



FHWA-supported Parking Pricing Project Updates

This document provides an update on a selection of parking-pricing efforts across the country that were funded by the Federal Highway Administration (FHWA) in most cases through its Value Pricing Pilot Program (VPPP) or the Small Business Innovative Research (SBIR) Program. The VPPP was established under Section 1216 (a) of the Transportation Equity Act for the 21st Century in 1998, and its funding continued through the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU). The most recent report on the VPPP to Congress (2016) noted that parking pricing efforts have led to reduced driving and a more balanced distribution of demand for existing parking spaces.

San Francisco Parking Supply and Utilization Study

San Francisco County Transportation Authority sought to explore the effectiveness of policies that address parking demand and supply as a way to reduce congestion by encouraging alternative modes and time of travel. The Parking Supply and Utilization Study (PSUS), partly funded by the VPPP, built upon the SF *park* pilot program that tested a new parking management system where prices are regularly adjusted based upon parking occupancy rates at many of San Francisco's metered on-street parking spaces and city-owned parking garages.

The PSUS evaluated the feasibility of several parking-related strategies for congestion reduction with the goal of shifting trips from auto to non-auto modes and to less congested time periods. To better inform the evaluation, the study also included data collection and an estimation of the total supply of off-street, non-residential parking spaces. Some of the modeled strategies that were found to have the most significant impact were:

- Flat, Peak Fee
 - *Strategy:* Each time a vehicle goes in or out of a garage during the peak period, the driver pays a flat fee (\$6.00) on top of the existing 25% tax.
 - *Impact:* In the AM peak, there was a projected 1.4% reduction in drive alone mode share to the Northeast quadrant (NE) of San Francisco (SF), a 4.2% reduction in vehicle miles traveled (VMT) and a 7.3% reduction in vehicle hours of delay (VHD).
- Flat, All-day Fee:
 - *Strategy:* Each time a vehicle goes in or out of a garage any time of the day, the driver pays a flat fee (\$3.00) on top of the existing 25% tax.

- *Impact:* In AM peak for NE SF, there was a projected 1.5% reduction in drive alone mode share, 2.6% reduction in VMT, and 4.4% reduction in VHD.
- Universal Parking Access Fee
 - *Strategy:* All parkers on work and non-work trips pay a fixed fee (\$3.00) 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.
 - *Impact:* In AM peak for NE SF, there was a projected 1.7% reduction in drive alone mode share, 2.8% reduction in VMT, and 4.6% reduction in VHD.

In general, the PSUS found that the evaluated parking strategies would perform modestly in mitigating area-wide congestion and were less effective than cordon pricing. This is partly due to the fact that a sizeable number of trips through downtown San Francisco are pass-through trips that would not be impacted by parking charges. The study concludes that as part of a larger transportation demand management (TDM) approach, changes to parking are likely to be effective.

The full report documenting the study and its findings is available here:

http://www.sfcta.org/sites/default/files/content/Planning/ParkingSupply_and_Utilization/Parking_Supply_final_report_11.29.16.pdf.

Small Business Innovation Research: Cruising-caused Congestion

The SBIR program, with financial and technical support from FHWA, initiated a project to develop a methodology and low-cost approach that would provide municipalities with insight into the extent of cruising for parking within their jurisdictions. Searching for parking, colloquially known as cruising, has been a concern almost since the beginning of automobile mass production and is associated with several problems, including causing excessive VMT. Excess travel from cruising causes additional congestion, air pollution, time wasted, and driver frustration, which could translate to increased risk of crashes and loss of economic competitiveness at destinations where parking is hard to find, especially if alternative access options, such as transit, are also scarce. In order to address the problem, it is imperative to understand the extent of cruising, which continues to be unclear despite several past attempts.

There were two awardees for this SBIR research project: Nelson-Nygaard and Rapid Flow, and each has completed a Phase 1 study and prepared a report to document findings.

The Nelson-Nygaard study utilized GPS traces derived from several sources to develop a nuanced understanding of cruising for parking in two cities: San Francisco, California, and Ann Arbor, Michigan. This work builds on an increasingly rich body of research and provides a promising path forward for the creation of robust tools that any city can employ at any level of geography to better understand parking search behavior and, in turn, create better policy responses than have been available to date. Preliminary results of the study show the extent of cruising in San Francisco is between 5 and 6% citywide. In Ann Arbor, the rate is about 3 to 4% in the downtown core. Cruising rates, though, could be much higher at certain times of day and in certain locations. The final study is available at: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2906528.

In 2015, Rapid Flow Technologies completed Phase 1 of its parking-cruising study with the goal of demonstrating the feasibility of a low-cost approach to automatic detection of cruising for parking using dense networks of automated vehicle identification (AVI) sensors. AVI sensors – such as Bluetooth, Wi-Fi, and toll tags – are widely used for travel time measurement on freeways and arterials. Rapid Flow extended these techniques to urban environments for vehicle route reconstruction, travel time measurement, and detection of cruising for parking. In the Phase 1 project, Rapid Flow deployed a network of 38 Bluetooth AVI sensors and then reconstructed the routes of vehicles from a controlled driving sample, where drivers carried Bluetooth units with known addresses and drove a set of pre-defined routes. Rapid Flow reconstructed all of the routes from the distributed sensor observations and used a classifier developed in this project to determine whether vehicles were cruising. Rapid Flow has received Phase 2 SBIR funding to develop a robust, scalable, commercially viable AVI sensor network approach to measuring cruising for parking that cities and agencies can easily deploy and use to aid in planning and operations based on the prototype system built in Phase 1. A low-cost, sensor design will be completed and large-scale permanent sensor networks in significant urban areas will be deployed. The final report of the Phase 1 study is available here: <http://rapidflowtech.com/sbir-phase1-report/>

MIT Commuter Parking Incentives Project

The Massachusetts Institute of Technology (MIT) Transit Research Program began as an academic research project involving commuter incentive programs in July 2014. The program is divided into two phases: phase 1 (year 1) consisted of the pre-implementation analysis and phase 2 (years 2 and 3) comprised trial implementation and monitoring.

Phase 1 of the program involved compiling results from existing MIT employers, and other exemplary employers' commuter incentive programs to quantify benefits and costs associated with a variety of employer-sponsored transportation incentives, including: pre-paid monthly transit passes; payment per transit ride; universality (ending of binary

choices); "free" introductory offers of transit; "free" occasional use of transit for employees with full parking passes; various levels of parking subsidies and new parking payment mechanisms; administrative restrictions on parking privileges; and partial transportation benefit "cash-out" options.

As part of this effort, a new commuter incentive package called AccessMIT was introduced to all benefits-eligible faculty and staff at MIT. This package included a shift to daily parking prices, a free universal bus and subway transit pass, an increased commuter rail monthly pass subsidy, a new parking subsidy at transit stations, an online commuter dashboard, and integration with existing programs. The primary goal of this package was to achieve a 10% reduction in parking demand over two years to stem the need to build additional parking and to provide more equitable and flexible options to employees that reflect the external cost of commuting by different modes.

Preliminary unscaled results of the AccessMIT program using a revealed choice survey of employees (with a 54% response rate) show that the drive alone "primary" mode share decreased from 30% in 2014 to 25% in 2016. The primary mode share for public transit increased from 43% to 48% over the same period. It was also found that AccessMIT benefits have influenced commuting decisions of a majority (57%) of the MIT staff, with at least 15% of the staff having changed their primary or secondary modes. Further, a comparison of employees' daily trip diary for a week in October showed that between 2014 and 2016 there was a 13% drop in the average number of days per week that all employees drove alone to work. Even among those employees who reported driving alone at least once during the survey week, there was a 5% drop in average drive alone frequency from 2014 to 2016. The continued roll-out of AccessMIT benefits will include several new rounds of commuter incentives and prizes. There will be a focus on carpooling strategies and incentives. The program will also include an advertising campaign to raise awareness and improve employee engagement. Further, the program will be evaluated further to determine more granular seasonal parking and transit utilization trends and breakdowns of employee groups who changed their commuting behavior so that the lessons learned can be made available for other prospective employers.

University of California, Berkeley, Parking Incentive Project

The University of California, Berkeley, is conducting an experiment that would allow parking permit holders to recoup some of their permit costs by selling back their parking on days that they are willing to forego it.

Previously, a broader experiment to reprice commuter parking was conducted. In that experiment, a new kind of employee parking permit, the FlexPass, was explored. Most employees of the University of California, Berkeley, buy a monthly parking permit with

pre-tax dollars. The FlexPass is the same, but it also offers employees partial refunds in proportion to the number of working days they did not park each month. The treatment effect of this new parking commodity is revealed by a randomized controlled trial. The FlexPass treatment reduced parking demand by a highly significant 6.1%.

In the current experiment, FlexPass holders enter a “willingness to accept” bid to sell their parking privilege, from \$.01 to \$15, by noon the day before the parking would occur. After the noon cutoff, a “second price reverse auction” is deployed whereby a random amount is generated as a proxy for market price on a given day. (All values between \$.01 and \$15 are equally likely to be observed.) If the random amount is greater than or equal to the bid, the subject wins and the bid is accepted at the random number value. The user will receive the random amount as a rebate and will not be able to park on campus that day. If the random number is less than the bid, no incentive will be issued and the user is allowed to park on campus. The system has the advantage of offering much more insight into the behaviors associated with price elasticity than the more traditional approach of changing prices and observing reactions does. Price elasticity was found to be heterogeneous and system revenues can be enhanced when parking is priced with this understanding.

FHWA Parking Cash-Out Study

FHWA, under contract with the consulting team including Leidos Inc., ICF International, and UrbanTrans, is performing analysis on the impact of city-level, parking cash-out ordinances on VMT and driving-related externalities.

Parking cash-out modifies existing employer-provided parking-only commute benefits to reward employees for using alternative transportation, while allowing employees who choose to continue to drive and park at work to do so without penalty. Under such ordinances, any parking subsidy offered to employees will have to be accompanied with an equivalently-valued subsidy for not driving to work and thus foregoing parking. The requirement to offer parking cash-out could be timed to enable employers to shed excess parking (through mechanisms such as opting for a lease with fewer parking spaces or subletting or selling unused parking spaces) and thus to recoup costs for spaces no longer needed by employees who accept the cash-out benefits in lieu of parking. Such a policy would not preclude future changes to parking benefits offered by the employer. Both employers and employees benefit from parking cash-out, since employees who accept the cash-out offer experience increased incomes, funded by savings from employers' reduced business expenses because of not having to lease or otherwise subsidize as much parking. Among 1,700 employees in eight case-study firms in Southern California, parking cash-out implementation led to an 11% reduction in drive-alone commute trips and a 12% reduction in commute VMT.

The analysis is being performed for six scenarios across nine cities. The six scenarios are:

- Scenario 1: Monthly parking cash-out: employees may cash-out their parking on a monthly basis.
- Scenario 2: Tax-exempt commuter benefit option: employers providing parking benefits must also offer all other non-driving, tax-exempt commute benefits.
- Scenario 3: Daily cash-out: employers are offered a tax credit to offer employees daily cash-out.
- Scenario 4: Employers that are not providing subsidized parking are still required to provide pre-tax transit benefits.
- Scenario 5: A tax credit is offered to employers that drop their parking benefit entirely and only offer other tax-exempt transportation benefits.
- Scenario 6: An alternative to cordon pricing in which there is a surtax on parking fees when someone arrives at or leaves a parking facility during peak-travel hours.

The nine cities included in this analysis are Houston, New York, Los Angeles, Chicago, San Diego, Philadelphia, Indianapolis, Washington, D.C., and Boston. The project is expected to be completed by September, 2017. FHWA will share its analysis broadly with the transportation policy community and focus outreach on cities that are contemplating enacting parking cash-out ordinances or other policies that would encourage parking cash-out.