed non-zero parking data and includes the continuous dependent variable. In these matrices, the number of stories and typical floor size variables was combined into a single explanatory variable. This variable was highly correlated with rentable building area and was therefore dropped.

Figure C.4 shows bivariate scatter plots of the dependent variable against each explanatory variable included in at least one of the two regression models. The left column shows untransformed variable plots at all locations with observed parking data. The middle columns shows the binary categorical dependent variable against transformed explanatory variables at all locations with observed parking data. The right column shows the transformed variable plots at observed non-zero parking locations.

Figure C.1 Dependent Variable Histograms for Non-Zero Parking Locations



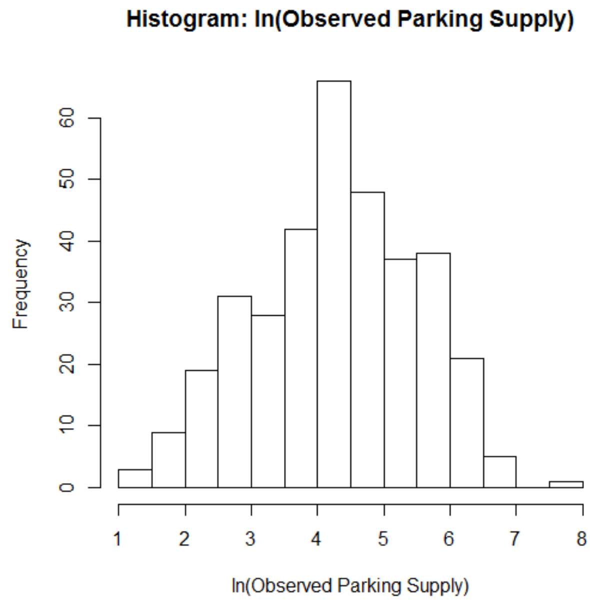


Figure C.2 Correlation Matrix for Records with Observed Parking Data

	Has Parking?	In Census?	ln(Costar Supply+1)	ln(Minutes to Transit Stop + 1)	Acreage^(1/10)	ln(# Stories* Typical Floor Size)	Percent Leased	Rentable Area^ (1/4)	Year Built	In C-3?
Has Parking?	1.00									
In Census?	0.91	1.00								
ln(Costar Supply+1)	0.42	0.39	1.00							
ln(Mins to Transit Stop + 1)	-0.04	-0.08	-0.04	1.00						
Acreage^(1/10)	0.50	0.48	0.52	0.01	1.00					
ln(# Stories*Typical Floor Size)	0.44	0.43	0.44	-0.12	0.64	1.00				
Percent Leased	-0.23	-0.21	-0.24	0.10	-0.05	0.00	1.00			
Rentable Area^(1/4)	0.47	0.45	0.47	-0.17	0.65	0.92	-0.01	1.00		
Year Built	0.39	0.36	0.38	0.01	0.39	0.43	-0.06	0.46	1.00	
In C-3?	0.21	0.22	0.14	-0.33	0.14	0.39	-0.05	0.48	0.18	1.00

Figure C.3 Correlation Matrix for Records with Non-Zero Parking Locations

	ln(# Parking Spaces)	In Census?	ln(Costar Supply+1)	ln(Minutes to Transit Stop + 1)	Acreage^(1/10)	ln(# Stories* Typical Floor Size)	Percent Leased	Rentable Area^ (1/4)	Year Built	In C-3?
ln(# Parking Spaces)	1.00									
In Census?	0.20	1.00								
ln(Costar Supply+1)	0.50	0.01	1.00							
ln(Mins to Transit Stop + 1)	-0.21	-0.14	-0.13	1.00						
Acreage^(1/10)	0.42	0.10	0.31	0.05	1.00					
ln(# Stories*Typical Floor Size)	0.42	0.07	0.28	-0.14	0.49	1.00				
Percent Leased	-0.24	0.01	-0.21	0.14	0.25	0.23	1.00			
Rentable Area^(1/4)	0.50	0.09	0.34	-0.22	0.51	0.87	0.21	1.00		
Year Built	0.27	0.02	0.18	-0.09	0.13	0.38	0.09	0.41	1.00	
In C-3?	0.24	0.10	0.17	-0.43	0.04	0.35	-0.03	0.49	0.26	1.00

Figure C.4 Bivariate Scatter Plots for Variables Included in Regression(s)

Left column shows untransformed variables for non-zero and zero locations; middle column shows transformed independent variables and binary dependent variable for non-zero and zero locations; right column shows transformed variables for non-zero locations.

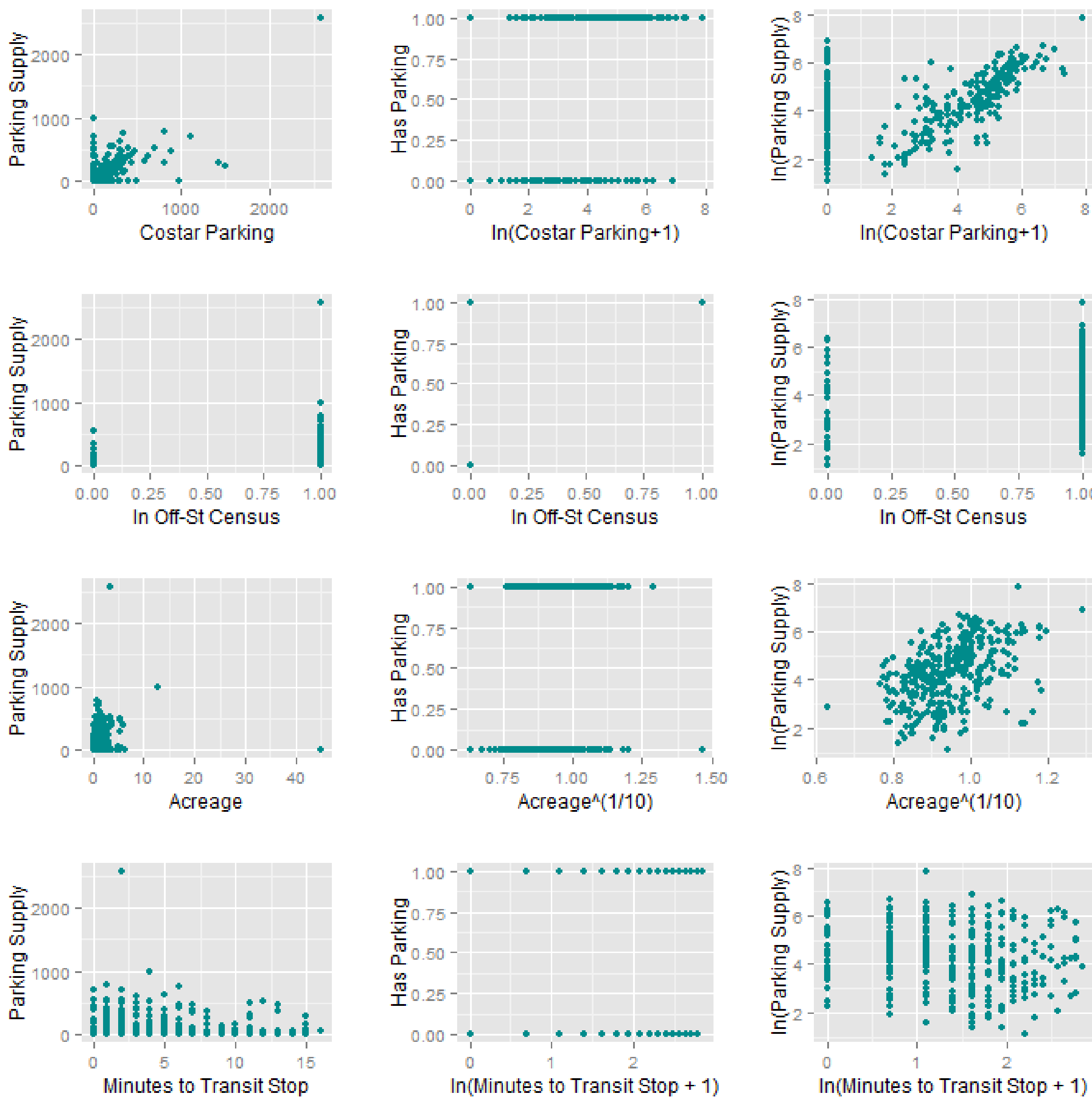
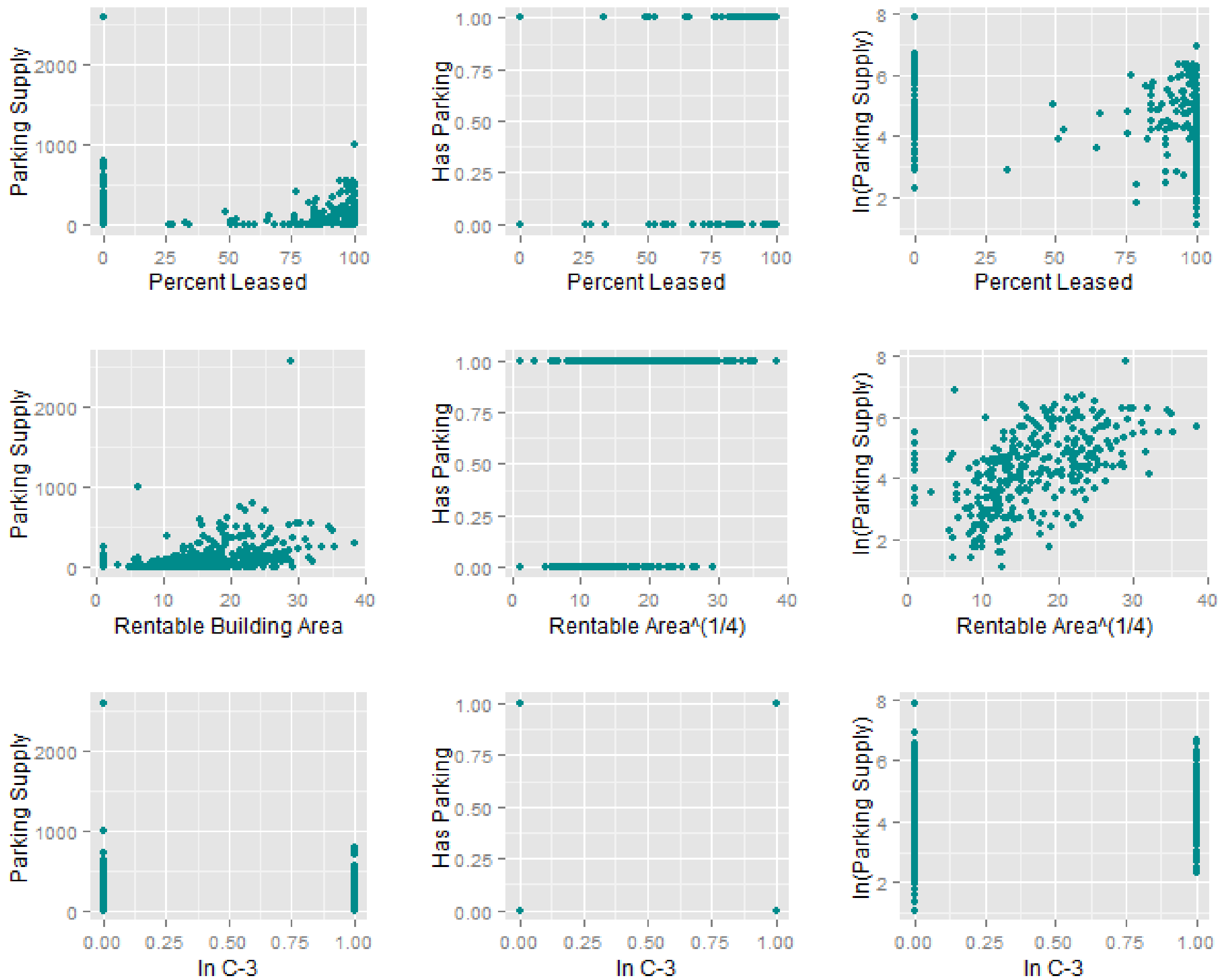


Figure C.4 Bivariate Scatter Plots for Variables Included in Regression(s) (continued)

Left column shows untransformed variables for non-zero and zero locations; middle column shows transformed independent variables and binary dependent variable for non-zero and zero locations; right column shows transformed variables for non-zero locations.



C.3.2 Regression Analysis

The study focused on selecting variables that would maximize overall model performance. The supply model serves more as predictive tool that seeks to estimate how many undocumented parking spaces exist as accurately as possible rather than an explanatory model that attempts to understand relationships between individual explanatory variables and the dependent variable as fully as possible. Thus, the study emphasizes overall model performance in this results section rather than detailed interpretations of individual coefficients.

Figure C.5 shows the final regression output for the logit model used to predict whether or not locations have parking. The model was estimated using the training dataset. The study focused on three performance diagnostics for the logit model:

- Classification Performance of Training and Testing Datasets. Table C.4 shows classification results for both datasets. The model correctly classifies 96% of the records in the training dataset, which was used to estimate the model. The model also correctly classifies 96% of the records in the testing dataset, indicating excellent performance.

- Log Likelihood Chi Squared Test Statistic. This statistic, 537.03, indicates a less than 0.001% probability of a valid null hypothesis that all of the model coefficients are equal to zero. Thus, the model is statistically significant according to this measure.

- McFadden's Pseudo R^2. The high value of this statistic, 0.832, suggests that the model fits the data well.

None of the variables were significant at the 95% confidence level, and the Costar parking space count was significant at the 90% confidence level. However, removing any of the included variables notably detracted from the overall model performance. Inclusion in the Census and higher Costar space counts, acreage, rentable building area, and walking time from the closest transit stop were associated with higher observed parking space counts, as expected. Unexpectedly, inclusion in C-3 was associated lower space counts.

Figure C.6 shows the final regression output for the linear model used to predict how many parking spaces exist at locations classified as non-zero in the logit model. Figure C.7 plots the observed versus modeled parking space counts for each location in the testing dataset. The adjusted R^2 of .481 shows that the model explained just under half of the variation in parking space counts. All included variables were significant at the 95% confidence interval. Inclusion in the Census and higher Costar space counts, acreage, and rentable area were associated with higher observed space counts, as expected. Lower percent leased values were associated with higher observed space counts.

Figure C.5 Logistic Regression Output from R

```
Logistic Regression Model

lrm(formula = is_parking ~ census_include + ln(costar_supply+1) + ln(mins_to_
      transit_stop+1) + acreage^(1/10) + rentable_area^(1/4) + is_c3, family
      = "binomial", data = train_knownys)


                     Model Likelihood     Discrimination    Rank Discrim.
                        Ratio Test           Indexes           Indexes
Obs           469    LR chi2     537.03    R2       0.909    C       0.986
 0            231    d.f.             6    g        8.465    Dxy     0.973
 1            238    Pr(> chi2) <0.0001    gr    4747.471    gamma   0.973
max |deriv| 0.01                           gp       0.483    tau-a   0.487
                                           Brier    0.034

                              Coef    S.E.    Wald Z Pr(>|Z|)
Intercept                     -6.9196  2.5191 -2.75  0.0060
census_include                14.5444 27.9763  0.52  0.6031
ln(costar_supply+1)            0.2693  0.1567  1.72  0.0858
ln(mins_to_transit_stop+1)     0.5918  0.3945  1.50  0.1336
acreage^(1/10)                 1.9194  3.2545  0.59  0.5553
rentable_area^(1/4)            0.1159  0.0738  1.57  0.1163
is_c3                         -0.4191  0.9202 -0.46  0.6488
```

Note: "R2" refers to Nagelkerke pseudo R^2. McFadden's pseudo R^2 is 0.832.

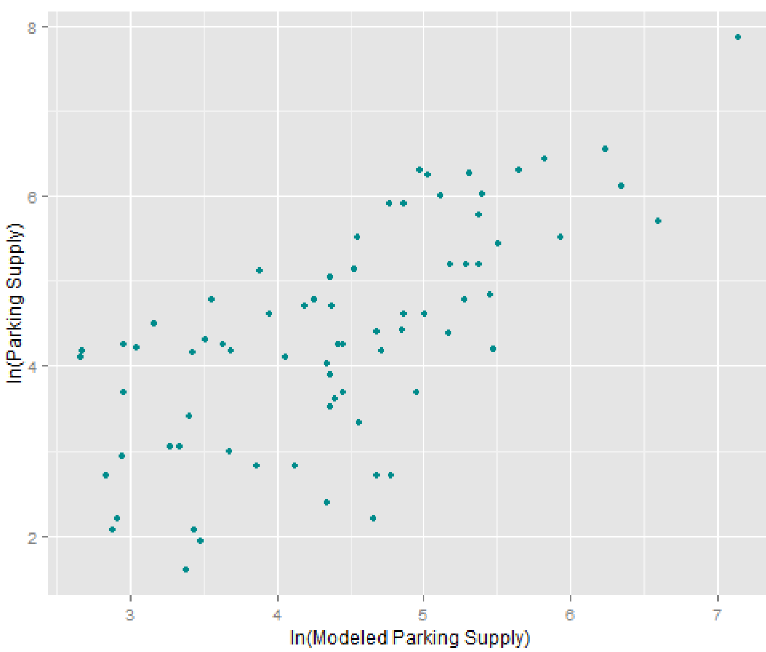
Figure C.6 OLS Linear Regression Output from R

```
Call:
lm(formula = ln(supply_given) ~ census_include + ln(costar_supply+1) +
       acreage^(1/10) + percent_leased + rentable_area^(1/4), data = train_kn
       ownparking)

Residuals:
     Min       1Q   Median       3Q      Max
-2.49366 -0.57747  0.06543  0.64736  2.39105

Coefficients:
                       Estimate Std. Error t value Pr(>|t|)
(Intercept)           -0.791882  0.684474 -1.157  0.248685
census_include         0.815181  0.219031  3.722  0.000257 ***
ln(costar_supply+1)    0.099210  0.030660  3.236  0.001420 **
acreage^(1/10)         3.992501  0.798885  4.998  1.26e-06 ***
percent_leased        -0.010587  0.001661 -6.373  1.26e-09 ***
rentable_area^(1/4)    0.063392  0.010694  5.928  1.32e-08 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.904 on 200 degrees of freedom
  (42 observations deleted due to missingness)
Multiple R-squared:  0.4933,   Adjusted R-squared:  0.4806
F-statistic: 38.94 on 5 and 200 DF,  p-value: < 2.2e-16
```

Table C.4 Logit Regression Classification Accuracy, Training and Testing Datasets

	Modeled Zero Parking Locations, Training	Modeled Non-Zero Parking Locations, Training	Modeled Zero Parking Locations, Testing	Modeled Non-Zero Parking Locations, Testing
Actual Zero Parking Locations	**229**	**2**	**83**	**0**
Actual Non-Zero Parking Locations	**19**	**219**	**7**	**81**

Figure C.7 Observed Versus Modeled Parking Supply, Testing Dataset



C.4 Simulation Results

At 10,000 iterations, the median, or 50th percentile, number of parking spaces was 1,300 and the median number of non-zero parking locations was 12 out of a possible 3,614 locations. Possible locations include Costar records with complete data for all variables included in either of the two regression models but without observed parking data. The average number of parking spaces was 2,900, and the average number of non-zero parking locations was 41.

For total parking spaces, the 10th and 90th percentile results were 300 and 6,000 spaces. The 5th and 95th percentile results were 200 and 9,200 spaces. For number of locations with parking spaces, the 10^{th} and 90^{th} percentile results were 3 and 55 locations. The 5^{th} and 95^{th} percentile results were 1 and 82 locations.

Table C.5 shows modeled summary statistics for the number of parking spaces, number of locations with parking, number of parking spaces per 1,000 square feet of rentable building area for locations with parking, number of parking spaces per 1,000 square feet of rentable building area for locations with and without parking, number of parking spaces in C-3, and number of parking locations in C-3.

Table C.5 Simulation Summary Statistics for Locations without Observed Parking Data

	Median	Mean	5^{th} Percentile	10^{th} Percentile	90^{th} Percentile	95^{th} Percentile
Number of parking spaces	1,300	2,900	200	300	6,000	9,200
Number of parking locations	12	41	1	3	55	82
Parking spaces per 1,000 sq. ft. rentable building area for location with parking	0.280	0.488	0.039	0.067	1.071	1.546
Parking spaces per 1,000 sq. ft. rentable building area for location with and without parking	0.01268	0.02685	0.00142	0.00266	0.05649	0.08677
Number of parking spaces in C-3	100	500	0	0	1,300	2,200
Number of parking locations in C-3	3	8	0	0	13	18

C.4.1 Post Processing

Results were adjusted for missing data. There were 4,106 Costar locations without observed parking data. The simulations addressed 3,614 of these locations, but 492 locations were dropped due to missing data. These missing locations represent a 17% increase in potential locations. Therefore, a simple 17% increase in parking spaces was added to results as follows:[23]

- Median: 1,600 spaces;
- Mean: 3,300 spaces;
- 5^{th} Percentile: 200 spaces;

[23] Rounding errors occur.

- 10^{th} Percentile: 300 spaces;
- 90^{th} Percentile: 7,000 spaces; and
- 95^{th} Percentile: 10,700 spaces.

Aside from the undocumented parking that the supply model estimates, approximately 85,900 off-street, non-residential spaces exist within the Study Area. The Costar locations accounted for 49,700 observed parking spaces in the Study Area; 47,900 of these spaces were observed in the Census and an additional 1,800 were observed in the supply and operator surveys. Aside from the Costar locations, the Census documents another 36,200 parking spaces in the Study Area.

The median supply model results suggests a 1.8% increase in the total observed number of non-residential, off-street parking spaces within the Study Area, for a total of 87,400 spaces. The 10^{th} and 90^{th} percentile results correspond with 0.4% and 8.2% increases in total observed parking.

Results were also simply extrapolated for outside the Study Area. The Census accounts for 81,500 off-street, non-residential parking spaces outside of the Study Area. Assuming the same percentage increases in total observed parking, the portions of the San Francisco outside the Study Area are expected to have 83,000 spaces under the median result, 81,800 spaces under the 10^{th} percentile result, and 88,100 spaces under the 90^{th} percentile result.

C.5 Conclusion

The supply model predicts a relatively limited increase in non-residential, off-street parking beyond what the extensive Off-Street Census already documents in the northeastern portion of San Francisco. This parking is likely to exist at parking garages or lots that have been created since the Census or at locations that are not readily advertised as publically available parking – permit holder only or customer only parking. Most of these additional parking spaces likely exist outside of C-3.

The supply model and model results reflect available data and resources. Data-related issues that could substantively affect results are the completeness (e.g., percentage of actual properties included) and accuracy of Costar's commercial property database, and the difficulties matching addresses from different datasets, including Costar and SFpark. Given available data, the logit model, which predicted whether or not sites had parking, performed very well. The linear model, which estimated the actual number of parking spaces, performed more modestly. But the error simulation should effectively account for the range of possible results according to both models. Results are intended to be used in aggregate.

The model results can help stakeholders better understand San Francisco's parking supply and more accurately evaluate parking-related policies.

Appendix D. Regulatory Environment Overview

This appendix summarizes codes, policies, and other regulatory topics pertaining to San Francisco parking. Specifically, it addresses non-residential, off-street parking. It seeks to briefly cover relevant policies and offer context to the Parking Supply and Utilization Study. It contains five sections: 1) San Francisco City Charter, 2) Current Laws 3) Plans, 4) Further Parking Pricing and Regulation Efforts, and 5) Conclusion.

D.1 San Francisco City Charter

Section 8A.100 – Preamble. This section requires the San Francisco Municipal Transportation Agency (SFMTA) to manage San Francisco's transportation system which includes automobile, freight, transit, bicycle, and pedestrian networks to help the city meet its goals for quality of life, environmental sustainability, public health, social justice, and economic growth. This Preamble also identifies a number of transportation-specific requirements of the San Francisco transportation system.

Section 8A.105 – Municipal Transportation Fund. This section stipulates that San Francisco's parking-related revenues be used to support public transit. These revenues include from parking meters (with certain exceptions), revenues from off-street parking facilities under the jurisdiction of SFMTA (with certain exceptions), and parking violation fines, forfeited bail, and penalties (with certain exceptions).

Section 8A.113 – Parking and Traffic – Governance. This section assigns parking and traffic management responsibilities to SFMTA.

Section 8A.115 – Transit-First Policy. Subsection A lists principles that constitute the City and County's transit first policy, including establishing the safe and efficient movement of people and goods as the transportation system's primary objective, asserting that travel by public transit, by bicycle and on foot must be an attractive alternative to travel by private automobile, and instructing that parking policies for areas well served by public transit shall be designed to encourage travel by public transit and alternative transportation. Subsection B asserts that San Francisco may not require or permit off-street parking spaces for any privately-owned structure or use in excess of the number that City law would have allowed for the structure or use on July 1, 2007, unless the additional spaces are approved by a four-fifths vote of the Board of Supervisors.

D.2 Current Laws

D.2.1 San Francisco Planning Code

There are several parking-related elements in the San Francisco Planning Code.[24] This discussion covers the most relevant items from parking-related portions of the code.

Section 155g. This section is meant to discourage long-term commuter parking at off-street parking spaces provided for a structure or use other than residential or hotel in a C-3, C-M, DTR, SLR, SSO, SPD, MUG, WMUG, MUR, WMUO, or MUO District.[25] C-3 denotes Downtown Commercial Districts, C-M denotes the Heavy Commercial District, and the other abbreviations denote various zones in the South of Market Mixes Use Districts and Eastern Neighborhoods Mixed Use Districts, which are located near the downtown area. 155g is the only element that specifically regulates parking prices. It requires the following rate or fee structures:

- The rate charge for four hours of parking duration is no more than four times the rate charge for the first hour;
- The rate charge for eight or more hours of parking duration is no less than 10 times the rate charge for the first hour; and
- Discounted parking rates for weekly, monthly or similar time-specific periods is not permitted.

Section 157.1. This sections lists criteria and requirements for going above the zoning caps on the number of parking spaces. Once these caps are exceeded, parking is not treated as an accessory to the building's purpose; instead, the building is considered a parking facility in its own right, and spaces must be made available to the public on equal terms. Since this section was incorporated, there have been very few applicants seeking to exceed their zoning caps.

Section 151.1. Section 151.1 covers parking limits by district.

Section 158. This section denotes criteria for major parking garages in the C-3 district.

Enforcement. The code (including 155g) is enforced by complaint basis only. SF Planning has the resources to address about 700 complaints a year. There have been conversations about sharing enforcement responsibilities with SFMTA, and the code might need to be amended to do this. SFMTA would then be able to enforce and penalize violations with fines. Right now, cease and desist orders, rather than fines, are SF Planning's response to infractions. Any properties with outstanding enforcement actions cannot obtain new permits, which affects

[24] The study thanks Josh Switzky from the San Francisco Planning Department for insight regarding the Planning Code.

[25] See http://www.sf-planning.org/index.aspx?page=1580 for a full list of zoning descriptions. A map is available at http://www.sf-planning.org/modules/showdocument.aspx?documentid=9016.

larger property owners more. Sometimes, the city attorney addresses cases of persistent non-compliance.

D.2.2 San Francisco Business and Tax Regulations Code

Article 9 – Tax on Occupancy of Parking Space in Parking Stations. This article levies a tax on parking rentals at all non-residential spaces in San Francisco, including spaces that are bundled with building leases. The tax is 25% of the rent charged for occupancy of a parking space. "Rent" is equal to the monthly rate for the public to park in the station. If monthly parking is not offered to the public, the monthly rent is considered to be $250 in the Downtown Area (i.e., C-3 Districts) and $80 in other areas. The Tax Collector can apply these two values as minimum monthly rates for publically available parking and can adjust these values if they do not reflect the market. [26] In accordance with Proposition A, which was passed in November 2007, the SFMTA receives 80% of the total parking tax revenues received by the City of San Francisco.[27]

D.2.3 SF Transportation Code

The Transportation Code governs most uses of the public right-of-way and addresses some parking-related topics, such as on-street and off-street parking infractions (Section 7.2). If focuses on on-street parking and publically operated off-street parking, but does not address the provision or management of privately operated off-street parking.

D.2.4 San Francisco Public Works Code

The Public Works code provides some public right-of-way regulations related to parking, such as obstruction and encroachment. These include Sections 723, 724, and 786. The code does not extend into management of parking facilities.

D.2.5 Proposition B, Proposition K, and the San Francisco County Transportation Authority

San Francisco voters passed Proposition B in 1989. The proposition established a 20-year local ½ cent sales tax for transportation. The San Francisco County Transportation Authority (SFCTA) was created to administer the tax. In 2003, voters passed Proposition K, which established a ½ cent sales tax and superseded Proposition B. SFCTA administers and oversees the delivery of Proposition K. The SFCTA also administers Proposition AA, a local vehicle registration fee that funds street repair and reconstruction, pedestrian safety, and transit

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[26] http://sftreasurer.org/parking-tax-notice

[27] https://www.sfmta.com/sites/default/files/pdfs/SFMTA%20Adopted%20Operating%20Budget%20Book%20FY2015%20AND%20FY2016.Full%20details.pdf

reliability and mobility improvement projects. The SFCTA's governing board comprises the eleven members of the San Francisco Board of Supervisors.[28,29]

SFCTA is also responsible for developing and administering San Francisco's Congestion Management Program (CMP). The Authority leverages state and Federal transportation dollars to complement Prop K revenues. SFCTA tracks transportation system performance and prepares the long-range San Francisco Transportation Plan to guide future investment decisions.[30]

D.3 Plans

D.3.1 San Francisco General Plan

The San Francisco General Plan mentions parking in many instances.[31] The following paragraphs are meant to identify the most relevant parking objectives and policies from the Plan's Transportation Element rather than serve as an exhaustive list of all parking-related issues.

Preamble – Priority Principle 4. This priority principle states that commuter traffic should not impede Muni transit services or overburden streets or neighborhood parking. Priority principles are used to resolve inconsistencies within the General Plan.

Transportation Element – Regional Parking– Objective 7. Objective 7 calls for developing a parking strategy that encourages short-term parking at the periphery of downtown and long-term intercept parking at the periphery of the urbanized bay area to meet the needs of long-distance commuters. The Fundamental Assumptions portion of the Plan's Transportation Element Introduction section describes the impetus for discouraging long-term parking: "As a land use, off-street parking facilities compete with and displace land uses that provide greater social and economic benefit to the city." In addition to land use concerns, this portion of the Plan also cites congestion mitigation as a motivation for limiting parking capacity, especially long-term parking in commercial areas.

Transportation Element – Parking Management– Objectives 16, 17. These objectives assert that parking management is one of the most effective employer-based strategies for reducing vehicle trips and increasing employee use of alternative modes. Objective 16 aims to manage parking supply and discourage drive alone trips. Objective 17 seeks to encourage efficient parking usage in the downtown area. Relevant policies from these two objectives include:

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[28] Sfcta.org

[29] http://www.bayrailalliance.org/l/?q=san_francisco_citycounty_proposition_b_12_sales_tax

[30] Sfcta.org

[31] http://www.sf-planning.org/ftp/general_plan/I4_Transportation.htm

- Policy 16.2: Reduce parking demand where parking is subsidized by employers with "cash-out" programs in which the equivalency of the cost of subsidized parking is offered to those employees who do not use the parking facilities. Cash-out is mentioned in other General Plan policies as well.

- Policy 16.3: Reduce parking demand through the provision of incentives for the use of carpools and vanpools at new and existing parking facilities throughout the City.

- Policy 16.4: Manage parking demand through appropriate pricing policies including the use of premium rates near employment centers well-served by transit, walking and bicycling, and progressive rate structures to encourage turnover and the efficient use of parking.

- Policy 16.5: Reduce parking demand through limiting the absolute amount of spaces and prioritizing the spaces for short-term and ride-share uses.

- Policy 17.1: Discourage the provision of new long-term parking downtown and near major employment centers.

Transportation Element – Citywide Parking – Objectives 30, 31, 32, 33, 34, 35. These objectives address citywide parking (Objectives 30-31), downtown (zone C-3) parking (Objective 32), and non-downtown parking (Objectives 33-35). Many of the policies reiterate principles conveyed in Objectives 16-17, including encouraging short-term over long-term parking, limiting parking supply, and establishing cashout programs. Relevant policies from these six objectives include:

- Policy 30.1: This stipulates that new parking facilities must meet a number of criteria before being developed. Relevant criteria include:

  - Demonstrated demand for additional parking that cannot be met by transit or more efficient use of existing facilities;
  - Provision of parking for bicycles, compact autos, and motorcycles (Policy 30.5 adds vanpools as well); and
  - Convertibility to other uses if parking demand decreases.

- Policy 30.6: Parking should be available to nearby residents and the general public when not being used by the business or institution to which it is accessory.

- Policy 31.1: Set rates to encourage short-term over long term automobile parking. This policy aims to establish parking rates that fully reflect the full monetary and environmental costs of parking. Policy 31.2, which is similar, stipulates that short-term parking with higher turnover is a more efficient use of parking than long-term parking. The policies do not explicitly address congestion.

- Policy 32.1: Discourage new long-term commuter parking spaces for single-occupant automobiles in and around downtown**.** Limit the long-term parking spaces to the number that already exists.

- Policy 34.5: Minimize the construction of new curb cuts in areas where on-street parking is in short supply and locate them in a manner such that they retain or minimally diminish the number of existing on-street parking spaces.

D.3.2 San Francisco Transportation Plan 2040

SFCTA's Transportation Plan 2040 highlights MAPS and SFpark and finds that generally, managing travel demand (e.g., parking pricing, cordon pricing) tends to be more cost-effective than investing in transportation supply (e.g., building new infrastructure).[32] Appendix C of the Transportation Plan, the Core Circulation Study, attempts to quantify how different transportation improvements would affect overall auto demand and congestion in the greater Downtown area, including SOMA.[33] It characterized the MAPS AM/PM Northeast Cordon scenario as one of the only proposed scenarios that could singlehandedly reduce PM peak vehicle miles traveled (VMT) in SOMA by 10% to 15%.

D.4 Further Parking Pricing and Regulation Efforts

D.4.1 Mobility, Access and Pricing Study

The SFCTA conducted the Mobility, Access and Pricing Study (MAPS), which was approved by the Transportation Authority Board in 2010. The study explored managing congestion, reducing greenhouse gases, and supporting sustainable growth through congestion pricing. Congestion pricing involves charging drivers a user fee to drive in specific congested areas or corridors, and using the revenue generated to fund transportation improvements, such as better transit service, road improvements, and bicycle and pedestrian projects. MAPS found that congestion pricing would be a feasible way of meeting San Francisco's goals for sustainable growth, but San Francisco is still in the early stages of exploring this strategy.[34] The study's AM/PM Northeast Cordon scenario performed particularly well. The scenario proposes to charge $3 fees to drivers crossing into or out of the northeastern portion of the city (bounded by Laguna St., Guerrero St., 18th St., and the waterfront) during AM or PM peak hours and would invest surplus fee revenues in transportation improvements.

D.4.2 SFpark Program

The SFMTA conducted the SFpark pilot program, which tested a new parking management system at 7,000 of San Francisco's 28,800 metered on-street spaces and 12,250 spaces in 15 of 20 city-owned parking garages. SFpark periodically adjusts parking pricing to match

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32 http://www.sfcta.org/sites/default/files/content/Planning/SFTP2/FinalReport/SFTP_final_report_low-res.pdf

33 http://www.sfcta.org/sites/default/files/content/Planning/SFTP2/FinalReport/Appendix%20C%20Core%20Circulation%20Study.pdf

34 http://www.sfcta.org/transportation-planning-and-studies/congestion-management/mobility-access-and-pricing-study-home

demand, ensuring that spaces remain available so that drivers can quickly locate parking. Demand-responsive pricing encourages drivers to park in underused areas and garages, reducing demand in overused areas. In 2014, SF*park* released its full evaluation, which demonstrated that demand-responsive pricing can improve parking availability and yield secondary benefits including reduced congestion and mobile emissions. Demand-responsive rate adjustments continue in the SF*park* pilot areas, and SFMTA will use the evaluation results to develop a proposal for expanding the SF*park* approach to SFMTA's other meters, lots and garages.[35]

D.4.3 San Francisco Commuter Benefits Ordinance

The San Francisco Department of Environment's (DOE) Commuter Benefits Ordinance (CBO) aims to reduce congestion and greenhouse gas emissions from drive alone trips. It requires businesses with a location in San Francisco and 20 or more employees nationwide to offer one of several benefits:[36]

- **Pre-tax Transportation Benefits –** A monthly pre-tax deduction, up to $130 per month, to pay for transit or vanpool expenses.
- **Employer-Paid Transportation Benefits –** A monthly subsidy for transit or vanpool expenses equivalent to the price of the San Francisco Muni Fast Pass (including BART travel), which is currently $76 per month.
- **Employer-Provided Transportation** – A company-funded bus or van service to and from the workplace.
- Any combination of the above.

In the event of non-compliance with the CBO, the DOE first delivers a written warning and then levies a fine 90 days after the initial written notice. Employers face a fine of $100 for the first violation, $200 for the second violation and $500 for the third violation, up to a maximum of $800.[37]

D.4.4 Bay Area Commuter Benefits Program

In 2014 the Bay Area Air Quality Management District (BAAQMD) and Metropolitan Transportation Commission adopted the Bay Area Commuter Benefits Program, which requires registration from any business with 50 or more employees across all sites in the Bay Area. San Francisco Bay Area employers with 50 or more full-time employees within the BAAQMD

[35] sfpark.org

[36] Businesses with more than 50 employees across the Bay Area do not need to comply with the San Francisco Ordinance but need to register with the Bay Area Commuter Benefits Program (see next subsection).

[37] http://www.sfenvironment.org/article/businessesemployees/san-francisco-commuter-benefits-ordinance-overview

geographic boundaries were required to register and offer commuter benefits to their employees by September 30, 2014 in order to comply with Air District Regulation 14, Rule 1: the Bay Area Commuter Benefits Program. Employers must select one of four Commuter Benefit options to offer their employees to encourage employees to take transit, vanpool, carpool, bicycle and walk rather than drive alone to work:

- Allow employees to exclude their transit or vanpool costs from taxable income, to the maximum amount, as allowed by Federal law (currently $130 per month);
- Employer-provided transit subsidy (or transit pass) or vanpool subsidy up to $75 per month;
- Employer-provided free or low cost bus, shuttle or vanpool service operated by or for the employer; and
- An alternative employer-provided commuter benefit that is as effective as in reducing single occupant vehicles as Options 1-3.[38]

D.4.5 State of California Parking Cashout Law

The State of California enacted a law in 1992 intended to reduce auto commute trips by requiring firms to offer employees parking cashout. Under this law, certain firms providing subsidized parking to employees are required offer a cash allowance to these employees in lieu of a parking space.

Firms that meet all of the following criteria are subject to the cash-out law[39]:

- Employ at least 50 persons (regardless of how many worksites);
- Have worksites in an air basin designated nonattainment for any state air quality standard;
- Subsidize employee parking that they do not own;
- Can calculate the out-of-pocket expense of the parking subsidies they provide; and
- Can reduce the number of parking spaces without penalty in any lease agreements.

While violations of the policy are subject to civil penalties of up to $500 per vehicle per civil action, the California Air Resources Board has announced its intention to "facilitate compliance before seeking civil penalties." In San Francisco, the law is self-implemented; there are no reporting requirements that would identify firms who failed to comply. Santa Monica is an example of a city that implements that law more strictly: it fines firms $5 per day for non-compliance with either the state ordinance or a set of local parking-related ordinances.[40]

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[38] https://commuterbenefits.511.org/

[39] California's Parking Cashout Program http://www.arb.ca.gov/planning/tsaq/cashout/cashout_guide_0809.pdf

[40] City of Santa Monica – Employers and Ordinance 1604 http://www.smgov.net/Departments/PCD/Transportation/Employers/

D.5 Conclusion

These documents, policies, plans, and studies constitute San Francisco's current parking regulatory environment and lay the groundwork for future parking management efforts. The City Charter assigns SFMTA parking management responsibilities and establishes the Transit-First policy. Portions of the city's Planning Code and General Plan discourage parking, particularly long-term parking, with the primary aim of more efficient land use. But parking management is not an established congestion mitigation tool in San Francisco's existing policies. SFCTA, which administers the Congestion Management Program, is currently studying off-street parking strategies that could help mitigate congestion and promote the Transit-First policy. These strategies could complement the on-street parking regulatory environment, including the demand-responsive pricing studied under SFMTA's SF*park* program.

Appendix E. PSUS Parking Strategy Evaluation

E.1 Introduction

Improving mobility and managing congestion are important elements in sustaining San Francisco's role as a growing social and economic center. According to the Texas Transportation Institute's 2015 Urban Mobility Scorecard, the San Francisco-Oakland urban area experienced the country's third highest yearly hours of delay per auto commuter in 2014.[41] With high projected housing and job growth in northeastern San Francisco, travel demand is expected to exceed the road network's capacity. The core network can only accommodate approximately half of the demand increase forecasted for 2035 before reaching perpetual gridlock during peak periods.[42]

The San Francisco County Transportation Authority (SFCTA) has explored several novel approaches that could enhance the city's mobility. Policies that address the demand for and supply of parking represent one set of these potential approaches.

An earlier SFCTA effort, the Mobility, Access and Pricing Study (MAPS), examined cordon pricing, which involves charging drivers a user fee to drive into or out of specific congested areas or corridors, and using the revenue generated to fund transportation improvements. MAPS found that congestion pricing would be a feasible way of meeting San Francisco's goals for sustainable growth.[43]

More recently, the San Francisco Municipal Transportation Agency (SFMTA) conducted the SFpark pilot program, which tested a new parking management system at many of San Francisco's metered on-street spaces and city-owned parking garages. The SFpark evaluation demonstrated that demand-responsive pricing can improve parking availability and yield secondary benefits, including reduced local congestion and mobile emissions.

The Parking Supply and Utilization Study (PSUS) evaluates the feasibility of several additional parking-related strategies from a transportation demand management perspective, examining potential for congestion reduction through mode shift and peak spreading. PSUS focuses on off-street, non-residential parking supply[44], looking at policies that could complement the

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[41] http://d2dtl5nnlpfr0r.cloudfront.net/tti.tamu.edu/documents/ums/congestion-data/national/national-table-all.pdf

[42] San Francisco Transportation Plan 2040 – Appendix C: Core Circulation Study. The "core" refers to the Downtown, South of Market (SoMa), and Mission Bay neighborhoods.

[43] http://www.sfcta.org/transportation-planning-and-studies/congestion-management/mobility-access-and-pricing-study-home

[44] The Introduction chapter overviews the different types of parking in San Francisco. The Study also further distinguishes off-street supply between publically- and privately-accessible parking. Publically-available parking is available for the general public but privately-accessible parking is not and is instead consumed by individuals who reserve it ahead of time

existing on-street regulatory setting, including SFpark demand based pricing. PSUS concentrated on the northeastern portion of San Francisco, which includes the downtown area.

This appendix summarizes evaluation and findings. At its onset, the Study compiled a list of candidate parking strategies and screened them based on effectiveness and evaluability.[45] Table E.1 lists the specific strategies that passed through the screening process and were evaluated. The strategies are grouped into four categories: fee-based strategies, bulk discount eliminations, parking cashout, and supply-related strategies.[46]

Table E.1 PSUS Evaluated Parking Strategies

Category	#	Strategy
Fee-Based	1B	Annual fee for pre-paid parking: Landlord is required to pass annual fee to driver.
Fee-Based	3	Universal parking access fee: All parkers on work and non-work trips pay a fixed fee each time they park, regardless of whether there is a financial transaction for use of the space; this fee can also be varied by time of day.
Fee-Based	4A	Fixed point of sale charge, all day: Each time paid parking is consumed, driver pays a flat fee on top of the existing 25% tax.
Fee-Based	4B	Fixed point of sale charge, peak-only: This strategy is same as 4A, except it only applies at certain times (to focus on peak congestion).
Bulk Discount Elimination	2A	Eliminate all bulk parking discounts citywide: This strategy would eliminate daily and monthly pricing discounts for publically-accessible and privately-accessible parking stall users. All users would pay hourly parking.
Bulk Discount Elimination	2B	Eliminate pre-paid monthly parking: This strategy would eliminate monthly parking passes for publically-accessible and privately-accessible parking stall users. All users would pay either daily or hourly parking.
Bulk Discount Elimination	2C	Adjust parking sales tax to reward parking operators (both publically-accessible and privately-accessible parking stalls) for eliminating non-hourly (daily or monthly passes) discounts.
Bulk Discount Elimination	2D	Institute a graduated annual per space fee to reward parking operators (both publically-accessible and privately-accessible parking stalls) for eliminating non-hourly (daily or monthly passes) discounts.
Supply	5A	Redevelop some SFMTA owned garages and lots to reduce supply.
Supply	5B	Constrain future growth of parking supply (not allow the number of spaces to exceed 2015 levels).

45 The Candidate Screening appendix describes the strategies and details the screening process. This appendix, the Parking Strategy Evaluation, uses the numbering scheme from the Candidate Screening appendix.

46 Bulk discounts refer to the lower per-hour prices charged to parkers who purchase parking on a daily or monthly rather than hourly basis. Parking cashout refers to a policy that requires employers who provide subsidized parking to their employees to offer cash in lieu of their parking spaces; these employees can choose to cashout their parking spaces and use alternative modes to commute.

Category	#	Strategy
Supply	5C	Cap and trade (at a certain parking supply level): This could create an incentive for new buildings that are required to build certain number of stalls to "trade" their parking allotment. Surface lots and privately-accessible garages would also be incentivized to convert to other land uses.
Cashout	7A	Increased enforcement of existing state parking cashout law.
Cashout	7B	Expand parking cashout to apply to smaller businesses (i.e., less than 50 employees) or larger businesses that are not subject to the law because they do not lease space, both of which are currently exempt from law.

The remainder of the appendix is organized into three major chapters. The methodology chapter explains the overall evaluation approach and the process used to evaluate the individual strategies. The results by strategies group chapter presents detailed findings for individual strategies organized by group. The closing chapter compares results across groups, highlights the key findings, and describes how the evaluation feeds into the overall study.

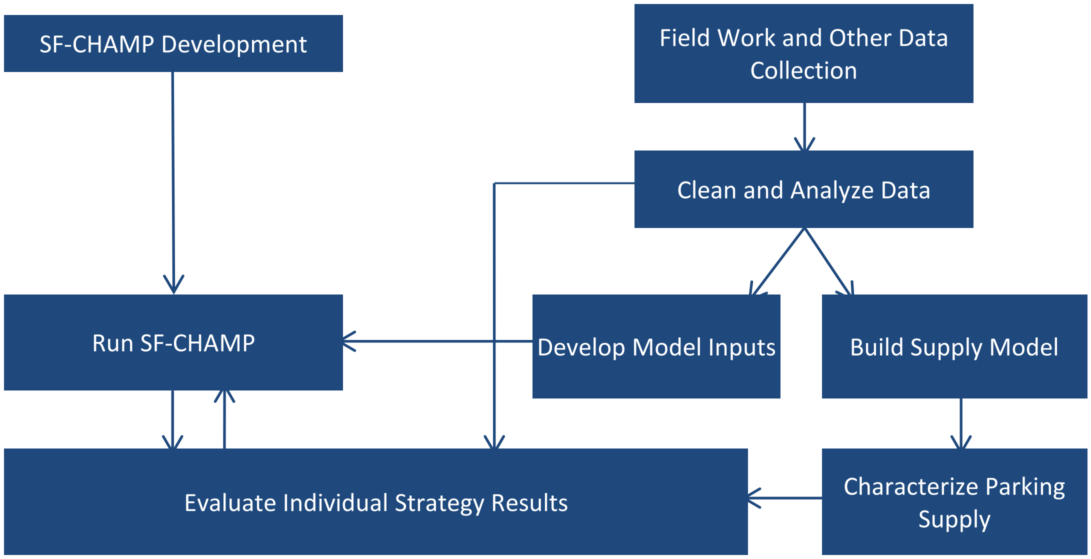
E.2 Methodology

E.2.1 Overall Evaluation Approach

The Parking Supply and Utilization Study seeks to evaluate how parking strategies affect congestion and mode share in San Francisco. It focuses on non-residential, off-street parking. Data collection and analysis, the SF-CHAMP[47] travel demand model capabilities, and other factors shaped the evaluation approach. Figure E.1 shows the different portions of the evaluation process.

[47] SF-CHAMP documentation is available on the SFCTA web site: http://www.sfcta.org/modeling-and-travel-forecasting.

Figure E.1 Parking Supply and Utilization Study Outline



Data were gathered from existing sources and field work. Field work was conducted in the northeastern portion of San Francisco and included an intercept survey of parkers, a supply survey to check whether off-street parking existed at different locations, and an operator survey of garage and lot operators. The Methodology chapter and Supply Model Methodology and Results appendix further discuss these data sources.

The study cleaned and analyzed the data to 1) produce SF-CHAMP model inputs, 2) evaluate individual parking strategies off-model, and 3) build the parking supply model. SF-CHAMP model refinements occurred in parallel with the final stages of data collection. Then, SF-CHAMP runs occurred in parallel with supply model development. Finally, the SF-CHAMP runs, off-model analysis, and supply model helped the study to evaluate the individual parking strategies.

The study used SF-CHAMP to understand how price changes associated with potential parking strategies could affect congestion and mode share. For the study, SFCTA revised the manner in which SF-CHAMP handles parking pricing inputs to capture more granularity. Accordingly, new parking pricing model inputs were developed to reflect variations in pricing structure (i.e., monthly, daily, hourly) and time of day (e.g., Early AM to PM Peak or AM Peak to Midday). Inputs for the percentage of parkers paying for their own parking were also updated.

E.2.2 Analysis Geographies and Timeframes

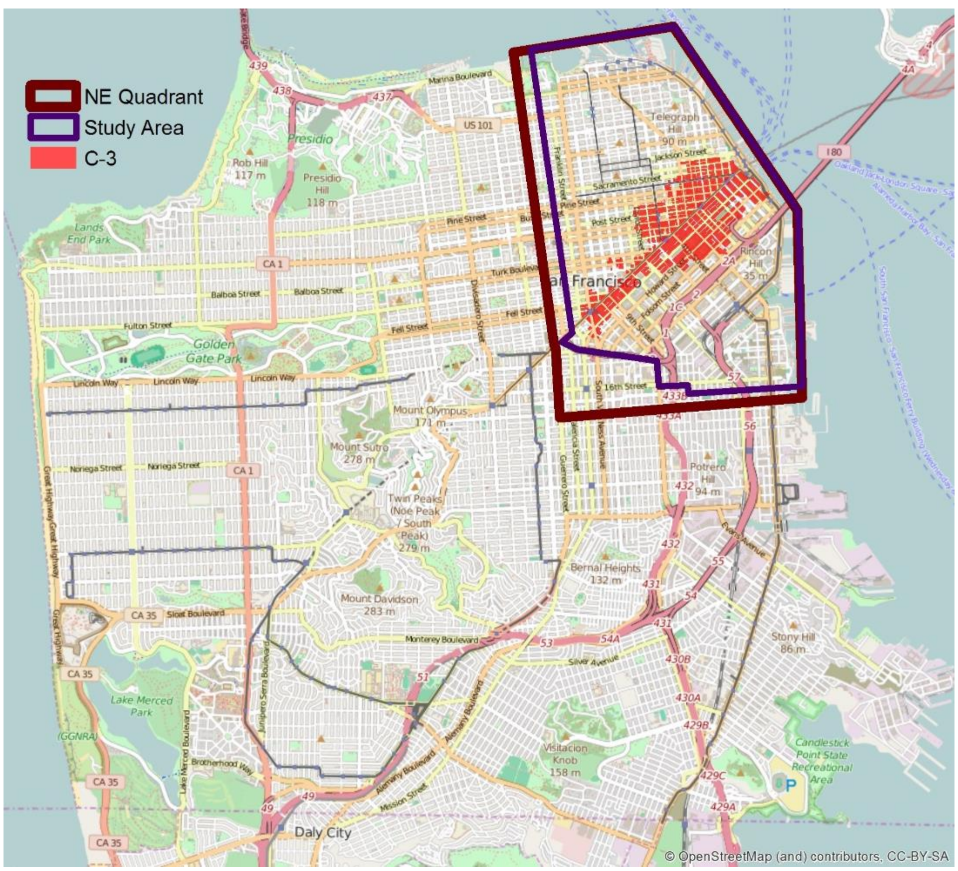
This report frequently discusses analysis and results using multiple geographies: the City as a whole, the Northeast Quadrant (or NE SF, for short), and the Study Area. The Northeast Quadrant is defined based on the cordon boundaries that the MAPS study identified in its top-performing scenario. This area is bounded by Guerrero Street, Laguna Street, 18th Street, and San Francisco Bay. Using the same geographic boundaries here in this study offers the opportunity to examine selected differences in transportation performance outcomes between cordon pricing and parking strategies.

The term "Study Area" refers to a smaller portion of the City where field work was conducted for the PSUS. A smaller Study Area allowed the field work to focus on neighborhoods with high concentrations of trip destinations, and thus parking facilities. The Study Area is bounded by:

- Gough Street to the west;
- Route 101 to the southwest;
- Potrero Avenue, 16th Street, and Kansas Street to the south central;
- Mariposa Street to the southeast; and
- San Francisco Bay to the north and east.

The report also references the C-3 area. The C-3 District, or Downtown Commercial District, is a Planning Department zoning designation given to many of the highest-density portions of northeastern San Francisco.[48] Figure E.2 shows the Northeast Quadrant and Study Area boundaries and the C-3 district.

Figure E.2 Northeast Quadrant and Study Area Boundaries



[48] http://www.sf-planning.org/index.aspx?page=1583

The Results figures and tables typically refer to two different timeframes – the AM Peak and 24-hour total – and two different geographies – the Northeast Quadrant and San Francisco as a whole. Four "timeframe-geography pairings" refer to the unique combinations of these two variables. SF-CHAMP includes other timeframes and geographies, but these were selected for relevance and simplicity. AM Peak and PM Peak results were similar, so the study chose to focus on one rather than both timeframes.

E.2.3 Evaluation Metrics

The evaluation focuses on metrics that reflect the study's goals of reducing congestion and shifting trips from drive alone to other modes, including transit, carpool, and active transportation. The emphasized transportation performance metrics are drive alone trip mode share, vehicle miles traveled (VMT), and vehicle hours of delay (VHD). Mode shifts are described as percentage point changes[49] and VMT and VHD reductions are described as percent changes. The Study seeks strategies that reduce VMT and especially VHD, typically attributable to reductions in drive alone mode share, and without significant trip suppression. Parking-related revenue is also discussed.

E.2.4 Strategy-Specific Evaluations

SF-CHAMP is good at evaluating the effects of pricing changes on transportation outcomes, but it does not explicitly represent parking supply at this time. Therefore, certain parking strategies need to be evaluated with off-model approaches. This section presents the evaluation approach for each potential strategy, distinguishing between SF-CHAMP evaluation and off-model analysis. Since SF-CHAMP does not differentiate between on-street and off-street parking, all evaluation approaches assume a commensurate change in on-street parking strategy to reinforce any of the scenarios tested. The pricing changes in SF-CHAMP apply to the Northeast Quadrant.

- **1B – Add annual fee for prepaid parking: Landlord is required to pass annual fee to driver.** This strategy would assess an annual fee on drivers.
  - SF-CHAMP Evaluation: No model run.
  - Off-Model Analysis: The supply model and accompanying data were used to estimate the percentage of spaces that are privately accessible. Since this percentage is very low, this strategy's impact on transportation performance outcomes is expected to be minimal.

[49] In the AM Peak Northeast Quadrant, baseline mode shares are 41 percent transit, 33 percent non-motorized, 15 percent drive alone, and 11 percent carpool. A 1.0 percentage point reduction in a 15 percent drive alone mode share is roughly a 6.7 percent reduction.

- **2A – Eliminate all bulk parking discounts citywide.** This strategy would eliminate daily and monthly pricing discounts for publically accessible and privately accessible parking stall users. All users would pay hourly parking.[50]
  - SF-CHAMP Evaluation: Used results from 2B model run.
  - Off-Model Analysis: The intercept survey was used to determine the proportion of bulk discount parkers who pay for parking on a daily versus monthly basis. The mode shift from the monthly discount elimination model run (see 2B below) was multiplied by the proportion of daily to monthly parkers to estimate possible mode shift for daily discount elimination. The mode shift for daily discount elimination was then combined with the monthly discount elimination estimate from 2B. Information from other SF-CHAMP runs about the relationship between mode share and congestion was used to determine how much this mode shift reduces congestion.
- **2B – Eliminate prepaid monthly parking.** This strategy would eliminate monthly parking passes for publically accessible and privately accessible parking stall users. All users would pay either daily or hourly parking.
  - SF-CHAMP Evaluation: Monthly pricing was eliminated and hourly and daily prices were applied in the model to individuals who pay for parking.[51]
  - Off-Model Analysis: Model results were supplemented with intercept survey revealed and stated preferences regarding this strategy.
- **2C – Adjust parking sales tax to reward parking operators (both publically accessible and privately accessible parking stalls) for eliminating nonhourly (daily or monthly passes) discounts.**
  - SF-CHAMP Evaluation: Used results from 2B model run.
  - Off-Model Analysis: Mode shift and congestion results from the 2B model run and 2A off-model analysis were used to determine how many daily and monthly parkers would switch modes if they did not purchase parking in bulk, and how this mode shift would affect congestion. Potential revenue loss to garages due to this mode switch was also examined.
- **2D – Institute a graduated annual per space fee to reward parking operators (both publically accessible and privately accessible parking stalls) for eliminating nonhourly (daily or monthly passes) discounts.**

[50] This strategy is an expansion of the San Francisco Planning Code section 155(g) to a larger geography and to buildings formerly unaffected by the policy. The Implementation chapter and Regulatory Environment appendix discuss 155(g) in greater detail.

[51] Since SF-CHAMP is a 24-hour simulation, it does not actually apply monthly prices in the baseline. Instead, it uses proxies for monthly pricing.

  - SF-CHAMP Evaluation: Used results from 2B model run.

  - Off-Model Analysis: Mode shift and congestion results from the 2B model run and 2A off-model analysis were used to determine how many daily and monthly parkers would switch modes if they did not purchase parking in bulk, and how this mode shift would affect congestion. Potential revenue loss to garages due to this mode switch was also examined.

- **3 – Institute a universal parking access fee.** All parkers on work and nonwork trips pay a fixed fee each time they park, regardless of whether there is a financial transaction for use of the space; this fee can also be varied by time of day.

  - SF-CHAMP Evaluation: Used results from 4B and 7B mode runs.

  - Off-Model Analysis: Mode shift and congestion results from the 4B and 7B[52] runs (see below) were used to approximate the effects of a peak-hour fee applied to all parkers. Model results were supplemented with intercept survey revealed and stated preferences. Price points from other model runs and survey data were used to determine the relationship between fee amount and the likely transportation performance impacts (i.e., mode shift, congestion reduction).

- **4A – Institute a fixed point of sale charge, all day.** Each time paid parking is consumed, driver pays a flat fee on top of the existing 25 percent tax.

  - SF-CHAMP Evaluation: A flat fee was applied in peak periods and midday to work trips not reimbursed by employers[53], as well as to nonwork trips.

  - Off-Model Analysis: Model results were supplemented with intercept survey revealed and stated-preferences. Price points from other model runs and survey data were used to determine the relationship between fee amount and the likely transportation performance impacts (i.e., mode shift, congestion reduction).

- **4B – Institute a fixed point of sale charge, peak-only.** This strategy is the same as 4A, but only applies in AM and PM peak periods.

  - SF-CHAMP Evaluation: A flat fee was applied in peak periods to work trips not reimbursed by employers, as well as to nonwork trips.

  - Off-Model Analysis: Model results were supplemented with intercept survey revealed and stated-preferences. Price points from other model runs and survey data were used to determine the relationship between fee amount and the likely transportation performance impacts (i.e., mode shift, congestion reduction).

[52] 7B was used to approximate the fee's impact on subsidized commuters.

[53] For 4A and 4B, the model applies the fee to all parkers; but for subsidized parkers, the employers, rather than the parkers, face the cost increase.

- **5A – Redevelop some SFMTA-owned garages and lots to reduce supply.**
  - SF-CHAMP Evaluation: No model run.
  - Off-Model Analysis: Several types of data were examined to roughly estimate maximum potential mode shift: 1) estimated supply of parking spaces in Study Area, 2) rough approximation of average headroom (i.e., available spaces) across these garages using SFMTA usage data, 3) rough approximation of average headroom at similarly located privately operated garages using the operator survey, and 4) breakdown of number publically operated versus privately operated spaces in the high-congestion areas using the supply model. With this information, the number of trips diverted from SFMTA garages was determined and then the amount of these trips that would likely be absorbed by existing private supply was estimated. The trips absorbed by private supply was subtracted from total diverted trips to obtain a maximum mode share estimate. Other SF-CHAMP model runs were used to approximate how this mode shift might affect congestion.
- **5B – Constrain future growth of parking supply (not allow the number of spaces to exceed 2015 levels).**
  - SF-CHAMP Evaluation: No model run.
  - Off-Model Analysis: Because evaluation of future horizon years is not part of this study, general assumptions about parking demand growth were made. Calculations from Strategy 5A above were used to determine how much headroom is available in current high-congestion areas. From this, the year headroom will be filled was calculated to estimate the timeframe for when changes in travel behavior would occur.
- **5C – Cap and trade (at a certain parking supply level).** This creates an incentive for new buildings that are required to build a certain number of stalls to "trade" their parking allotment. Surface lots and private garages would also be incentivized to convert to other land uses.
  - SF-CHAMP Evaluation: No model run.
  - Off-Model Analysis: The "cap" element was covered in 5A and 5B. The evaluation of the "trade" element was not proposed given lack of detailed projections of construction by building type.
- **7A – Increase enforcement of existing state parking cashout law.**
  - SF-CHAMP Evaluation: Since the 7B SF-CHAMP run (below) had limited effects on transportation performance, a separate run was not conducted for 7A.
  - Off-Model Analysis: U.S. Census County and Zip Code Business Pattern firm size data were used to determine the proportion of employees working at firm sizes greater than

50, one criterion for the state cashout law. Using this ratio, the Study examined the subset of transportation effects from 7B that would also apply to 7A.

- **7B – Expand parking cashout to apply to smaller businesses, or to larger business that are not subject to the law because they do not lease space.**
  - SF-CHAMP Evaluation: Individuals who receive subsidized parking in the baseline were assumed to now pay 75 percent of parking cost to simulate the effect of cashout.[54]
  - Off-Model Analysis: Information from the intercept survey and other data sources was used to characterize potential market size for cashout in San Francisco. Baseline SF-CHAMP trip and tour information was used to supplement the analysis.

E.2.5 Scenario Development

Based on the strategy-specific methodologies, the following scenarios were modeled in SF-CHAMP. Each SF-CHAMP scenario is a specific proposed implementation of one of the parking strategies that can be tested, modeled, quantified, and evaluated.

- Baseline scenario (no strategies implemented);
- 2B. Eliminate monthly discount;
- 4A. Flat fee charged during AM peak, midday, and PM peak periods[55] ($3) [56;]
- 4Bi. Flat fee charged during peak periods ($3);
- 4Bii. Flat fee charged during peak periods ($6); and
- 7B. Elimination of employer-paid parking.

E.2.6 Relationship between Mode Shift and Congestion

Some strategies without their own SF-CHAMP scenarios rely on the modeled SF-CHAMP scenarios for information on the relationship between congestion and mode share. While survey data can estimate how individuals would shift modes if a particular strategy were in place, these instruments cannot effectively estimate the congestion changes associated with these mode shifts and are prone to biases. Travel demand models such as SF-CHAMP are often the best tools for estimating this congestion. The results from the modeled scenarios were used to develop a linear regression of the relationship between mode shift and congestion in order to estimate the congestion impacts of strategies that were not tested in SF-CHAMP.

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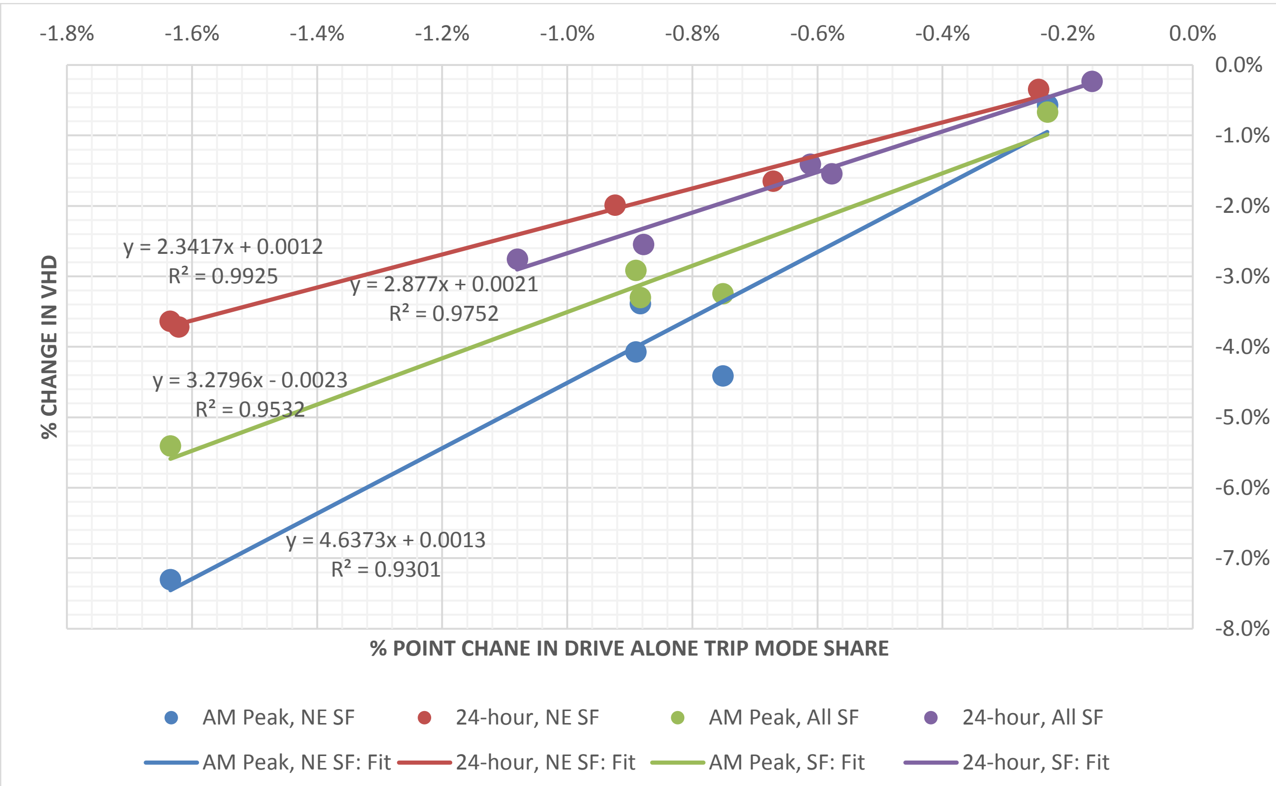
[54] Formerly subsidized individuals pay 75 percent, rather than 100 percent, since the reduction in parking benefit is equivalent to the pre-tax portion of the benefit, which constitutes most but not all of the benefit.

[55] SF-CHAMP uses five time periods: Early (3 – 6 AM), AM Peak (6 – 9 AM), Midday (9 AM – 3:30 PM), PM Peak (3:30 – 6:30 PM), Evening (6:30 PM – 3 AM).

[56] Fee amounts are discussed in the Fee-Based Strategies section.

Figure E.3 shows the percent change in VHD based on the percentage point change in drive alone mode share according to SF-CHAMP. It displays series for both AM Peak and daily and both the Northeast Quadrant and all of San Francisco. Each point corresponds with one of the tested scenarios. Linear trendlines fit each series.

Figure E.3 Relationship between Drive Alone Trip Mode Shift and Congestion Reduction



The chart shows a positive correlation between drive alone mode share and vehicle hours of delay. As drive alone mode share decreases, congestion tends to decrease. The high R-squared values of the fitted trendlines indicate that the lines fit the data very well. Therefore, the relationship between drive alone mode share and congestion is assumed to be approximately linear. The equations for each fitted trendline show how the slope of this linear relationship varies by geography and time period. The AM Peak, Northeast Quadrant trendline has the steepest slope; drive alone mode share reduction decreases congestion at a higher rate here compared to the other three geography-timeframe pairings.

E.3 Results by Strategy Group

This section describes the strategy evaluation findings, summarizing results for individual strategies in four groups: parking fee strategies (1B, 3, 4A, and 4B), bulk discount elimination strategies (2A, 2B, 2C, and 2D), parking cashout strategies (7A and 7B), and parking supply strategies (5A, 5B, and 5C). The next section, Synthesis and Conclusion, compares findings across policy groups and underscores key findings.

E.3.1 Parking Fee Strategies

Introduction

Several flavors of parking fee strategies were evaluated. Strategy 4A, or the all-day fee, charges a flat fee each time that paid parking is consumed in the Northeast Quadrant during the AM Peak, Midday, and PM Peak periods. Strategy 4B, or the peak fee, charges a flat fee each time that paid parking is consumed in the Northeast Quadrant during only the AM Peak and PM Peak periods. Strategy 3 charges a universal access fee on all work and non-work trips in the Northeast Quadrant during the AM Peak and PM peak periods. Strategy 1B levies an annual fee on drivers who use privately-accessible parking stalls (i.e., parking that is not available for the general public and instead is consumed by individuals who reserve it ahead of time). In locations where the 25% parking sales tax is applied, fees would be levied in addition to the 25% tax.

The study focused on two fee amounts: $3 and $6. Based on past analysis of pricing strategies and the intercept survey results from this study, a $3 fee is likely to be high enough to influence travel behavior at meaningful levels, while still being relatively modest compared to other costs of transportation use. The $6 fee, at twice the level of the $3 fee, represents a high book-end estimate of how parking fees could influence transportation performance. It roughly corresponds with the best performing cordon toll scenario from the MAPS study, which assumed $3 for entry and $3 for exit.

SF-CHAMP is well-suited for modeling strategies that directly manipulate parking pricing, such as fees. SF-CHAMP model scenarios were prepared for strategies 4A ($3 amount) and 4B ($3 and $6 amounts). The model simulated these fees by increasing parking costs only for individuals who pay for their own parking, because subsidized parkers would likely be insensitive to price changes. In contrast, the universal parking access fee is meant to exist independently of the parking payment transaction so that it influences both paying and subsidized parkers. To roughly approximate the universal access fee's transportation impacts, results from two model runs were combined together. Specifically, the peak fee strategy (4B) and expanded cashout strategy (7B) were synthesized. The scenario for strategy 7B applied parking cost to all individuals, including those who were subsidized, so it provides a way to assess the effect of the universal access fee on subsidized parkers.[57] Because strategy 3 would apply a flat fee rather than the full cost of parking, the approximation overestimates the fee's effect on subsidized parkers where the cost of parking is higher than the fee, and underestimate the fee's effect where the fee is higher than the cost of parking.[58] However, the

[57] 7B charged formerly subsidized parkers three quarters of the full cost of parking.

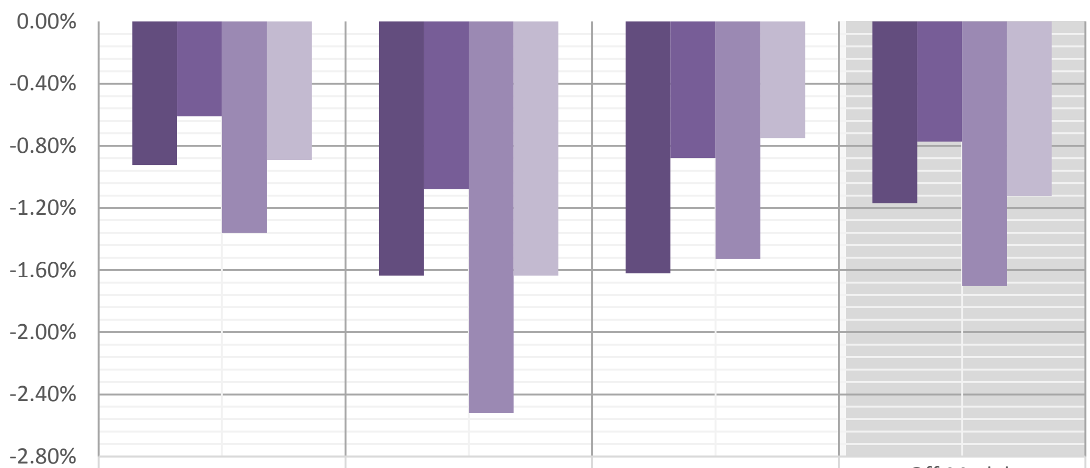
[58] The average revenue per transaction in the Northeast Quadrant is $5.49, so in aggregate, this approximation likely overestimates the effect of a $3 fee (three quarters of $5.59 is greater than $3).

estimated effect on subsidized parkers is small (i.e., the 7B results show limited changes in travel behavior), so this should not affect the results substantially.

Peak, All-Day, and Universal Access Fee Results

Figure E.4 charts drive alone trip mode share reduction for the 3 SF-CHAMP modeled fee scenarios plus the unmodeled universal access fee scenario, shaded in gray. Predictably, the peak $6 fee causes more mode shift than the other three scenarios that had lower fee levels. It reduces drive alone mode share by 2.5 percentage points in the Northeast Quadrant for the AM Peak. The $3 fees perform similarly to each other, with the universal access fee reducing drive alone mode share by 1.7 percentage points, the all-day fee reducing by 1.5 percentage points, and the peak fee reducing by 1.4 percentage points. As expected, the all-day fee reduces 24-hour drive alone mode share more effectively than the peak-fee in both the Northeast Quadrant and entire city. For the 24-hour results within the Northeast Quadrant, the $3 all-day fee and $6 peak fee produce nearly the same mode shift.

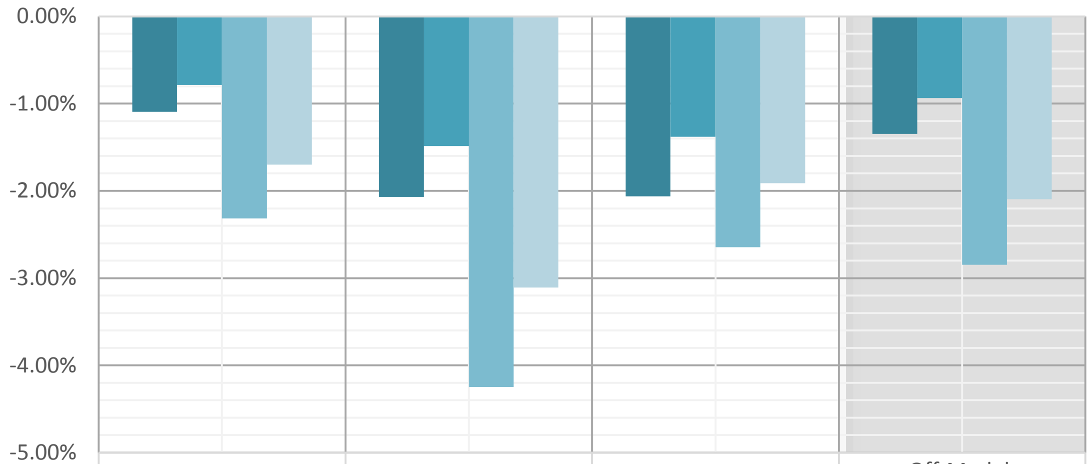
Figure E.4 Fee Strategy Comparison: Percentage Point Change in Drive Alone Trip Mode Share



	Model: Peak $3 Fee (4Bi)	Model: Peak $6 Fee (4Bii)	Model: All-Day $3 Fee (4A)	Off-Model: Univ. Acc. Peak $3 Fee (3)
24-Hour, NE SF	-0.9%	-1.6%	-1.6%	-1.2%
24-Hour, All SF	-0.6%	-1.1%	-0.9%	-0.8%
AM Peak, NE SF	-1.4%	-2.5%	-1.5%	-1.7%
AM Peak, All SF	-0.9%	-1.6%	-0.8%	-1.1%

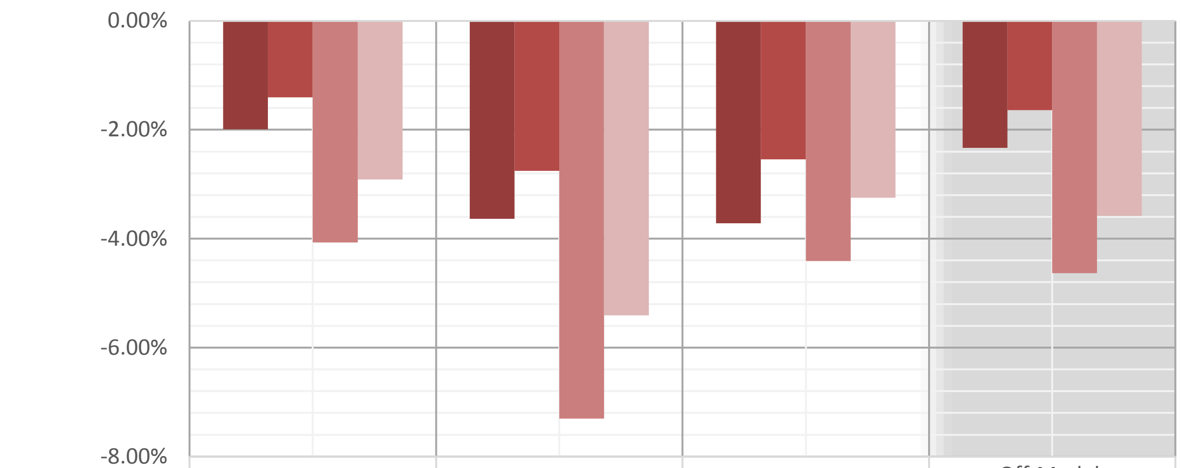
Whereas the peak fees incentivize a portion of commuters to shift their travel out of peak periods, the all-day fee appears to incentivize some of those drivers to shift modes altogether. For VMT and VHD reduction (Figures E.5 and E.6), the results are similar to those seen for reductions in drive-alone mode share. As before, the $3 universal access fee and $3 all-day fee perform better than the $3 peak fee in the AM Peak Northeast Quadrant. The all-day fee's application across the entire workday is able to influence the AM Peak congestion more than the peak-only fee. This could occur for a few potential reasons. The all-day fee might reduce congestion at the very start or end of the midday period, residually easing traffic during the abutting peaks. Or, perhaps some drivers on multiple-trip tours spanning several time periods (e.g., AM Peak to midday) might have been willing to make an AM Peak trip and pay the $3 fee once but were then unwilling to pay it again during midday and therefore changed modes.

Figure E.5 Fee Strategy Comparison: Percent Change in VMT



	Model: Peak $3 Fee (4Bi)	Model: Peak $6 Fee (4Bii)	Model: All-Day $3 Fee (4A)	Off-Model: Univ. Acc. Peak $3 Fee (3)
24-Hour, NE SF	-1.1%	-2.1%	-2.1%	-1.3%
24-Hour, All SF	-0.8%	-1.5%	-1.4%	-0.9%
AM Peak, NE SF	-2.3%	-4.2%	-2.6%	-2.8%
AM Peak, All SF	-1.7%	-3.1%	-1.9%	-2.1%

Figure E.6 Fee Strategy Comparison: Percent Change in VHD



	Model: Peak $3 Fee (4Bi)	Model: Peak $6 Fee (4Bii)	Model: All-Day $3 Fee (4A)	Off-Model: Univ. Acc. Peak $3 Fee (3)
24-Hour, NE SF	-2.0%	-3.6%	-3.7%	-2.3%
24-Hour, All SF	-1.4%	-2.8%	-2.5%	-1.6%
AM Peak, NE SF	-4.1%	-7.3%	-4.4%	-4.6%
AM Peak, All SF	-2.9%	-5.4%	-3.2%	-3.6%

Intercept Survey Elasticities and Peak Fee Information

Table E.2 shows the intercept survey's price elasticities of demand for flat daily cost increases among existing parkers. Price elasticity of demand is the percent change in quantity consumed divided by the percent change in price. In this particular calculation, the quantity is the number of days per week that parkers would park at the garages where they were surveyed and the price is the daily cost of parking at these garages. The table shows both stated-preferences – information on how individuals would respond to hypothetical price changes – and revealed-preferences – information on how parkers reported that they have responded to actual historical price changes. Revealed-preference data tends to be harder to collect but more reliable. The table shows how elasticities differ by payment structure and, for stated-preference, by hypothetical cost increase amounts from the survey questions. For the revealed-preference data, survey respondents reported actual historical price changes which were averaged together across all responses into one elasticity value for each payment method.

Table E.2 Intercept Survey Price Elasticity of Demand for Out-of-Pocket Parking Cost Increases

Payment Structure	Stated-preference							Revealed-preference		
	N	$2.50 per day increase		$3-$5 per day increase		$6-$10 per day increase		N	Avg. % price change	Avg. elasticity
		Avg. % price change	Avg. elasticity	Avg. % price change	Avg. elasticity	Avg. % price change	Avg. elasticity			
Hourly	31	24%	-2.65	38%	-2.68	76%	-2.04	16	26%	-0.15
Daily	47	15%	-2.93	24%	-2.80	48%	-1.81	44	27%	-0.54
Monthly	73	23%	-2.85	38%	-2.34	75%	-1.37	7	36%	-0.40
Total	***151***	***21%***	***-2.83***	***33%***	***-2.55***	***67%***	***-1.64***	***67***	***28%***	***-0.44***

The results show that parking demand among current parkers is much more elastic in the stated-preferences than in the revealed-preferences. Individuals are susceptible to exaggerating their anticipated reactions to hypothetical price increases. Furthermore, revealed-preferences are based on past price changes, and the survey only includes individuals who still park at least some. The revealed-preference figure of -0.44 indicates that parking is a relatively inelastic good (typically, values less than -1 are considered relatively elastic, and values between 0 to -1 are considered relatively inelastic) among these individuals who park at least one day per week. Existing parkers are relatively insensitive to price changes, corroborating the SF-CHAMP results. According to the revealed-preferences, daily parking is slightly more elastic than monthly parking, and both are more elastic than hourly parking. Stated-preferences, which have higher sample sizes, show less consistency between elasticities for different payment structures.

The intercept survey data also includes stated-preferences on how peak fees would affect individuals' arrival and departure times. 57% reported that their times would be affected. The nature of the time shifts was evenly distributed among different options, with the most popular shifts being: 12% would arrive earlier and leave later, 12% would arrive and leave later, and 10% would arrive and leave earlier.

Fee Amount

Performance of each of the fee strategies depends heavily on fee amounts. Larger fees achieve more congestion reduction and auto mode shift, but the results indicate that larger fee increases have somewhat diminishing returns in terms of transportation outcomes. For instance, doubling the $3 peak fee to $6 less than doubles mode shift. The stated-preference elasticities in Table E.2 corroborate this result; as fee amounts rise, parking demand becomes less elastic.

Revenue

The peak, all-day, and universal access fees capture significant additional revenue for the City and County of San Francisco that could be used to improve the transportation system and make non-auto mode options more attractive for system users. Predictably, the $6 peak fee captures more revenue than the $3 fees. According to SF-CHAMP, it would increase public revenue by 131%. The $3 all-day fee would increase baseline revenue by 118%, significantly more than the $3 peak fee, which shows a 71% increase. Parking transaction and the existing parking tax revenues are projected to decrease between 5 and 10 percent depending on the fee scenario.

A universal access fee applied to the peaks and midday is expected to slightly outperform the all-day fee at the same amount, since it applies the same fee structure to more individuals. Likewise a universal access fee applied to the peaks is expected to slightly outperform the peak fee at the same amount. But universal access fees would be very difficult to implement from a technology perspective (see the Implementation chapter).

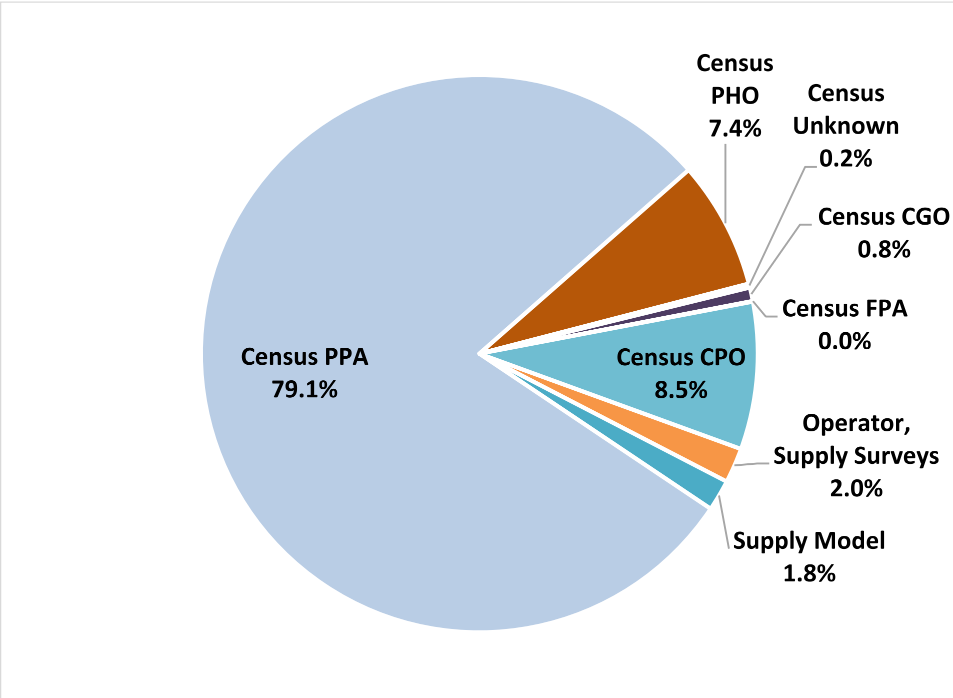
E.3.2 Privately-Accessible Parking Fee Results

Strategy 1B is much different than the other fee strategies in that it affects a smaller portion of drivers, because it applies only to drivers who use privately accessible garages and lots, instead of commercially available parking in public garages and lots. This study's supply model work[59] confirmed that privately accessible parking represents a small portion of parking supply in the Study Area.

Figure E.7 shows the components of this off-street, non-residential parking supply. Supply categories documented in the SFpark Off-Street Census are denoted with "Census." The remaining two categories in the chart were derived from field work and analysis conducted for this study. A number of Census categories are not affected by strategy 1B, including:

[59] The supply model documentation more fully describes the range of estimated additional supply.

Figure E.7 Study Area Off-Street, Non-Residential Parking Supply by Type



- Paid, publically available (PPA) parking constitutes the majority (79 percent) of the total supply.
- Customer parking only (CPO), is the next largest slice, with 8.5 percent.
- Commercial/government only (CGO), with 0.8%
- Free parking (FPA), with effectively 0%

The categories that are affected by Strategy 1B include:

- Census permit holder only (PHO) parking (7.4%),
- Census parking of unknown type (0.2%),
- Operator and supply survey additional parking (2.0%)
- Supply model median expected additional parking (1.8%)

This means that at most, privately-accessible parking affected by Strategy 1B is 11.5 percent of the total parking supply in the Study Area. Some of this parking, such as publically accessible facilities covered in the operator survey additional supply, do not qualify for the 1B fee, so 11.5 percent represents a high-end estimate of the total parking that could be affected by the strategy in the Study Area. But given that this 11.5 percent is still a limited portion of overall supply, Strategy 1B is likely to have very modest impacts on mode share and congestion compared to the other fee-based strategies. Transportation performance impacts for the Study Area are likely similar for the Northeast Quadrant, assuming that the supply compositions are consistent across geographies. Given the high level of overlap between the two geographies, discrepancies in supply composition are expected to be minor.

E.3.3 Bulk Discount Elimination Strategies

Introduction

Several potential strategies involve eliminating daily and/or monthly parking discounts so that individuals pay hourly rates for parking. The ability to purchase parking in "bulk" (either for the whole day or month at a time) encourages more driving, because parking expenses become perceived as a sunk cost, with the effect that the apparent cost of each driving trip is reduced as compared to other travel options. When drivers have to pay incrementally for their parking usage, the mode choice decision better reflects the true costs to the traveler.

Strategy 2A eliminates both monthly and daily discounts, and Strategy 2B eliminates monthly discounts only; both strategies would likely use a regulatory prohibition to ensure that garage operators did not offer their customers the discontinued pricing. In contrast, strategies 2C and 2D incentivize rather than require privately operated parking garages to eliminate bulk discounts. 2C adjusts the parking sales tax to reward operators for eliminating discounts, and 2D institutes an annual per-space fee that is set in such a ways as to discourage discounted parking.

Quantitatively evaluating strategies is more straightforward for required bulk parking elimination (i.e., 2A and 2B) than for incentivized elimination (i.e., 2C and 2D). SF-CHAMP was able to model the no monthly discount scenario (Strategy 2B). Intercept survey data was used to help apply those model results to the other three strategies.

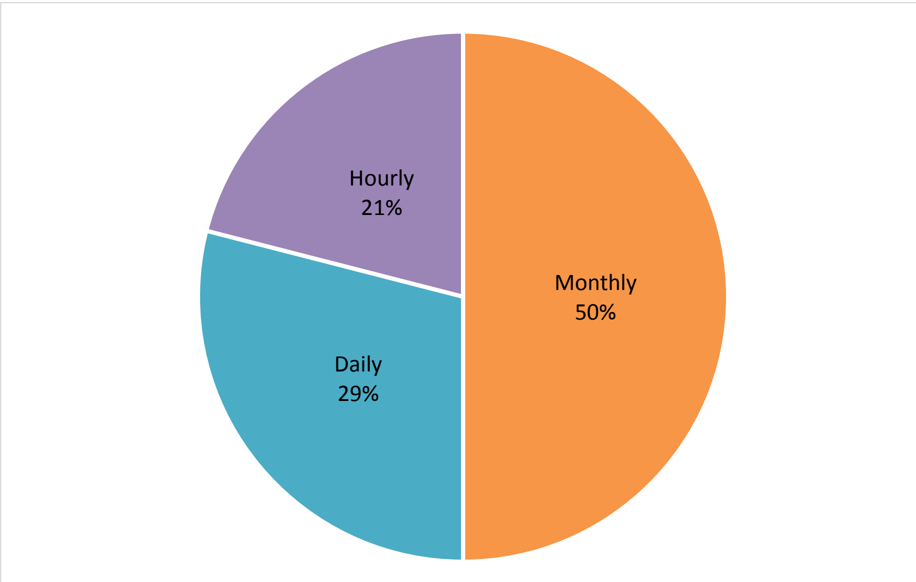
From a transportation performance perspective, it should be possible to design an incentivized elimination scenario that would perform the same as one of the required elimination scenarios (i.e., x percent sales tax reduction or $y per-space fee amount). But the strategies' performances relative to one another vary by revenue potential and political feasibility. This section discusses the former, and the Implementation chapter discusses the latter.

Also, the transportation performance results assume that hourly pricing remains the same after discount elimination. In reality, garage operators might be able to maximize revenue by lowering hourly rates in order to attract more customers, though this section's finding suggest that this might not necessarily be the case. Strategies could require hourly rates to remain at previous levels, but determining exactly how these levels would be regulated would involve technical and political implementation challenges. The Implementation chapter covers these topics.

Results

According to this study's intercept survey of 265 unique parkers in the Study Area, 50 percent of parkers pay for their spaces on a monthly basis (see Figure E.8). Another 29 percent pay daily, meaning nearly four fifths buy bulk parking. The remaining 21 percent pay hourly. Respondent trip purposes were split 88 percent work, 5 percent home, and 7 percent other.

Figure E.8 Intercept Survey Parking Payment Basis

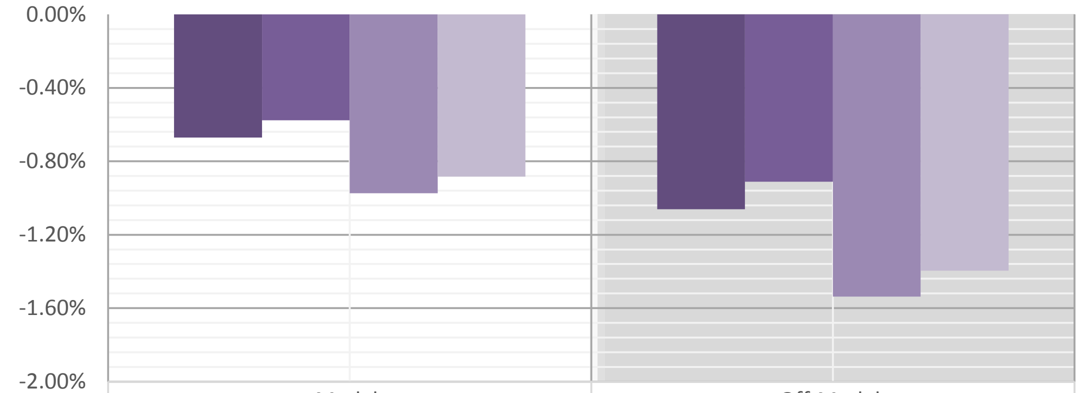


Daily discount elimination transportation performance metrics were extrapolated using the modeled monthly discount elimination metrics and proportion of daily to monthly parkers, plus the relationship between mode share and congestion. Daily and monthly elimination metrics were added to estimate metrics for combined discount elimination (2A). According to the Intercept survey revealed and stated-preference data on price elasticity, daily parkers are slightly more sensitive to price changes than monthly parkers, so this method's transportation performance estimates for daily discount elimination might be somewhat conservative. The parking payment method breakdown was assumed to remain constant between the Study Area, where the survey was distributed, to the larger Northeast Quadrant. While this breakdown could vary between geographies, the variation is likely to be minimal given that 1) the Northeast Quadrant contains the entire Study Area and 2) while portions of the Northeast Quadrant extend beyond the Study Area, the vast majority parking transactions occur in the higher density portions of the Northeast Quadrant that do overlap the Study Area.

Figures E.9 through E.11 show the required bulk eliminations, with the off-model combined discount elimination shaded grey. The combined discount elimination obviously performs better than the monthly discount elimination. The monthly elimination decreases drive alone mode share (Figure E.9) by 1.0 percentage point in the AM Peak Northeast Quadrant and 0.7 percentage points in the daily Northeast Quadrant. The combined discount reduces these shares by 1.5 and 1.1 percentage points, respectively.

Figure E.9 Bulk Discount Strategy Comparison

Percentage Point Change in Drive Alone Trip Mode Share

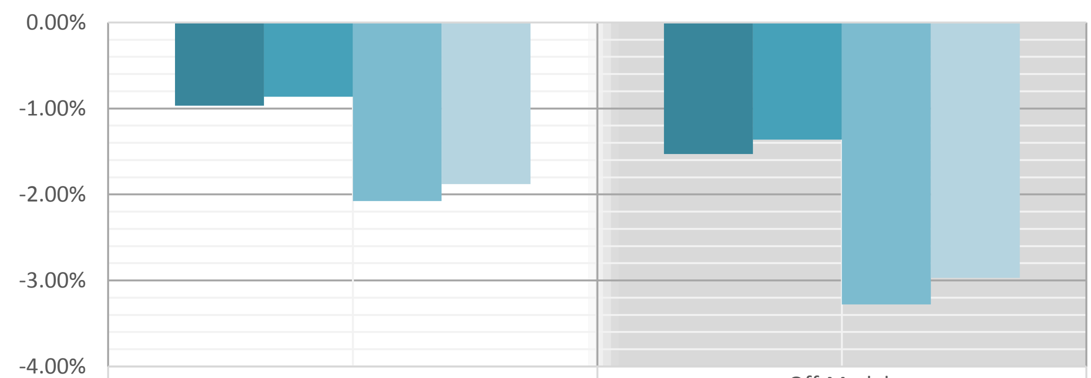


	Model: No Monthly Discount (2B)	Off-Model: No Discount (2A,2C,2D)
24-Hour, NE SF	-0.7%	-1.1%
24-Hour, All SF	-0.6%	-0.9%
AM Peak, NE SF	-1.0%	-1.5%
AM Peak, All SF	-0.9%	-1.4%

VMT and VHD reduction figures are similar (see Figures E.10 and E.11). The combined discount elimination reduces AM Peak Northeast Quadrant VMT by 3.3 percent and VHD by 5.7 percent.

Figure E.10 Bulk Discount Strategy Comparison

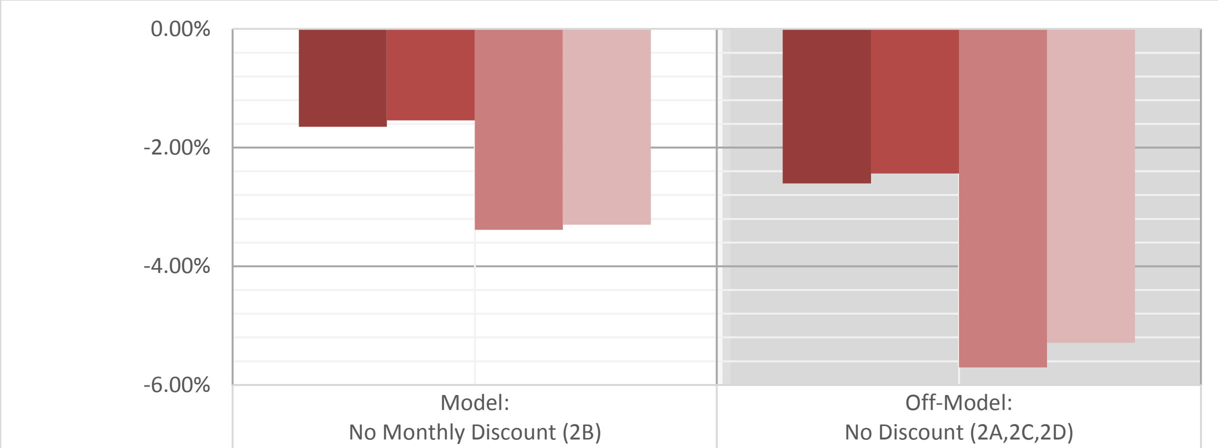
Percent Change in VMT



	No Monthly Discount (2B)	Off-Model: No Discount (2A,2C,2D)
24-Hour, NE SF	-1.0%	-1.5%
24-Hour, All SF	-0.9%	-1.4%
AM Peak, NE SF	-2.1%	-3.3%
AM Peak, All SF	-1.9%	-3.0%

Figure E.11 Bulk Discount Strategy Comparison

Percent Change in VHD



	Model: No Monthly Discount (2B)	Off-Model: No Discount (2A,2C,2D)
24-Hour, NE SF	-1.6%	-2.6%
24-Hour, All SF	-1.5%	-2.4%
AM Peak, NE SF	-3.4%	-5.7%
AM Peak, All SF	-3.3%	-5.3%

The monthly discount elimination was the only modeled scenario to capture increased parking tax revenues versus the baseline. While the monthly discount elimination shifts some individuals away from auto modes, decreasing revenue somewhat, the increased revenue from the remaining auto trips outweighs this shift. The monthly discount elimination could increase baseline parking sales tax revenue and garage operator revenue by as much as 9 percent.[60] Combining the daily and monthly discount eliminations could increase these baseline revenues by 14 percent.

Conceptually, it should be possible to design tax-incentivized discount elimination (2C) and fee-incentivized discount elimination (2D) that would be able to achieve the same mode shift and congestion reduction as required elimination (2A). The implementation issues inherent in designing an appropriate tax or fee structure are discussed in the Roadmap to Implementation chapter; the remainder of this discussion focuses on the scale of incentivization that might be required in order to achieve positive transportation outcomes by implementing either strategy 2C or 2D.

The revenue increase under 2A and 2B suggested that operators would benefit from the required discount elimination. Such an incentive does not exist in the voluntary scenario; if one garage eliminated bulk discounts, then its discount parkers would likely look for better deals at neighboring garages. Requiring discount elimination for all garages (as in strategies 2A and

[60] This revenue increase assumes that hourly and daily rates remain the same after monthly discounts are eliminated.

2B) prevents this slippage phenomenon.[61] Without a regulatory requirement, financial incentives can help encourage industry-wide conversion, helping to mitigate slippage.

The monthly discount elimination scenario (2B) reduced Northeast Quadrant daily parking transactions by 14,800. Assuming daily discount elimination reduces transactions proportionally (based on the percentage of monthly and daily parkers), combined discount elimination (2A) reduced daily parking transactions by 23,400 transactions. The average pre-tax revenue per parking transaction in the Northeast Quadrant was $4.39. Thus, in aggregate, these operators stand to lose up to $102,800 per day due to mode shift by those who will not be willing to pay higher (i.e., non-discounted) prices. However, actual net revenue loss is likely to be considerably lower for several reasons. First, under a voluntary program, it is unlikely that all parking operators would change their pricing at once, so many garages and drivers would be unaffected; some individual garages might even see increased business relative to the baseline. And, for those parking operators who do eliminate discounts, while some of their customers would switch modes, revenue from remaining parkers would increase (parkers who purchased discount parking in the baseline would be paying undiscounted hourly rates).

Some form of first-mover bonus might be required to convince garages to change their pricing voluntarily. To incentivize discount elimination, operators could be offered some amount of compensation (in the form of lower fees or lower parking taxes) if they chose to eliminate discounts. The incentive amount could be set based on the net revenue performance of the first-mover garages compared to their peers, so that there is a competitive advantage to making the shift right away. The initial incentives paid out would likely be much lower than $102,800 per day, because only a subset of garages would choose to adopt early. Also, using this relative approach means that as more garages switch, the differential is reduced and the need for incentives declines over time.

From a revenue perspective, the city would receive more revenue from the required elimination strategy than the voluntary elimination. Although individual garages might lose some customers after eliminating discounts, it is likely that many lost customers would utilize other available facilities, leading to little change in sales tax revenues in the aggregate. However, the incentives paid out as part of a voluntary discount elimination strategy would reduce overall public revenues. Under voluntary elimination, revenue would likely be lower than in the baseline.[62]

It is difficult to predict how parkers and operators would react under incentivized elimination in the long term. Thus, achieving the same transportation performance as required elimination would require a careful implementation with close monitoring of parking consumption by bulk versus hourly payment structure and a flexible incentive structure.

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[61] Working with garage operators to better understand and evaluate this revenue result would be an important step in implementing the strategy.

[62] In SF-CHAMP scenario 2B (monthly elimination), the city captured received $45,600 more per day than in the baseline. This number plus any revenue increases from daily elimination (approximately $72,000) would likely be less than the amount that the city would need to incentivize monthly and daily elimination (up to $102,800).

E.3.4 Cashout Strategies

Introduction

The study examined two strategies involving parking cashout, where employers that subsidize employee parking offer these employees the option of taking a cash subsidy in lieu of a parking space. Strategy 7A entails a broader enforcement of the existing California cashout law. Strategy 7B examines the idea of extending the cashout requirements to firms not currently covered by the law.

The State of California enacted a law in 1992 intended to reduce auto commute trips by requiring firms to offer employees parking cashout. Firms that meet all of the following criteria are subject to the cash-out law[63]:

- "Employ at least 50 persons (regardless of how many worksites);
- Have worksites in an air basin designated nonattainment for any state air quality standard;
- Subsidize employee parking that they do not own;
- Can calculate the out-of-pocket expense of the parking subsidies they provide; and
- Can reduce the number of parking spaces without penalty in any lease agreements."

While violations are subject to civil penalties of up to $500 per vehicle per civil action, the California Air Resources Board has announced its intention to "facilitate compliance before seeking civil penalties." In San Francisco, the law is self-implemented; there are no reporting requirements that would identify firms who failed to comply.

The SF-CHAMP model does not include enough sensitivity to simulate all of the aspects of workers being offered cashout. While SF-CHAMP does include information on the percentage of individuals who pay for their own parking during work trips (i.e., do not receive subsidized parking), the model cannot simulate a cash subsidy that is dependent on the travelers mode choice to work. Also, the model does not simulate anything about employers, so inputs cannot be tailored for firms of different sizes or whether employers own or lease parking. As a result, the model runs conducted for this study focused exclusively on the effects of eliminating employer-subsidized parking across the board.

The SF-CHAMP scenario described above comes closest to Strategy 7B, which evaluates the idea of expanding cashout much more broadly. To test this idea, SF-CHAMP set the percentage of workers who pay for parking cost to 100%, so that all commuters faced parking costs. Formerly subsidized parkers pay three quarters of full parking cost in this scenario. By representing the cashout offer as a lost subsidy, this simulation oversimplifies the decision that parkers face when they are offered cashout. In reality parkers do not lose their subsidy but can instead chose to opt out of the subsidy and receive cash. The simulation could therefore overestimate how the cashout offer financially impacts loss-averse individuals. Also, the

[63] California's Parking Cashout Program http://www.arb.ca.gov/planning/tsaq/cashout/cashout_guide_0809.pdf

modeled subsidy does not depend on mode choice; all commuters face full parking costs rather than only existing auto commuters.

To evaluate 7A, the study examined results from the 7B model run and combined this with separately collected data on the proportion of individuals who work at employers with over 50 employees, one of the existing cashout law criteria. This method likely overestimates transportation performance effects, because in reality, not all firms with over 50 employees are required to offer cashout (e.g., those that own their own parking are exempt).

Results

Subsidized Parking

Cashout's potential effect on overall transportation system performance depends heavily on how many people it influences – the number of individuals who receive subsidized work parking as a proportion of overall travelers. Several employer and commuter surveys were examined to characterize this proportion. Generally, the information showed that a limited proportion of Study Area parkers receive subsidized parking.

265 drivers at 27 unique parking sites in the Study Area answered this study's intercept survey. 88 percent of these drivers were parking for work. Of these parking commuters, 72% received no parking subsidy, 10% received a partial parking subsidy, and 18% received a full parking subsidy. 35% of partially or fully subsidized parkers indicated that their employers offer alternative transportation benefits, such as transit passes.

The SF Environment Commuter Survey also revealed information on employer-paid parking. Its 2014 random sample of 1,831 San Francisco workers reported that less than 25% of employees receive any parking related benefits: 13% receive pre-tax deductions, 8% receive free or subsidized parking, and 1% receive cashout options.

1,850 employers also responded to the 2014 SF Environment Employer Survey as part of the Commuter Benefit Ordinance (CBO) compliance process. Few of the responding firms provided parking benefits: 6% offer pre-tax deductions, 10% offer free or subsidized parking to some employees, and less than 1% offer cashout. Of the respondents whose addresses were geocoded and who provided more specific subsidy information and San Francisco-based employee sizes (1,596 respondents), 4% of employees receive free or subsidized parking from their employers. These employers report approximately 99,024 employees in the San Francisco area.[64] Of the surveys examined, this dataset had the most geographic diversity within San Francisco. Given its diversity, large sample size (both of employer respondents and estimated employees at these employers), this dataset was used to develop geographic "percentage paying for work parking" inputs to SF-CHAMP.

According to the SF-CHAMP baseline scenario, there are approximately 618,000 daily tours with destinations in the Northeast Quadrant. Of these, roughly 244,000 represent work tours.

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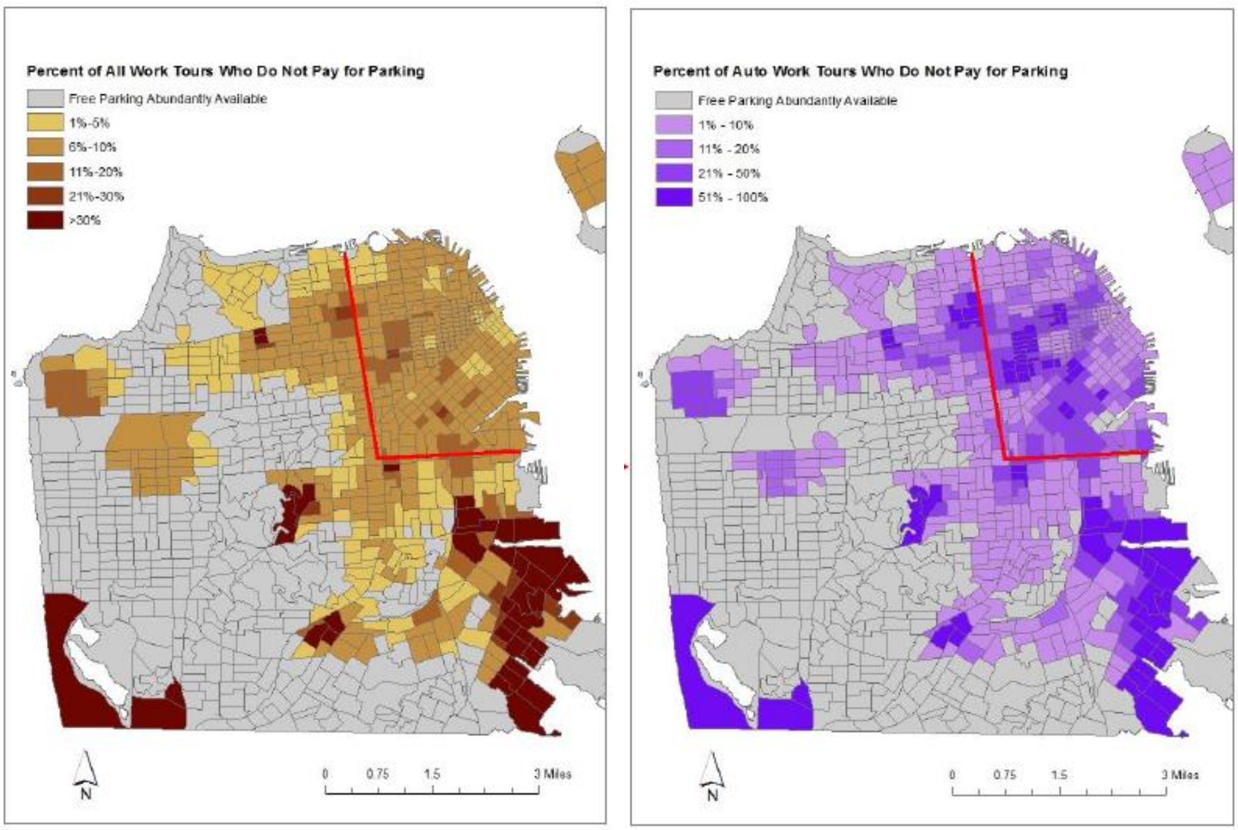
[64] Responding employers reported San Francisco-based employee sizes in categories (e.g., 1-19, 20-49). The midpoints of reported categories were used to estimate numerical employee counts.

Drive alone work tours are at roughly 33,000 and carpool work tours are at roughly 14,000. Approximately 13,300 of these tours do not pay for parking. Thus, in SF-CHAMP, subsidized parkers represent about 2% of total tours, 5% of work tours, and 28% of driving and carpool work tours.

Figure E.12 shows baseline scenario maps of the percent of work tours with subsidized parking. The left map shows subsidized tours as a percent of all work tours, and the right map shows subsidized tours as a percent of auto only tours.

Figure E.12 Baseline Scenario
Percent of Work Tours with Subsidized Parking
(All Modes and Auto Only)



Expanded Cashout Model Results

An SF-CHAMP scenario where all commuters paid for their own parking was used to approximate expanded cashout (7B). Expanded cashout showed little change in transportation system performance versus the baseline. Eliminating employer-paid parking reduces drive alone mode share by 0.2 or 0.3 percentage points in each timeframe-geography pairing. For

AM Peak Northeast Quadrant VMT and VHD, expanded cashout shows 0.4 and 0.7 percent reductions, respectively.

Enforcing Existing Cashout

Enforcing existing cashout (7A) applies to fewer people than 7B, so transportation performance is assumed to fall between the baseline and 7B scenario results. Firm size distributions helped roughly estimate the proportion of the 7B commuters that are eligible for cashout under the existing law (7A). Data for several downtown San Francisco zip codes[65] were obtained from the U.S. Census Bureau's County Business Patterns and ZIP Code Business Patterns[66]. While the County Business Patterns database provides total paid employees in our selected zip codes, it does not provide data on how many total employees fall into each employer size buckets. The midpoints of these employer buckets were used to numerically estimate employee count. Firms in "1,000 or more" bucket were assigned only 1000 employees. Overall, this method slightly overestimates the total number of employees in these zip codes (275,870) versus the County Business Patterns' estimate (264,418). By this method and in these zip codes, the estimated total number of employees working at establishments with 50 or more employees to be approximately 172,068, or 62 percent of total employees.

This percentage represents a high end estimate of those who meet the firm size criterion of the current cashout law. The number of individuals who work at firms who subsidize their parking, fall into this size category, and meet the other cashout requirements is limited. Since the 7B results show little change in mode share and congestion, 7A is likely to affect these measures marginally. But cashout may still be an important piece of a broader travel demand management portfolio and is likely less costly to implement than many other evaluated strategies.

E.3.5 Supply Strategies

Introduction

While the other strategies focus on managing parking demand through direct manipulations of price, this set of strategies would attempt to manage travel demand by changing the available parking supply in San Francisco. With fewer spaces available relative to total demand, the market rate cost to park—and thus to drive-might increase enough to influence mode choice and thereby improve transportation performance. Strategy 5A redevelops some SFMTA parking facilities to directly reduce supply from current levels. Strategy 5B caps parking supply at 2015 levels so that it does not grow in future years. Strategy 5C caps supply at a certain level and then allows buildings to trade parking spaces among themselves.

[65] Selected zip codes included: 94102 (Tenderloin), 94103 (SoMa), 94108 (Chinatown), 94105 (Embarcadero South), 94104 (Financial District), and 94111 (Embarcadero North).

[66] United States Census County Business Patterns, retrieved in March 2014 http://www.census.gov/econ/cbp/

SF-CHAMP is an effective tool for evaluating how parking demand responds to price changes and similar adjustments, but it does not explicitly represent parking supply or parking space occupancy, and thus it is not equipped to assess changes in parking supply from a mode share and congestion perspective. Thus, off-model calculations were used to help evaluate the parking supply strategies. This section describes the evaluation of strategies 5A and 5B. The cap element of 5C was examined as part of 5B, but evaluating the trade element was not feasible given the lack of detailed projections on future construction by building type.

To evaluate SFMTA garage redevelopment (5A), the study examined total spaces and approximate current peak occupancy at SFMTA sites and privately-operated sites in the Study Area. These were used to estimate head room, or remaining available parking spaces during peak occupancy, at these two site types. Then, the study looked at how many diverted occupants the privately-operated supply could absorb in the case of SFMTA garage redevelopment. Unabsorbed trips would presumably either shift trip time, parking location, or mode. The off-model analysis showed that the number of unabsorbed trips was relatively small and thus the transportation impacts of this strategy under current transportation demand and land use conditions would likely be minimal.

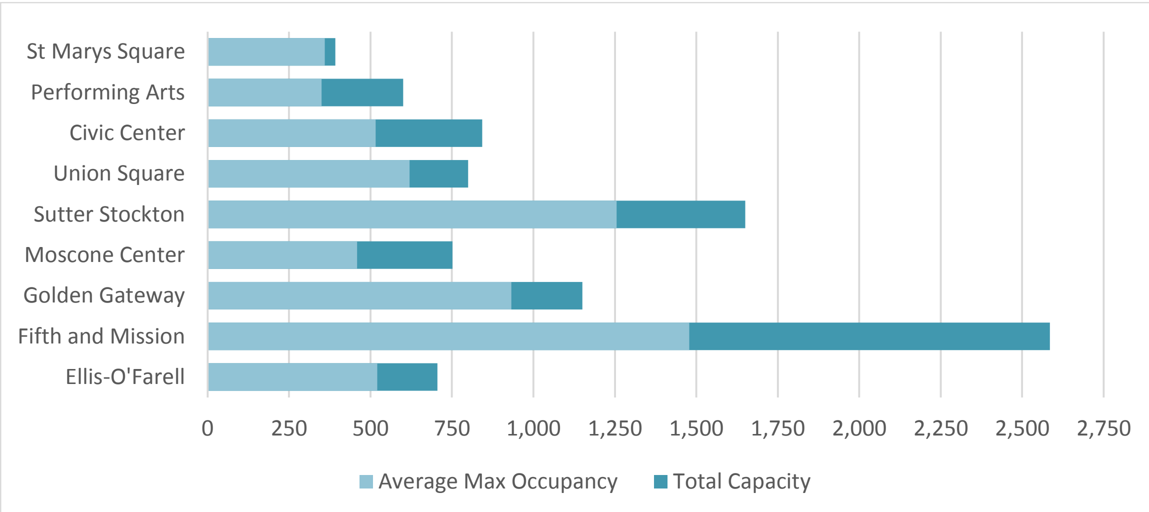
Evaluating the parking cap (5B) involved examining when future unabsorbed trips would exceed supply, based on the current number of unabsorbed trips (estimated for 5A) and growth rates in these trips. Cap and trade (5C) was assumed to experience the same transportation performance as 5B, but the two strategies differ from an implementation perspective.

Parking Occupancy

Parking occupancy varies based on time of day, day of week, season, weather, location, and special events, so it is difficult to generalize about availability and utilization without detailed data sets. At the same time, private garage operators are reluctant to provide detailed occupancy data, which they view as a commercial trade secret that may be a competitive advantage. As a result, data availability and simplicity dictated the evaluation approach for these strategies.

The SFpark pilot project gathered garage occupancy data for SFMTA public garages, and a subset of these data were used for the study. This subset contained average occupancy for each weekday hour, disaggregated by month over the period from May 2011 to December 2013 for each garage. The study identified the maximum occupancy hour for each garage and took the inter-monthly average of the occupancy figures for the maximum occupancy hour at each garage. The maximum occupancy times tended to occur during the midday, between 11 AM and 1 PM. Occupancy was compared to total capacity at each garage. Figure E.13 shows average occupancy as a proportion of total capacity at the garages within the Study Area. The weighted average maximum occupancy across all of these garages was 69 percent of total capacity.[67] SFpark's occupancy target of 40 to 80 percent for off-street SFMTA sites corroborate this estimate.

Figure E.13 Average Occupied Parking Spaces during Maximum Occupancy Hour at SFMTA Operated Garages in Study Area, 5/11-12/13



Occupancy data for privately-operated garages is particularly challenging given its proprietary nature. The operator survey was able to gather some information on if and when garages in the Study Area typically fill during weekdays. Most operators did not provide exact percentages, but their responses could be grouped into three categories: 1) sites that typically fill up, 2) sites are mostly full or occasionally full, and 3) sites that are rarely or never full. Table E.3 shows how the responding sites and number of parking spaces at those sites fall into these three categories.[68]

Table E.3 Operator Survey Responses by Occupancy Category, Privately-Operated Parking Facilities

Category	Number of Responses	Percentage of Responses	Total Spaces	Percentage of Spaces
Never/rarely full	12	24%	2,700	21%
Mostly/occasionally full	5	10%	1,000	8%
Usually fills up	34	67%	9,200	71%
Total	***51***	***100%***	***12,900***	***100%***

[67] This average is weighted by number of parking spaces.

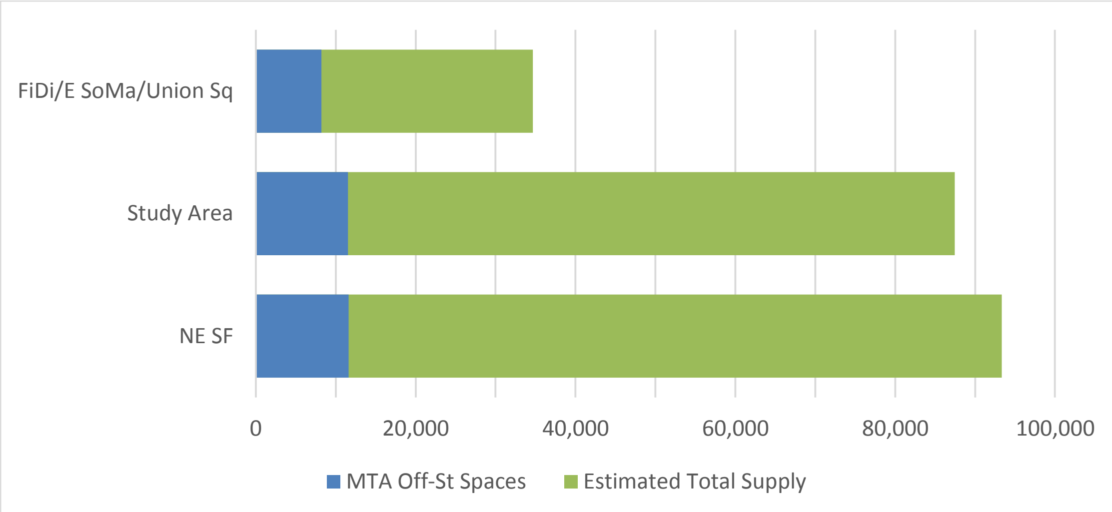
[68] Figures are rounded in this section, so calculations may include some rounding error.

Two thirds of the 51 survey respondents that provided some occupancy information indicated that their garages or lots usually fill. These 67 percent of respondents account for 71 percent of the parking spaces managed at these 51 sites. 10 percent indicated that their garages are mostly full at peak occupancy and/or occasionally fill. 24 percent indicated their garages rarely or never fill. There was not a clear spatial pattern between these categories; there were some full garages far outside of the busiest areas, such as the C-3 district, and some rarely full garages in the C-3 district. Some of the privately operated garages reached peak capacity earlier in the day than the SFMTA garages, but this varied by location. Less than half of the regularly full privately-operated garages reached capacity before 10 AM.

To quantify headroom at these privately-operated garages, headroom assumptions were made for each capacity category. At peak occupancy, the "usually fills up" category was assumed to be 100 percent full, the "mostly/occasionally full" category was assumed to be 85 percent full, and the "never/rarely full" category was assumed to 69 percent full. The latter number was chosen to correspond with the SFMTA average occupancy at peak. The three assumed headroom rates were multiplied by the number of spaces within each category, to compute total available spaces. Total available spaces as a percentage of total capacity – or estimated total weighted headroom – was 8 percent, a much lower value than the SFMTA garages. This figure varies based on the assumed category percentages; for instance, a 75 percent peak occupancy rate at the "never/rarely full" level results in a total weighted headroom of 6 percent. The difference between headroom at privately-operated and SFMTA garages in unsurprising; SFMTA sets occupancy targets of 40 to 80 percent whereas private operators maximize profits and are likely to do so by utilizing all or nearly all of their parking capacity.

Privately-operated parking constitutes a much larger portion of overall supply than the SFMTA garages. Figure E.14 shows SFMTA off-street supply in relation to total estimated supply in the Northeast Quadrant, Study Area, and three high-congestion neighborhoods – the Financial District, Eastern SoMa, and Union Square ("FiDi/E SoMa/Union Sq" in the chart). Total supply was assumed to fluctuate in proportion to the number of SFpark Census sites in each of these three areas. The SFMTA off-street supply is equivalent to 12 percent of the total supply in the Northeast Quadrant, 13 percent of total supply in the Study Area, and 23 percent of total supply in FiDi/E SoMa/Union Sq.

Figure E.14 SFMTA Off-Street Spaces and Estimated Total Spaces by Geography



Results

SFMTA Garage Redevelopment

If the SFMTA were to redevelop all nine garages in the Study Area, it would eliminate 11,500 spaces, which house, at peak occupancy of 69 percent, an estimated maximum of 8,000 trips. The Study Area contains an estimated 87,400 non-residential, off-street spaces, 75,900 of which are privately operated (i.e., separate from SFMTA garages). At an estimated headroom rate of 8 percent, this privately-operated supply could absorb an additional 5,900 trips during peak occupancy time. If these driving trips were absorbed, there would be an extra 2,100 unabsorbed driving trips in the Study Area. Assuming a similar ratio of SFMTA parking to private parking outside the Study Area, we can use the ratio of Census sites in the Study Area versus Northeast Quadrant to estimate that there would be approximately 2,200 unabsorbed driving trips in the Northeast Quadrant. Each of these unabsorbed trips would either 1) switch modes to carpool, transit, etc.; 2) adjust trip timing to arrive when more parking is available; or 3) adjust trip destination to places with available parking.

In the baseline scenario, there are 1,900,800 trips made daily across all modes and tour purposes from, to, and within the Northeast Quadrant. 292,600, or 15.4 percent, of these are drive alone trips. In the unlikely event that all 2,200 unabsorbed Northeast Quadrant driving trips switched modes while maintaining the same travel times and destinations, it would change daily Northeast Quadrant drive alone mode share by 0.1 percentage points. Even with this maximum assumed mode shift, congestion would be affected minimally.

This mode share shift is relatively insensitive to the specific occupancy rate assumptions for private garages described in the previous section. For example, if the assumed peak occupancy rate for "never/rarely full" privately-operated garages was 60% (resulting in a total weighted headroom of 10%), all diverted trips could be absorbed by private supply. If this rate were 75% (resulting in a total weighted headroom of 6%), 3,500 driving trips would be unabsorbed in the Northeast Quadrant, raising maximum estimated mode shift from 0.1 percentage points to 0.2 percentage points.

On the other hand, these calculations rely on many simplifying assumptions and do not account for different peak occupancy times at different locations, precise privately-operated garage occupancy data, different years and seasons of collected occupancy data, how former SFMTA parkers would react (i.e., switch parking location, time of day, or mode) to being diverted, and how operators would adjust prices given supply changes. Overall, the transportation improvements associated with 5A are likely limited. Reductions in SFMTA garages would probably be most effective in the FiDi/E SoMa/Union Sq area, or other areas where SFMTA represent a comparatively high proportion of overall parking supply.

Strategy 5A would explicitly eliminate one revenue stream, because SFMTA would no longer collect parking costs or the related taxes for redeveloped garages that are removed from the market. At the same time, there would almost certainly be an increase in parking sales tax at private garages as drivers relocated to other facilities in the city. Depending on the private garage operators' pricing responses to the elimination of SFMTA-owned supply and the revenues generated from redeveloped properties, the net change in revenues received by the City could be positive or negative.

Parking Supply Cap, and Cap and Trade

For the parking supply cap strategy (5B), the study examined how different parking demand growth rates would influence the time when current total capacity is reached. Current peak occupancy across SFMTA and privately-operated garages was compared to total capacity in the Study Area: 78,000 current occupants at peak time and 87,400 total capacity.

The State of California Employment Development Department published a 2012 to 2022 annual average growth in occupational employment of 1.2 percent for San Francisco, Marin, and San Mateo Counties.[69] If parking demand grows at the same 1.2 percent rate, peak occupancy will equal total capacity in 10 years.[70] Again, additional drivers may not necessarily switch modes once capacity is reached (they could adjust trip time or destination instead), but this strategy would likely start leading to changes in travel behavior at this point. Under a slower demand growth rate of 0.5 percent, peak occupancy would equal capacity in 23 years. Under a faster rate of 4%, peak occupancy would equal capacity in 3 years. Thus, the strategy's timeframe depends heavily on the actual growth rate.

The direction and magnitude of future parking revenues for 5B are uncertain. Potential revenues would be lost from spaces that would have been built had the cap not existed. But a higher pricing of constrained supply could drive revenues upward.

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[69] *2012-2022 Occupational Employment Projections (Marin, San Francisco, and San Mateo Counties).* State of California Employment Development Division, Labor Market Information Division, 2014.

[70] Employment growth is used as a proxy for overall travel demand growth. Travel demand includes trips aside from commuting.

Strategy 5C is a cap-and-trade approach, so its transportation performance results will be similar to 5B. Revenue results will depend on the implementation of the trading scheme.

Generally, parking supply strategies are unlikely to have a major effect on mode share and congestion today. But these strategies could be effective for managing San Francisco's growing transportation system in the long term.

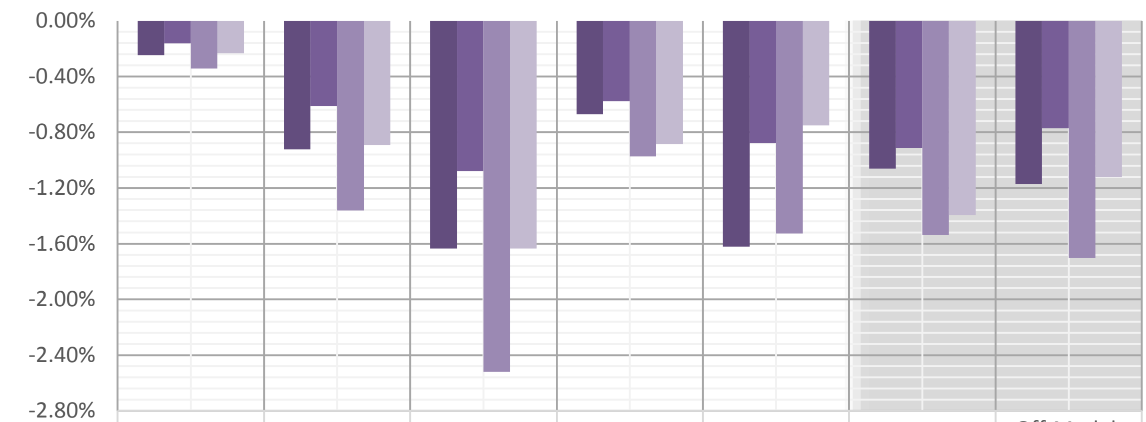
E.4 Synthesis and Conclusion

E.4.1 SF-CHAMP Model Results

This section compares results between the SF-CHAMP modeled scenarios. Across the different strategy types, the parking scenario model results showed performance improvement in varying degrees. Figure E.15 shows the percentage point change[71] in drive alone trip mode share by scenario versus the baseline, with two off-model scenarios shaded grey. The $6 peak period parking fee captures more mode share than other scenarios during the AM Peak period. The $3 all-day fee, $3 peak universal access fee, an combine discount elimination perform similarly in the Northeast Quadrant AM Peak, with the $3 peak fee not far behind. Aside from the $6 fee, the $3 all-day fee performs the best in the Northeast Quadrant 24-hour period, the combine discount elimination performs the best in the citywide AM peak. These two policies perform similarly for the citywide 24-hour period. Eliminating employer-paid parking reduces drive alone mode share by 0.2 or 0.3 percentage points in each timeframe-geography pairing.

[71] This report describes mode shifts as percentage point changes rather than percent changes. A 1.0 percentage point reduction in a 15 percent drive alone mode share is roughly a 6.7 percent reduction.

Figure E.15 Percentage Point Change in Drive Alone Trip Mode Share



	Model: Expanded Cashout (7B)	Model: Peak $3 Fee (4Bi)	Model: Peak $6 Fee (4Bii)	No Monthly Discount (2B)	Model: All-Day $3 Fee (4A)	Off-Model: No Discount (2A,2C,2D)	Off-Model: Univ. Acc. Peak $3 Fee (3)
24-Hour, NE SF	-0.2%	-0.9%	-1.6%	-0.7%	-1.6%	-1.1%	-1.2%
24-Hour, All SF	-0.2%	-0.6%	-1.1%	-0.6%	-0.9%	-0.9%	-0.8%
AM Peak, NE SF	-0.3%	-1.4%	-2.5%	-1.0%	-1.5%	-1.5%	-1.7%
AM Peak, All SF	-0.2%	-0.9%	-1.6%	-0.9%	-0.8%	-1.4%	-1.1%

Figure E.16 depicts the overall mode splits for each scenario, including the baseline, during the AM Peak in the Northeast Quadrant. Transit and non-motorized modes dominate the mode profile in the northeastern portion of the city. Across the scenarios, 41 to 44 percent of AM Peak trips use transit in the Northeast Quadrant. Another 33 to 35 percent use non-motorized modes, including walking and biking. Auto accounts for the remaining trips, with 12 to 15 percent drive alone and 9 to 11 percent carpool.

The Figure E.16 bars show how reduced drive alone trips redistribute among remaining modes. In the $6 peak fee scenario, for instance, drive alone and carpool trips decrease by 2.5 and 0.7 percentage points whereas transit and non-motorized trips increase by 2.2 and 1.0 percentage points. Under the strategy scenarios, carpool trips tend to decrease along with drive alone trips rather than absorb them. Transit tends to absorb more reduced auto trips than non-motorized.

Figure E.16 AM Peak, Northeast Quadrant Trip Mode Share by Scenario

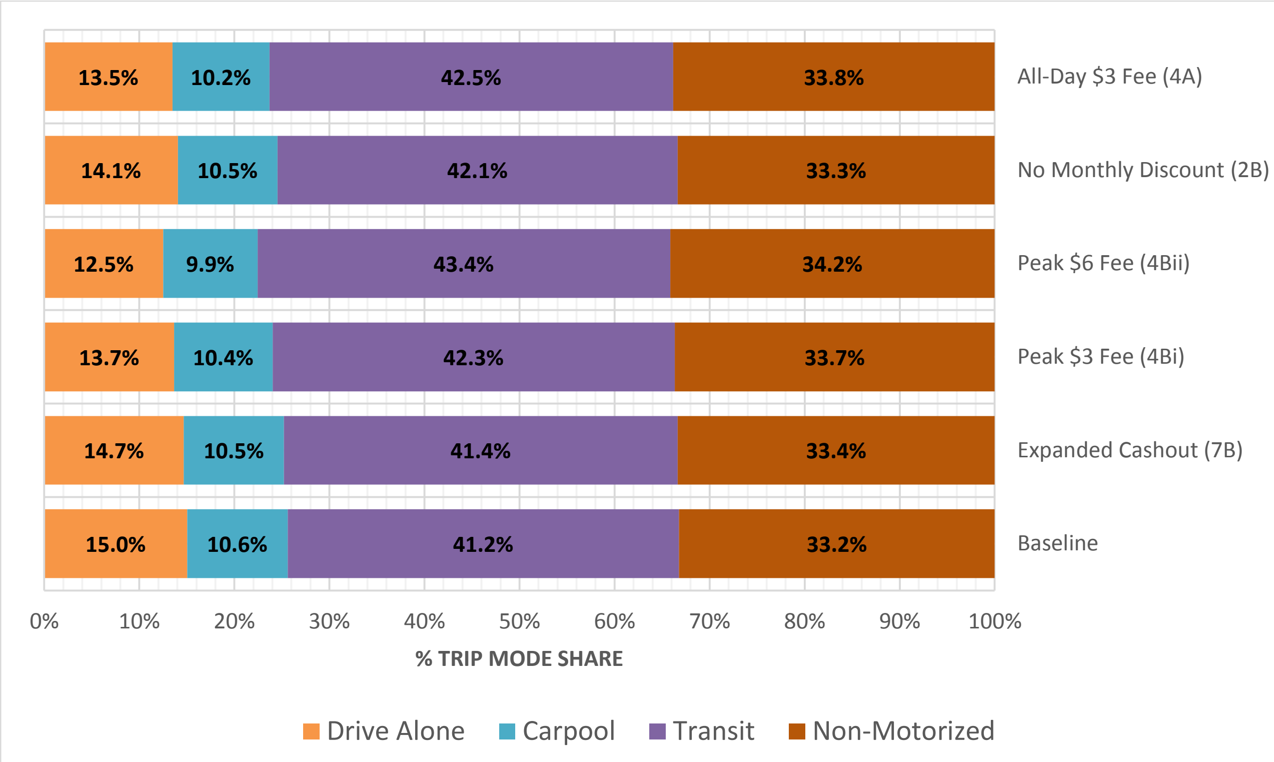
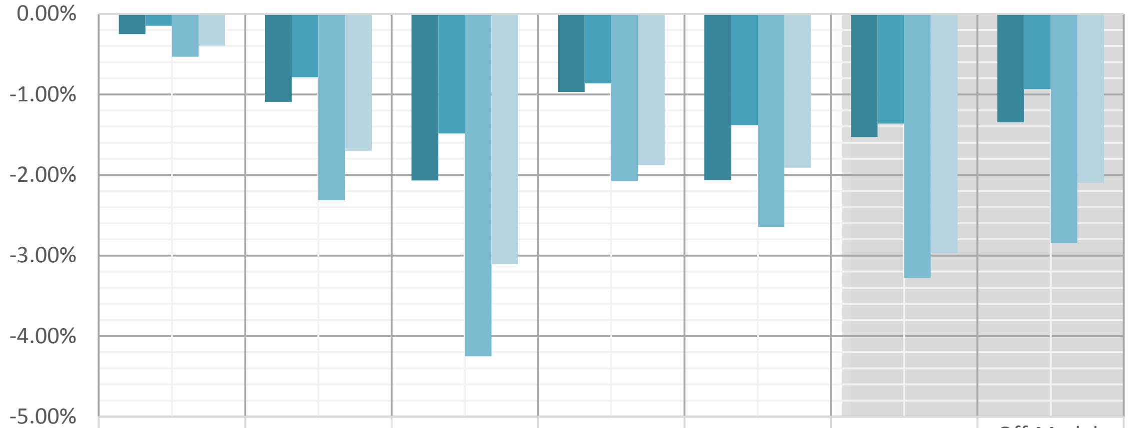


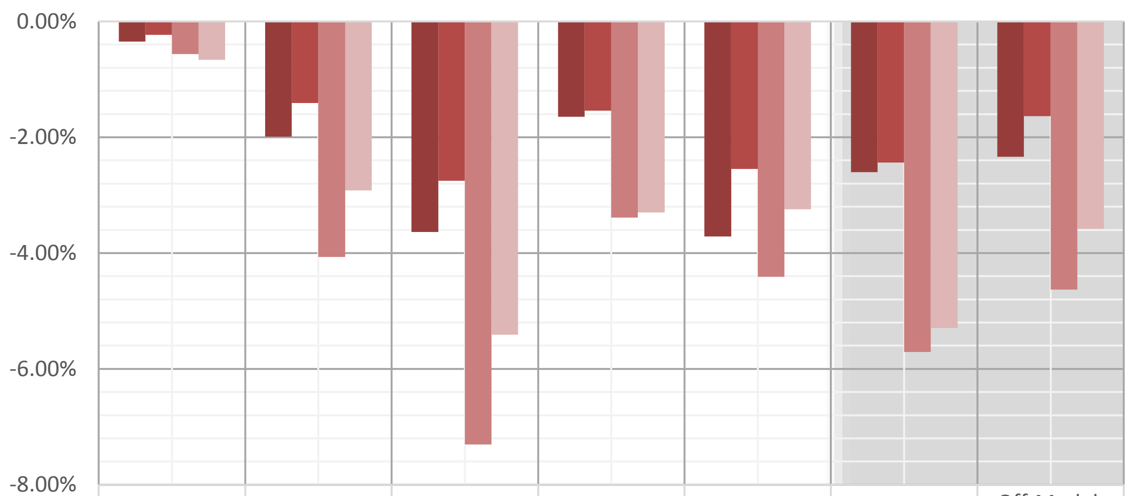
Figure E.17 shows percent change in VMT, and Figure E.18 shows percent change in VHD. The results indicate that changes in VMT and VHD are proportional; for a given scenario, VMT reduction performance relative to other scenarios tends to be the same as VHD performance relative to other scenarios. Congestion results tend to be proportional to mode shift results for each scenario. The $6 peak fee reduces VMT by 4.2% and VHD by 7.3% in the Northeast Quadrant during the AM Peak. Aside from the $6 fee, the $3 all-day fee performs the best for the Northeast Quadrant 24-hour period and the combined discount elimination performs the best for the Northeast Quadrant and citywide AM peak. Eliminating employer-paid parking has lower VMT and VHD reductions in the SF-CHAMP output.

Figure E.17 Percent Change in VMT



	Model: Expanded Cashout (7B)	Model: Peak $3 Fee (4Bi)	Model: Peak $6 Fee (4Bii)	No Monthly Discount (2B)	Model: All-Day $3 Fee (4A)	Off-Model: No Discount (2A,2C,2D)	Off-Model: Univ. Acc. Peak $3 Fee (3)
24-Hour, NE SF	-0.3%	-1.1%	-2.1%	-1.0%	-2.1%	-1.5%	-1.3%
24-Hour, All SF	-0.1%	-0.8%	-1.5%	-0.9%	-1.4%	-1.4%	-0.9%
AM Peak, NE SF	-0.5%	-2.3%	-4.2%	-2.1%	-2.6%	-3.3%	-2.8%
AM Peak, All SF	-0.4%	-1.7%	-3.1%	-1.9%	-1.9%	-3.0%	-2.1%

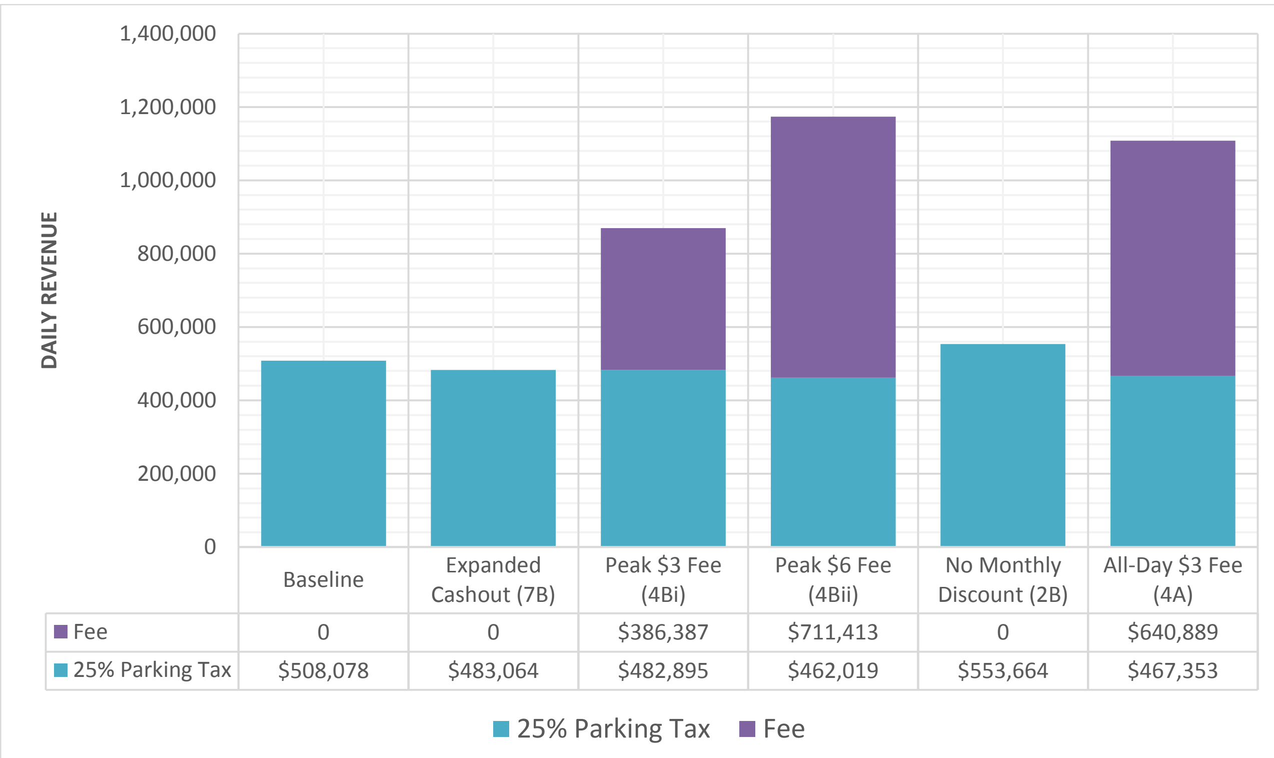
Figure E.18 Percent Change in VHD



	Model: Cashout (7B)	Model: Peak $3 Fee (4Bi)	Model: Peak $6 Fee (4Bii)	Model: No Monthly Discount (2B)	Model: All-Day $3 Fee (4A)	Off-Model: No Discount (2A,2C,2D)	Off-Model: Univ. Acc. Peak $3 Fee (3)
24-Hour, NE SF	-0.3%	-2.0%	-3.6%	-1.6%	-3.7%	-2.6%	-2.3%
24-Hour, All SF	-0.2%	-1.4%	-2.8%	-1.5%	-2.5%	-2.4%	-1.6%
AM Peak, NE SF	-0.6%	-4.1%	-7.3%	-3.4%	-4.4%	-5.7%	-4.6%
AM Peak, All SF	-0.7%	-2.9%	-5.4%	-3.3%	-3.2%	-5.3%	-3.6%

Figure E.19 compares City and County of San Francisco revenues for each scenario in two components: the existing 25% parking sales tax and parking fees associated with the scenarios. The three parking fee scenarios would substantially increase public revenue. Predictably, the $6 peak fee captures more revenue than the $3 fees, increasing public revenue by 131%. The $3 all-day fee would increase baseline revenue by 118%, significantly more than the $3 peak fee, which shows a 71% increase. For most of the scenarios, existing parking tax revenue decreases as individuals shift modes or timeframes. Unexpectedly, the no monthly discount scenario leads to tax revenue increases.

Figure E.19 City and County of San Francisco Daily Revenue by Scenario



E.4.2 Key Findings

Overall, the examined parking strategies translated into modest changes in mode share and congestion in San Francisco. Parking strategies do not apply directly to through trips with destinations outside the pricing or policy area, so the strategies do not appear to achieve a similar level of congestion reduction as the cordon toll studied during MAPS. Comparing the parking strategies to the MAPS preferred scenarios is challenging since the modeled cordon pricing scenarios had significant transportation investments, which made alternative modes more attractive than the baseline. This study's parking scenarios do not contain similar modifications to the network.

The PSUS evaluation found that many of the strategies perform similarly and there is not a clear top performer. However, some of the strategies could be part of the City and region's larger congestion management efforts. The all-day (i.e., peak and midday) flat fee is one of the more promising options and would increase City and County of San Francisco public revenues substantially, freeing up funding to improve the transportation system. The monthly and daily bulk discount elimination would also reduce some congestion and could increase garage operator and public revenues.

Key findings include:

- Increasing the cost to park influences some drivers to choose alternative modes and/or travel times. Results vary depending on fee level, as well as the traveler population(s) and time(s) of day affected by the change.
- The travel demand model results showed that driver-response to parking scenarios was somewhat modest. Price changes alone may be insufficient to compensate for underlying trends in congestion and delay. But they may be important strategies in managing congestion.
- At the $3 fee level, the all-day fee (peak and midday) scores better than the peak fee for 24-hour metrics and some AM Peak metrics.
- Each parking fee regime would considerably increase existing parking-related revenues for the City and County of San Francisco; these revenues could be used to improve transportation system infrastructure, which could lead to improved performance outcomes. The fees capture more revenue than the cordon toll evaluated in the prior MAPS study; this is partly because the cordon toll does not apply to trips occurring within the Northeast Quadrant, while parking fees target all trips terminating within the priced zone.
- Unexpectedly, the combined monthly and daily bulk discount elimination achieves mode shift and congestion reductions that rival or exceed those of the $3 fees in some timeframe-geography pairings. Furthermore, the discount elimination was the only modeled strategy to show revenue increases for garage operators and the existing 25% parking sales tax.
- Relatively few Study Area parkers receive employer-subsidized parking. Therefore, parking cashout affected overall transportation system performance minimally.
- Parking supply strategies, such as capping parking supply at current levels, are unlikely to influence mode share and congestion in the next few years but could play an important role in the long term.
- The supply model and other data parking supply data sources suggest that four fifths of the off-street, non-residential parking in the Study Area is publically available. Thus, strategies that target privately available parking are unlikely to markedly affect overall transportation system performance.
- For parking-related strategies, the relationship between drive alone mode share and VHD reductions was approximately linear.

E.4.3 Next Steps

Within the context of this report's transportation performance and revenue findings, the Implementation Chapter explores the political and technical feasibility of the top-performing parking strategies to round out the PSUS evaluation. The Applying Findings to Other Context chapter discusses which results are likely to relate to other geographies, helping PSUS serve as a national resource on off-street parking solutions.