Contemporary Approaches to Parking Pricing:

A PRIMER

U.S. Department of Transportation
Federal Highway Administration

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1.0 Introduction

United States drivers were introduced to the concept of paid, on-street parking in 1935 when the first parking meter was installed in Oklahoma City. In the ensuing decades little was done to improve the basic tools or processes of parking pricing. Many cities arbitrarily set fixed parking rates that resulted in excess demand for a finite resource. The failure of cities to price parking based on demand has resulted in an underperforming parking system, the impacts of which include lost revenue, increased congestion, decreased access to businesses, environmental harm, and inconveniences to travelers.

Underpriced and free parking also distort travel decisions. Studies have found that free parking can increase the drive-alone rate for commute trips by as much as 50 percent (Hess, 2001; Willson and Shoup, 1990a; San Francisco County Transportation Authority, 1996) and work by Donald Shoup (2006) reported that approximately 30 percent of cars in congested downtown traffic may be looking for parking, adding unnecessary vehicle trips to already congested areas. Correctly pricing parking can help address these issues.

Today, technological advances offer the opportunity to effectively manage and price parking. Improvements in parking management infrastructure and tools combined with innovative thinking by politicians, transportation and parking professionals, and researchers are advancing the field of parking management. New technologies are making it possible to collect and analyze large amounts of data about parking utilization. That in turn allows cities to define clear policy goals and accurately adjust pricing to meet those goals. Better technology has also improved revenue management, provided users with more payment options, and improved enforcement while lowering associated costs.

Because of the opportunities brought about by these new technologies, cities across the United States are able to improve their parking pricing policies to address congestion, improve customer service, increase availability, and address safety concerns for non-motorized travelers. For example, San Francisco and Seattle have both established occupancy goals for on-street parking. San Francisco aims to achieve occupancy rates between 60 to 80 percent and Seattle has a goal of two open spaces per block. Each city now regularly adjusts meter rates to meet the identified goals. Chicago and San Francisco are exploring the use of parking pricing as an alternative to cordon charges. Boulder and Aspen, Colorado have residential parking permit programs that allow commuters to purchase parking passes on a space-available basis. New York City is testing peak-hour parking charges, and Washington, DC is using license plate reader technology to support and analyze its performance-pricing program. Recent experiences in these cities and others provide lessons and opportunities for practitioners interested in advancing parking pricing policies.

This primer discusses advances covering a broad array of parking pricing applications, available technology, preferred user accommodations, and strategies for gaining public acceptance for policy changes. The information provided is meant to increase awareness of innovative approaches, help communities design strategies that are applicable to their unique needs, and encourage new innovations in the field of parking pricing.

The programs and policies discussed here are likely just the beginning of what will be transformative changes to parking management across the United States. Parking professionals will find ways to use technology that have not yet been considered, parking managers will push for more advanced equipment, parking technology will become more affordable, and consensus builders will advance new policies. The Federal Highway Administration (FHWA) hopes that this primer helps to further discussion and innovation during this exciting period.

Pricing Overview 2.0

FHWA and local governments are looking at leveraging market forces by pricing transportation resources to reduce congestion. Pricing, if properly instituted, accomplishes three important objectives:

1) It can allocate scarce transportation resources in a way that mitigates congestion and ensures greater efficiency from the entire transportation system;

2) It reduces potentially market distorting subsidies that have induced excess auto travel; and

3) It creates a revenue stream that can be invested in access enhancements, which could in turn reduce parking (and driving) demand.

Pricing parking can be a powerful tool—especially when used in conjunction with other travel demand management strategies—to influence travelers' decisions about whether to drive alone, carpool, use transit, or use non-motorized travel modes. Reductions in drive-alone travel can subsequently reduce emissions and congestion and improve access and revenue generation.

This section of the primer discusses the two basic approaches to parking pricing: 1) free and fixed-rate pricing and 2) performance-based pricing. Within performance-based pricing there are two primary strategies: variable prices and escalating prices. These approaches can be used by cities to better manage parking supplies while simultaneously improving the travel experience of those who continue to choose driving. Depending on how parking revenues are invested, a parking strategy can more broadly improve access to an area where the desire to drive and park currently exceeds road capacity and/or parking supply.[1]

2.1 FREE AND FIXED RATE PARKING

Cities own a tremendous amount of real estate that comprises the public right-of-way (ROW). While the value of the ROW as an asset is implicit in permit fees for uses ranging from block parties and construction to non-automobile storage, peculiarly, most cities allow residents and visitors to store their automobiles rent free on much of the ROW. In some instances, typically in business districts, municipalities will charge nominal parking meter fees. Because cars are parked about 96 percent of the time and because estimates of the number of parking spaces per automobile range from three to five, the 194 million registered vehicles in the United States take up between 5,200 and 8,700 square miles of parking space. The land devoted to parking in the United States could fill an area between the size of Connecticut and New Jersey—a valuable asset that is underutilized.

As noted in the introduction, the first parking meters were installed in Oklahoma City in 1935. Studies pre-dating the installation of those meters showed that vehicles parked on commercial streets belonged, by and large, to local merchants and their employees. Customers, who had begun to own automobiles at increasing rates, were left to circle around hoping that a parking space would become available. These drivers contributed to the incipient but fast growing downtown congestion problems. Civic leaders recognized that by renting the curb, rather than giving it away, they could shift the dynamic. Meters were first installed on only one side of each street. In the morning, as workers and merchants arrived, the free spaces quickly filled. By 10:00 a.m., as shoppers came downtown, metered spaces made up the majority of available parking. As customers completed their business and departed, the metered spaces were used by later arriving customers, who also paid for use of the parking spaces. By one account, merchants

[1] In many instances of apparent parking under-supply it is infeasible and/or unsound to add parking capacity. This occurs where the street system is also congested and where adding parking would require reducing active uses of the land.

on the free side began to clamor for meters on their side as well (Popular Mechanics, 1935). The pricing strategy was very effective; instead of having all the spaces taken up by all-day parkers, ample turnover allowed many users to access the area. In short order, other cities adopted this approach to rationing the curb. All-day parkers resorted to finding spaces in slightly more remote areas, or left their vehicles at home, allowing the high-demand spaces to turn over repeatedly throughout the day. The outcome was good for business and good for street performance.

With inflation, however, the price of the meters effectively became lower and lower, and the rationing effect was eroded. Losing sight of the initial reason for meter installation, city leaders became dependent on parking revenues but lacked the political will to price the curb effectively to continue the initial success. Instead, downtown merchants, fearing competition from the burgeoning suburbs, fought for cheap or free parking.

Boston is an instructive case. In January 2011 Boston increased meter rates for the first time in 25 years, after "mulling it over for 10 years" (Andersen 2011). By the time of the rate increase, the pre-existing $1.00 an hour meter rate, set uniformly across the city, had lost value with inflation. The rate was effectively half what it had been when it was set in the mid-1980s. To restore the meter rate to what it had been the city would have had to double the rate to $2.00. Rather than use a performance-based pricing strategy, as explained below, the city simply increased the rate to $1.25 and justified the increase as a way to raise revenue for the city's general fund. Lacking a travel management rationale, the rate hike was seen by parkers as a tax on drivers.

On-street parking and most municipally or publicly owned off-street parking, particularly at transit stations, has traditionally been free or set at fixed prices that vary little by location or time of day. In those cases where prices had at some time been established according to supply and demand, the failure of pricing to keep pace with inflation (and demand) has left the municipalities and agencies in charge of parking pricing without a sound justification for taking action. As in the Boston example, fixed-price parking, across time and geography, without respect to demand or inflation, is not very different from free parking in terms of congestion mitigation and access. Fixed-price parking has a benefit over free parking in that it does signal a fee for use of the space rather than simply an entitlement to the ROW, but it falls far short of its potential as an effective demand management tool.

In the 1960s and 1970s, cities concerned about competition from suburban merchants focused on trying to offer free and abundant parking instead of focusing on parking access. Boulder, Colorado, however, was an exception. Boulder's city leaders and merchants believed the essential ingredient to success was available parking for those who drove to the main business district, but, at the same time, they saw the value of rationalizing access, realizing that in order to offer abundant free parking, as suburban developers did, they would have to redevelop in a suburban style. By allowing the large-scale development of parking facilities, the city would essentially erode land values and become "suburban" itself. Instead, the city established the first parking benefit district, charging for parking, coordinating on-street and off-street fees, and using the revenue to enhance other transportation modes.

Photo credit: iStockphoto

Rather than maintaining fixed pricing, increasingly cities are taking a holistic approach, as Boulder did. The current approach considers access broadly, taking into account all travel modes, and uses modern parking-management strategies to define and meet demand. These cities set parking rates to achieve specific occupancy goals or other objectives. Depending on the goals and local conditions, parking rates can vary by location, time of day, and presence of a special event. Policies and subsequent pricing are data-driven and designed to balance demand throughout neighborhoods and central business districts. Because they are data-driven, these policies allow city managers to adjust prices quickly based on economic and land-use changes.

2.2 PERFORMANCE-BASED PRICING

Fixed-rate pricing has been the standard parking-pricing option for cities since the parking meter was introduced. While it may not adequately price parking, it does have advantages. The pricing scheme can be implemented with mechanical meters, requires no additional special equipment, and does not require the collection of data regarding parking utilization and availability. Unfortunately, fixed-rate pricing fails to manage parking supply.

Pricing parking based on performance goals for the street or transportation system, often called performance-based pricing, allows cities to better manage the parking supply. Parking experts generally agree that 10 to 20 percent (one or two spaces) of on-street parking per block should be vacant most of the time as a way to reduce or eliminate cruising for parking (BPR, 1956; Levy, et al. 2012). Higher vacancy rates may be a sign that pricing is too high.

While a vacancy rate of 10 to 20 percent might be the most common performance goal used by cities, other goals can be considered as well. Pricing can be set to drive turnover, maximize value extraction, and transition travelers away from private automobiles to more sustainable travel modes. In any case, the performance standard is met through various pricing schemes, including rates that escalate the longer a person is parked, prices that vary by location, prices that vary by time of day, or a combination of these options.

Implementing a performance-based pricing program begins with understanding the local parking context and establishing a balance between parking supply, both on street and off, and demand. Accurate and up-to-date supply and demand data are helpful to determine appropriate parking rates, but the rates can be set empirically as well. San Francisco and Seattle are good examples of cities that are empirically setting rates to reduce cruising. San Francisco has taken a complex approach with the aid of "smart" meters that can accommodate multiple forms of payment, charge variable parking rates, and record data regarding usage and duration of use; parking sensors; and a very advanced data collection system, whereas Seattle is experimenting with a low-technology approach that focuses on manual measurements of on-street parking conditions. Both cities seek to set rates that assure an appropriate level of available space (see the Seattle case study in section 7 and the San Francisco callout at the end of this section).

Variable Rates

Parking rates should be allowed to vary across a variety of dimensions. One dimension should be geographical, as some areas of a city will have greater parking demand than others. Rates should also vary by time of day, which is already a common practice as meter rates are typically in effect only during daytime hours and overnight parking is free. A few cities, New York City and San Francisco being notable examples, have implemented differential parking rates that vary by time of day based on changes in parking demand. New York City implemented variable parking rates in two pilot neighborhoods. In one neighborhood the peak rate is charged between 12:00 p.m. and 7:00 p.m. and in the other neighborhood the peak rate is charged between 6:00 p.m. and 10:00 p.m. As in most meter applications, overnight parking is still free, leaving three distinct price regimes throughout the day. Rates should also vary across days of the week, as some areas will have higher demand on weekdays than weekends and vice versa. They should also vary across time more generally: as inflation erodes prices and as areas gain or decline in popularity, meter rates should fluctuate to reflect these realities.

A somewhat controversial approach is to vary prices in real-time, which the District of Columbia is proposing to pilot for some on-street commercial vehicle parking. This approach is analogous to a travel lane that is priced to ensure a particular travel time. As parking utilization on a given block increases, the price escalates from a base

price. The practice is more controversial with respect to parking as there is a value-driven belief among most city leaders that people should have a reasonable a priori expectation of prices. Also, it may be counterproductive to keep the price low for people who arrived during a period of high availability. That outcome would encourage people to arrive early and stay for longer periods.

Escalating Prices

Often used in off-street parking, escalating rates increase the longer a vehicle is parked at a location. The rate structure is designed to discourage long-term parking, thereby increasing parking turnover and availability. Differentiated rates are common practice at airports. Airport operators typically divide parking into short-term and long-term lots. The spaces nearest the terminal are well suited to people who are dropping off or picking up passengers and will only use the space for a short time. People who will be parking overnight or for multiple days are often accommodated farther away so the airport operator has adequate parking supply for those who need the more convenient spaces. The way that airports enforce the distinction is by setting different prices. Frequently they will set an escalating price in the short-term lot to discourage long stays. Atlanta's Hartsfield-Jackson airport charges short-term parkers $2.00 per hour for the first 2 hours and then $3.00 per hour for the next 4 hours. At Chicago's O'Hare Airport they charge $2.00 for the first hour, $3.00 for the second hour, nothing for the third hour, and then a steep rise to $5.00 for the fourth hour and $19.00 for the fifth hour. An escalation like this encourages people to park only for short periods to accomplish a task. In the case of an airport, the task is to pick up passengers.

Cities may also use this model where they wish to encourage additional parking turnover. For example, they may wish to use this approach in commercial areas that have many deliveries. If deliveries can be accomplished in 1 or 2 hours, having a third and fourth hour charge that is very high will discourage all-day parkers, allowing an adequate turnover rate so that deliveries can be accommodated. In New York City, certain spaces throughout the city are designated for commercial vehicles. The rate for these spaces is $4.00 for the first hour, $5.00 for the second hour, and $6.00 for the third hour.

2.3 PARKING TURNOVER VERSUS PARKING AVAILABILITY

Cities that have adopted explicit performance goals usually seek to achieve a certain level of parking turnover or a certain level of parking availability. At the heart of each goal is the objective that people wishing to park should be able to do so with minimum search costs. As a practical matter turnover may be hard to measure (especially if space sensors have not been deployed), which means it is difficult for a city to know if it has met a turnover-related performance standard; however, availability may be simpler to measure (e.g., by occasionally conducting manual counts and supplementing such counts with meter-payment data). Turnover is also harder to enforce. Many cities adopted time limits on metered spaces to meet their turnover goals. Anecdotally it is unclear that citizens understand that a time limited meter is to be vacated at the end of the time limit. Many people think they need only return to their

SF*park*

SF*park* is the nation's largest and most sophisticated performance-parking program to date. It includes 6,000 parking spaces in seven pilot districts and has received over $19 million in Federal funds to implement. SF*park*'s overarching goal is to price city-owned on-street and off-street parking facilities at rates that help redistribute demand and ensure that one parking space is usually available per block and that at least some parking will be available in garages. Additionally, SF*park* is intended to change public attitudes towards metered, on-street parking by providing better parking information and customer service.

The heart of the program is its technological innovation and data collection: sensors at each of the 6,000 parking spaces collect real-time occupancy information that is used to make future pricing decisions that are data-driven and easily understood by the traveling public. Smart-meters play a crucial role in the program by allowing SF*park* to charge different rates at different times and to adjust pricing remotely. The city uses an in-house database tool to link data from its various parking assets and make rate adjustments. Parking rates are set to achieve occupancy goals of 60 to 80 percent and can range between $0.25 and $6.00 per hour. Rates vary both geographically and by time of day.

SF*park* has developed a book detailing the innovative program's implementation and lessons learned. The book, "SF*park*: Putting Theory Into Practice," is available from the SF*park* Web site at *SFpark.org*.

car and "feed the meter" in order to be in compliance with the regulation. The evidence shows that meter time limits are frequently violated (Weinberger et al., 2010). Time limit enforcement used to rely on agents placing chalk marks on the tires of parked cars. Newer approaches use license plate recognition technologies but still require an enforcement agent to make frequent passes along the streets.

Technological advances have made obtaining data, setting prices, and adjusting prices much easier. New smart meter systems can accommodate multiple forms of payment, charge variable parking rates, and record data regarding usage and duration of use. These meters can be supplemented with parking sensors and license plate reader technology, both of which have been used by cities to determine occupancy with varying degrees of success.

Instituting different pricing strategies does not require advanced technology but it is made much easier and defensible with emerging meter and data collection technology. These technological advances are the subject of the next section.

3.0 Technology and Pricing

The tools to manage parking inventory and facilities are advancing rapidly, helping to support and make possible some of the parking pricing programs and policies discussed in the previous section of this primer. New technologies allow parking managers to collect large quantities of data at relatively low costs, which results in more transparent decisionmaking, particularly when setting parking rates. Technology advances also allow parking managers to implement dynamic pricing, increase revenue generation, offer real-time reporting, and allow for more efficient parking enforcement. At the same time that parking technology is improving the decisionmaking and management process, it is also improving the customer service experience. This combination of improvements can decrease the potential for negative reactions to new parking policies and prices.

Electronic parking meters have essentially replaced mechanical meters, offering improved security and a simplified process for changing parking rates. Today, intelligent single-space parking meters, multi-space meters, pay-by-phone technologies, and automated off-street facilities offer even more convenience and flexibility. These technologies increase the number of payment options available to users, provide more information regarding revenue and utilization, and allow for real-time updates to pricing. Advances in license-plate-recognition (LPR) technologies and space sensors further improve enforcement and data collection.

The customer benefits associated with new technologies are significant. Users can receive real-time information regarding available parking spaces and pricing, have multiple payment options, remotely extend their parking time using a phone or computer, and even be told where they parked if they have forgotten.

This section of the primer discusses available parking technologies, items to consider when selecting a technology, and options for implementing advanced parking policies with older parking assets.

3.1 AVAILABLE TECHNOLOGY

What follows is a list of currently available technology to accept parking payments, monitor use, and conduct enforcement. The list represents both older and newer technologies and includes assets applicable to on-street and off-street parking spaces.

Single-space Meters

Single-space meters are the oldest type of parking asset and have traditionally been very limited in their ability to accept multiple payment options, adjust prices, report revenue collected, and monitor utilization; however, intelligent single-space meters have been developed that can be retrofitted into existing meter housings and accept both coin and credit card payments. These meters are solar powered, wirelessly networked to allow real-time reporting, automatically report system failures, and support dynamic pricing. Responding to other technology innovations, discussed later, they can also integrate with pay-by-phone systems and vehicle-detection sensors.

The benefits of single-space meters include the ability to pay at the space rather than at a central payment location; the presence of a visual reminder to users (i.e., the meter itself) that they must pay to park; the failure of a meter affects only one parking space rather than an entire block face or parking lot; meter mechanisms can be removed for repair at a maintenance facility; and enforcement personnel can visually determine if a vehicle is in violation. Upgrading to the intelligent single-space meters also allows existing meter housings to be reused, reducing system retrofit costs and allowing for faster installation.

Multi-space Meters

The multi-space meter classification represents a broad assortment of payment and technology options. Multi-space meters are common with both on-street and off-street facilities and can support pay and display, pay by space, and pay by license plate. While each of these has unique benefits and applications, all are capable of accepting coin and credit card payments, real-time reporting, and dynamic pricing while reducing the clutter associated with single-space meters. Specific options associated with multi-space meters are summarized below:

- Pay and display requires users to walk to a central pay station, make their payment, and place a receipt on their vehicle's dashboard. This option allows enforcement personnel to determine quickly if a vehicle is in violation of time limits and, as long as time remains on users' receipts, they can move within a parking district without making additional payments. A disadvantage is that users may find it inconvenient to return to their vehicles after paying. Also, if a pay-and-display station is out of service, multiple parking spaces are affected, resulting in lost revenue.
- Pay by space functions similarly to pay and display, but rather than placing a receipt on their dashboard, users enter a space number associated with their parking space. Complaints are reduced because users do not need to return to their vehicle, but enforcement personnel must pull reports to determine which occupied spaces may be in violation of time limits, which can slow enforcement processes. It is possible to integrate this payment system with space sensors, discussed below, to simplify the enforcement process. Pay by space removes the option that allows users who still have parking time remaining to move to another space within a parking district without paying again. As with pay and display, an out-of-service station will affect numerous parking spaces.
- Pay by license plate is very similar to pay by space; however, rather than entering a space number, users enter their license plate number. The primary drawback is that some users do not know their license plate number or might key it in wrong. As with pay and display, this option allows users with parking time remaining to travel within a parking district without paying additional fees.

In-car Meters

In-car meters are small, programmable devices that hang from rearview mirrors and driver's side grab bars (handles located above the driver's side window) or are placed on dashboards. The meters are pre-loaded with funds that are deducted based on the location of a vehicle and duration that it is parked. When users arrive at a parking space they select the appropriate parking zone, which tells the meter what parking rate to charge, and activate a timer that deducts funds from the user's account based on the time the vehicle is parked.

Reusable and disposable versions of in-car meters are available, and funds can be added over the phone, on the Internet, or using smart cards that are inserted into the devices. Some in-car meters contain Global Positioning System (GPS) cards that allow the meters to determine their location and automatically charge the appropriate rate. Efforts are currently underway to integrate in-car meters into vehicle navigation systems, such as OnStar. In-car meters offer an alternative to single-space and multi-space meters but do not typically replace those meters.

In-car meters allow users to pay only for the time they use, reduce the threat of vandalism, and yield higher levels of compliance. Because money is loaded onto the meters before use, parking departments have the dual benefits of receiving revenue up front while reducing collection costs. The ability to pay in the vehicle allows users to avoid standing outside to pay at single-space meters or walking to multi-space meters. Unlike multi-space and smart meters, however, in-car meters do not provide real-time information to parking managers. Some parking agencies have also expressed the concern that visibly placed in-car meters are subject to theft.

Photo credit: SF*park*

Pay-by-Phone

Pay-by-phone technology allows users to pay for parking by phone, text message, or with a smart phone application. Users are typically required to preregister and provide a credit card number. There are two ways in which this system charges for parking. The first option, typically referred to as "start duration," allows the user to arrive at a parking location, enter a code associated with the location, and select the amount of time they would like to park. Some systems will send text messages or other notifications to users before their time expires and allow them to add time with their phone, so long as doing so will not cause them to be parked beyond any existing time limits. The second option, called "start stop," requires parkers to contact the system when they first park and again when they are ready to leave.

Pay-by-phone systems are typically privately operated and are capable of integrating with intelligent single-space and multi-space meters and LPR technology. The integration with LPR means enforcement officers using that technology can be automatically notified of time violations. If not integrated with meters or LPR, pay-by-phone systems require enforcement officers to check an additional database before issuing a parking violation. Any cities using pay by phone must share data regarding street sweeping, time limits, and other restrictions with the vendor to assure that the data remain up to date. Creating a process and system through which this information can be shared is a significant and potentially costly undertaking that may require changes to business processes and organizational culture; however, the end result is a system through which data can be easily shared across many departments and with the public.

Benefits include an additional, convenient payment option for users, the ability to add additional parking time remotely, and the capability to warn users if they attempt to park during a period in which restrictions are in place. The technology also reduces costs associated with cash collection and prevents users from exceeding posted parking time limits. Rates can be easily adjusted and the systems can provide utilization data.

Automated Technologies for Off-street Facilities

Some parking payment technology is specific to off-street parking facilities. This technology allows staffing at facilities to be reduced and can support real-time reporting. The two primary technologies are pay on foot and pay in lane, both of which are discussed below.

- Pay on foot allows users to obtain a parking ticket upon entering a facility and make their payment at a pay station before returning to their vehicle and exiting. At exit, an exit verifier accepts the customer's parking ticket, confirms that the parking fee has been paid, and allows the customer to exit. This system speeds up the exit process and reduces staff costs; however, users may forget to take their parking ticket with them or may not realize that they must pay before exiting. Installing exit lane verifiers that can accept credit cards for payment or providing vehicle escape lanes so customers can park again and visit a pay station can mitigate this issue. Additional drawbacks associated with pay on foot are the cost of the system and the loss of attendants. (Some communities place a high priority on the assistance that attendants are able to provide to visitors in terms of way finding, payment processing, and other general help.)

- Pay in lane requires users to pay for parking in the exit lane of a parking facility using an automated kiosk. This system can be less confusing than pay on foot because it allows users to leave their parking ticket in their vehicle and does not require users to make a payment prior to returning to their vehicle. Staffing costs are reduced, but no one

will be available to offer assistance to parkers. Pay-in-lane systems cost less than pay on foot because they do not require both pay stations and exit verifiers. Exit flow can be significantly reduced with pay in lane compared to pay on foot. Pay in lane can provide a way to reduce staffing needs during less busy times when parking demand, and therefore exiting traffic flow, is low (e.g., during evening hours or on weekends).

License Plate Recognition Technology

LPR technology uses cameras and optical character recognition to read license plates. The systems can be hand-held or vehicle-mounted and work in daylight and low-light conditions. Once read, the license plate is referenced against a database containing violation, payment, and other pertinent information.

LPR also serves as an enforcement and data collection mechanism. It is able to determine if a vehicle has remained in a parking space or district beyond allowed time limits or lacks a necessary parking permit. The technology can also be integrated with payment systems for off-street parking facilities. Entrance and exit barriers will automatically open for registered vehicles. If appropriate, users' accounts can be charged for the amount of time spent in the facility. LPR is also able to monitor vehicle occupancy and duration in both on-street and off-street facilities.

The systems help prevent fraud by replacing printed permits, can significantly decrease staffing requirements for enforcement personnel, can identify stolen or wanted vehicles, and can simplify duration counts. LPR technology is not perfect, however. Systems may have trouble reading some States' license plates, worn out license plates generally cannot be read, the readers are not effective if license plates are covered with debris such as dirt or snow, errors occur if enforcement personnel with vehicle-mounted systems drive too fast, and community members may raise privacy concerns.

Parking Space Sensors

Parking space sensors typically use ultrasonic, magnetometer, or digital-camera technology to determine if a space is occupied. The sensors can be placed in pavement, affixed to single-space parking meters, or hung from ceilings in parking garages. Space sensors are used for enforcement, data collection, and informing users of the location of available spaces. Data can also be used to determine occupancy rates.

Photo credit: SF*park*

Data from space sensors can be posted on Web sites, accessed through smart phones, or provided on message signs so that drivers know where to find open parking spaces. In off-street facilities the increased reliability associated with sensor data (versus magnetic loops) allows occupancy to be increased from an industry standard of 85 percent to 90 to 92 percent. Newer digital-camera parking sensors are able to determine vehicle type, color, and license plate number. If people cannot find their car they can enter basic details about their vehicle and the system will tell them where their vehicle is parked.

There are some drawbacks to these systems. The current cost of space sensors keeps them beyond the financial reach of most cities and parking facility operators. In-pavement sensors can allow water to flow behind them, negatively impacting the life of paving materials. Some sensors must also be flush mounted for snow removal and require battery replacement approximately every 5 years. Privacy concerns may also be raised with the use of camera sensors that record license plate information.

Databases

No company currently manufactures all types of parking technology. This means that cities wishing to use multiple types of technology, including LPR, smart meters, parking sensors, and pay by phone, will need to develop database tools to integrate data from the various systems. This is a process that can quickly become complex. *SFpark* and Seattle both had database tools developed to collect, store, and analyze data from parking assets. Personnel from SF*park* recommend that cities outsource development to assure they have sufficient staffing and skill levels. They also recommend that those staffs that will implement the tool be involved from the beginning, that one vendor not be allowed to control the process, and that cities understand that development will take longer than expected. Cities should also consider developing application programming interfaces that allow parking data to be shared with developers, who can then create applications for the public.

3.2 SELECTING A TECHNOLOGY

When selecting a technology, items to consider include reliability, purchase costs, installation costs, maintenance costs, staffing requirements, and revenue potential. Parking providers must determine whether the new technology needs to be integrated with existing infrastructure or if an entirely new system in needed. The data collection and analysis process will help narrow the technology options. As with other elements of parking management, selection of a final technology should be a community effort that involves affected stakeholders.

Once a technology has been selected, the parking provider needs to create a specifications package, which is generally released to vendors as part of a request for proposals (RFP) process. While RFPs need to be very clear to avoid any issues and potential challenges from bidders, many parking operators may be tempted to provide very detailed specifications that cover minutiae such as the location and color of buttons. Specify what an asset needs to do and what a report needs to contain, but maintain flexibility by avoiding unnecessary specifics.

3.3 DOING MORE WITH LESS

Some agencies may not have the money to purchase advanced meters, space sensors, and database solutions. Fortunately, innovative programs can be implemented with basic technology. A look at Seattle, the subject of a case study provided in section 7 of this primer, proves the point. Occupancy and duration information are the two primary data points driving price and time-limit decisions at the more innovative parking agencies. While it is much easier and quicker to collect this information with space sensors and to adjust prices with advanced meters, less technical options also exist.

In smaller downtowns it is possible to conduct license plate occupancy and duration counts that cover all or most of the inventory manually. These counts can be conducted with assistance from part-time employees or interns. Ideally, counts should be updated at least once a year or after changing prices or time limits. In larger communities it may not be possible to analyze all parking facilities on a regular basis. In this situation conducting counts in sample areas that are representative of the larger community can reduce costs. LPR technology can significantly decrease the staff time required to conduct occupancy and duration counts.

If a community has advanced meters but lacks space sensors, meter payment data can be used to roughly estimate parking occupancy and duration. SF*park* and other agencies are developing processes for doing this in an accurate manner. Meter data can be supplemented by manual counts.

Adjusting prices on an annual basis, rather than quarterly or monthly, will further reduce the staff time needed to implement a performance-based parking policy.

3.4 GOING FORWARD

In the future, technology will become more affordable, integrate better, and offer more opportunities for sharing data. Cities and municipalities are likely to use overlapping technologies such as parking meters, pay by phone, and LPR technology, which will likely result in increased demand for improved data integration. In turn, this should make it easier for cities to integrate parking payment and enforcement systems.

Improvements in LPR technology should make the collection and tracking of occupancy and duration data easier as well, and the way in which parking data are shared is also likely to change. Online and mobile tools that allow parkers to check on the availability and cost of parking are just beginning to appear, and their presence in the marketplace is likely to increase significantly in the future. The integration of radio-frequency identification chips that allow cell phones to communicate with nearby electronics will likely give parkers one more way to pay. The potential to integrate mobile devices into the payment, data tracking, and parking space locator functions should offer significant opportunities to innovative manufacturers and communities.

Mechanical parking meters ruled the world of parking for decades, negating the need for parking managers to monitor new technologies and manufacturers. Today a parking agency must carefully examine its technology options and attempt to see far enough into the future that its asset purchases do not become quickly outdated.

Technology	Accepts Cash (coins or bills)	Accepts Credit Cards	Requires User to Return to Vehicle	Time Can Be Added Remotely	Outage Affects Multiple Spaces	Provides Real-time Reporting	Transferable within a Parking Zone	Off-street Only	Potential Challenges	Cities Using the Technology
Single-space Meters										
Electronic	Yes	No	No	No	No	No	No	No	Difficult to change pricing, limited revenue reporting, on-street "clutter"	New York, NY; Boston, MA; Phoenix, AZ
Intelligent	Yes	Yes	No	Yes	No	Yes	No	No	Cost and on-street "clutter"	Denver, CO; Atlanta, GA; Seattle, WA; Los Angeles, CA
Multi-space Meters										
Pay and Display	Yes	Yes	Yes	No	Yes	Yes	Yes	No	Users must walk back to car to place ticket on dashboard	New York, NY; Miami, FL; Long Beach, CA; Portland, OR; Washington, DC
Pay by Space	Yes	Yes	No	Yes	Yes	Yes	No	No	Users must remember their space number	Las Vegas, NV; Minneapolis, MN; Portland, ME; Atlanta, GA
Pay by License Plate	Yes	Yes	No	Yes	Yes	Yes	Yes	No	Users must know their license plate number	Regional Transportation District, CO; Calgary, Canada
Automated Technologies for Off-street Facilities										
Pay on Foot	Yes	Yes	No	n/a	Yes	Yes	n/a	Yes	Can be confusing to users, no parking attendants to provide assistance	Milwaukee, WI; Cincinnati, OH; Seattle, WA; Bozeman, MT
Pay in Lane	Yes	Yes	No	n/a	Yes	Yes	n/a	Yes	Exit flow can be reduced, no parking attendants to provide assistance	Wilmington, NC; Lansing, MI
Other Options										
In-car Meters	No	Yes	No	n/a	No	No	Yes	No	No real-time reporting, subject to theft	Aspen, CO; Miami Beach, FL; New York, NY
Pay by Phone	No	Yes	No	Yes	Yes	Yes	Yes	No	Cities must create a process and system for sharing parking information across multiple departments	Washington, DC; Aspen, CO; Fort Lauderdale, FL, San Francisco, CA

Employer and Developer Focused Parking Pricing Strategies 4.0

Previous sections of this primer discussed pricing policies and tools that can be used to manage city-owned parking spaces and facilities. In most communities city-owned or controlled parking represents only a small proportion of the total parking available, and privately owned parking is often made available at no cost to drivers. Shoup estimates that 95 percent of commuters receive free parking at work (1997), and this free parking is not limited to suburban and rural locations; over 50 percent of automobile commuters in the central business districts of cities like Los Angeles, New York, and London receive free parking paid for by their employer (Wilson and Shoup 1990b, Schaller Consulting 2007, Department of Transport 1992).

While cities cannot directly control whether an employee receives free parking, a number of strategies exist to encourage employers and developers to charge for parking or, minimally, make employees more aware of the true cost of parking. Applying a cost to parking can reduce the number of people who drive alone, maximize the utilization of transportation facilities, and encourage more efficient land use.

Cities have the opportunity to influence three primary areas of commuter parking. First, cities can work with employers and developers on employee trip reduction programs that include parking pricing strategies. These can be voluntary or mandatory, depending on the severity of the problem. The transportation demand management field has found that parking cash out and transportation allowances can be used to raise commuter awareness of parking costs and encourage employees to walk, bike, carpool, or take transit to work. Parking cash out provides a payment that can be used to purchase transit fares or kept as cash to employees who elect to give up their employer-owned parking space. Transportation allowances are stipends provided directly to employees who can then choose to purchase parking, buy transit passes, carpool, or pocket the money for another use. There are many supporting strategies in the transportation demand management field that are not discussed in this primer, but can also influence an employee's commute behavior.

Cities have a second opportunity to influence commuter parking through zoning and development regulations. Cities are able to encourage developers to charge for parking separately from office space, a strategy often referred to as "unbundling" that allows employers to see financial benefits when they stop paying for employee parking. Unbundling in residential developments can also influence commute behavior and vehicle ownership levels. In addition, zoning codes can be written to encourage the allocation of parking for car-share vehicles,[2] free or discounted parking rates for carpools and vanpools, and the establishment of secure bicycle parking.

Cities can also design and charge parking taxes to encourage employers and developers to charge for parking, discourage the construction of excessive quantities of parking, and encourage more efficient land use. These strategies are detailed further below.

[2] Car sharing is a business model wherein users sign up for a membership and are able to rent cars by the hour. It is particularly suited for urban areas where car ownership is less desirable due to the prevalence of public transportation. This demand management mechanism is discussed in greater detail in section 5.

4.1 PARKING CASH OUT AND TRANSPORTATION ALLOWANCES

Parking cash out and transportation allowances are similar economic incentive tools. Parking cash out is effective when employers provide free parking to employees, often in employer owned or leased lots. Employees who choose to give up their parking space are offered a payment that can be used to purchase transit fares or kept as cash. Employees typically participate in cash out on a monthly basis, but daily cash out programs do exist. With daily cash out employees receive a set amount of money for each day that they choose to not drive to work. Parking cash out is a better strategy than direct parking charges at employment sites where a move to paid parking is likely to cause significant employee morale issues or where management, for whatever reason, is unwilling to ask employees to pay for parking.

Transportation allowances are provided directly to employees, who can then choose to purchase parking, buy transit passes, carpool, or keep the money. Transportation allowances are best used when employers do not own or lease parking spaces and failure to cover employees' parking costs may put the company at a real or perceived hiring disadvantage. In both cases, payments are tax exempt up to Federal limits when spent on parking, transit, vanpooling, or bicycle commuting.

Parking cash out and transportation allowances are successful because they apply a value to a commodity that is often perceived as free and allow employees to make travel decisions that maximize their individual welfare. The programs are palatable because employees are not asked to bear the actual cost of parking if they do choose to park. Employers can implement these policies on their own to help them compete for the best workers, or cities or states can mandate or incentivize their implementation to encourage reductions in driving.

Both cash out and transportation allowances have shown significant benefits in terms of reducing employee vehicle trips and parking demand. Shoup evaluated eight employer cash-out programs in California and found that, on average, the programs reduced drive-alone trips from 76 percent to 63 percent of total commute trips, increased carpooling from 14 percent to 23 percent, increased transit trips from 6 percent to 9 percent, and increased walking from 2 percent to 3 percent (1997). De Borger and Wuyts created a model using Belgian data to evaluate the effectiveness and costs of parking cash out. Their model results showed that parking cash out reduced car commuting by approximately 8.5 percent and increased transit use by 17 percent (2009). Within the model, congestion was also significantly reduced, with average speeds rising to almost 50 km/hour from 40 to 43 km/hour. Actual benefits will vary by geography. Shoup notes that trip reductions will depend "on the market price of parking at the worksite" (1995, 15).

Even if users are paying for their own parking in the form of a fixed-cost monthly parking pass, such a product can be redesigned to reward regular parkers with reduced costs or rebates for days they do not park. Such a redesign might be instituted by the parking operator or an employer offering a parking subsidy, but in either case it may be considered "daily parking cash out" if a financial incentive is provided for each day that parking is foregone. Alternatives to monthly parking passes were tested in Minneapolis, Minnesota, in 2010 and 2011. This research targeted purchasers of monthly parking passes and examined the effects of various alternative incentives. These incentives were either bundled with the parking pass or offered in the form of a restructured parking pass enabling both onsite parking and a choice of financially-attractive alternatives. Programs tested included:

- Buying Flexibility, where a heavily discounted monthly transit pass (i.e., $20 instead of $130) was made available for purchase in combination with the parking pass (despite very heavy marketing, only 14 people purchased this, and while results clearly seem to indicate reduced parking and more transit use, the sample size was too small to find statistical significance);

- Disincentive Removal, where a monthly transit pass was provided for free to purchasers of monthly parking passes;
- Marginal Rebate, where a monthly transit pass was provided free to purchasers of monthly parking passes, and those taking transit instead of parking any day of the month received a $2 rebate, which is reflective of the marginal parking cost of $7 per day and the marginal transit cost of $5 per day; and
- PayGo Flex-Pass, which is the same as Disincentive Removal, except that a rebate of $7 would be provided on days where neither parking nor transit was used (with the total monthly rebate capped at half the cost of the monthly parking pass).

The most flexible and successful of the incentive programs studied, PayGo Flex-Pass, led to a decline in driving days from 78.5 percent to 56.5 percent, a large reduction (Lari, et al., 2011).

Travel allowances have also proved successful at changing travel behavior. Los Angeles County replaced free parking for its employees with a travel allowance and saw solo driving decrease from 53 to 47 percent of commute trips. CH2M Hill in Bellevue, Washington, replaced free parking with a travel allowance and saw solo driving decrease from 89 to 64 percent of commute trips (USDOT, 1994).

As with any changes made to parking, cash-out programs and travel allowances can present challenges, but they may be overcome with careful implementation. The programs are also likely to increase costs slightly for employers; if employees do not use their payments for tax-deductible transportation expenses, employers must pay employment taxes on the amounts. Employers will also incur administrative costs. All these costs could, however, be offset by small reductions in travel allowances or parking subsidies (i.e., charging employees who decline a cash-out offer a small fee for parking).

The United States Government has developed a number of documents to assist governments and employers that are interested in implementing cash-out programs. The FHWA's Non-toll Pricing: A Primer (2009) provides an overview of parking cash out. The Federal Transit Administration's (FTA's) TDM Status Report: Parking Cash Out (1994) provides travel reduction benefit estimates and implementation steps for government agencies wishing to implement parking cash out. The EPA's Parking Cash Out: Implementing Commuter Benefits as One of the Nation's Best Workplaces for Commuters (2005) is a how-to guide for employers wishing to implement a parking cash-out program. The EPA's report also includes information on employer benefits and tax considerations. Less information has been published regarding travel allowances; however, the two strategies do not differ significantly in terms of implementation or cost.

Photo credit: FHWA

4.2 UNBUNDLED PARKING

The cost of parking for residential units and commercial space is often included or "bundled" in lease or purchase costs. This means that parking costs are "sunk" and cannot be avoided regardless of actual need. This serves as a disincentive to companies to offer cash out, as any reduction in parking space utilization will not be accompanied by an equivalent reduction in parking costs. It also encourages car ownership because residential renters or lessees will see no financial gain from reducing their off-street parking needs. "Unbundling" the cost of parking from commercial and residential leases and purchases addresses these issues by allowing buyers and lessees to purchase or lease only as much parking as they need.

The unbundling of parking at commercial locations has no direct effect on travel behavior if employers pay for their employees' parking. However, unbundling creates a financial incentive for employers to implement strategies that decrease the number of employees who drive to work. Unbundling also places a clear price on parking that employers may choose to pass on to employees.

In the residential setting, unbundling of parking can directly impact travel behavior. An analysis of the impacts of off-street parking on car ownership and vehicle miles of travel in New York City "strongly suggests that the provision of residential off-street parking effects commuting behavior" (Weinberger, et al., 2009, 24). Thus, decreasing the amount of off-street parking, which unbundling encourages, is likely to result in decreased vehicle trips among commuters.

An interesting study on managing residential parking in San Francisco with car sharing and unbundling examined the effects of two residential parking requirements there: that residential projects of 50 units or more offer one or two car-sharing spaces, and that off-street parking at residential projects of ten units or more be leased or sold separately from the property. The study found these policies to result in a significantly lower rate of household vehicle ownership and a higher rate of car-sharing membership. The most significant finding of the study was that the combination of unbundling parking with on-site car sharing vehicle access corresponded to an average vehicle ownership rate of 0.76 per household—which was a statistically significant reduction from the statistically indistinguishable rates of 1.03, 1.09, and 1.13 vehicles per household—where buildings had neither car sharing nor unbundling, car sharing only, and unbundling only. Clearly, then, there is a market in San Francisco, and likely elsewhere, for housing with unbundled parking and car sharing where residents respond with reduced vehicle ownership, and presumably take some of their savings and spend it for better housing and to occasionally use car sharing (ter Schure, et al., 2011).

Some developers have expressed concern that unbundled parking requirements may affect their ability to obtain loans. If parking utilization rates are lower than anticipated, the developer may not realize as much revenue as expected, which could affect loan repayment. It is therefore important that cities not require parking minimums when asking or requiring developers to offer unbundled parking.

Ideally unbundled parking will allow residents and employees to purchase parking on a monthly or even daily basis. In the case of commercial parking the spaces can be rented through the property management association or a third-party parking manager. In the case of residential parking, spaces can be leased through the homeowners' or umbrella owners' association. Each option allows businesses and residents to purchase only as much parking as they need.

4.3 PARKING TAXES AND FEES

Parking taxes and fees can affect travel behavior by decreasing the amount of available parking, increasing the cost of parking, or encouraging employers and developers to pass the cost of parking onto drivers. Fees and taxes do this by increasing the construction or maintenance cost of parking or by directly increasing parking rates. Drivers are able to respond to higher parking rates or lower availability by parking in another location, changing their travel mode, or changing the timing of their activities (Feitelson and Rotem, 2004). Taxes and fees are most appropriate when applied to parking that is not mandated or required by land use regulations.

The effect of parking taxes and fees is dependent on the type of tax used and the manner in which it is charged. Taxes can be placed into two primary categories: (1) taxes and fees charged to users and (2) taxes and fees charged to parking facility owners. User taxes and fees are typically charged on a per-transaction basis. They may be a percentage of the cost to park or a flat amount and typically only affect facilities where users are charged to park; although, such a limitation is not necessary. Taxes and fees charged to facility owners can be based on land value, surface area, or number of available parking spaces. These taxes and fees are extremely flexible: lots that charge parking fees can be excluded, credits can be issued when preferred spaces are offered to carpoolers or car-share vehicles, and garages and subterranean lots can be excluded or charged based on land area rather than facility square footage. Owner fees and taxes can exclude facilities that are charging market rates, which allows facilities that are already engaged in efficient parking management to avoid the fees and taxes. Funds from parking taxes and fees can be invested in transit and other transportation improvements that increase the number of travel options available.

User fees and taxes increase the cost of parking and encourage the use of non-auto travel modes and/or the shifting of travel times. Chicago currently charges a $3.00 per day tax for all vehicles that park in the central business district. San Francisco has a fee structure that provides a $2.00 discount to vehicles that enter a parking garage before 7:30 a.m. or leave after 7:30 p.m. and stay for at least 3 hours (for a total discount of up to $4.00). The discount is designed to encourage travel outside of peak congestion periods. Numerous other cities charge taxes that are a percentage of parking fees paid by drivers, including Cleveland at 8 percent, Santa Monica at 10 percent, San Francisco at 25 percent, and Pittsburgh at 37.5 percent, the nation's highest (Alleghany Institute 2011). The taxes do not affect parking lots where parking is provided for free.

Selecting an appropriate fee or tax rate must be done carefully. Richard Voith developed a model that identifies parking tax rates that maximize central business district (CBD) size and land values (1998). His model showed that appropriate parking taxes can increase land values and community size and that failure to charge a tax may result in excessive congestion, which reduces community size and land value. However, if taxes are set too high the result will be lower congestion but smaller CBDs and lower land values. Additionally, transaction taxes may encourage some employers to move from paid parking to free parking in order to avoid the tax.

Unlike most user fees and taxes, facility-owner fees and taxes can impact parking facilities even if parking is offered for free. However, fees charged based on number of parking spaces or surface area remain relatively uncommon in the United States. The fees have been successfully implemented in Sydney, Perth, and Melbourne in Australia. Sydney charges a flat fee per parking space, Perth charges a variable fee based on use, and Melbourne charges a fee only for spaces that are designated for long-term use. All three cities charge an annual fee; however, fees could also be charged at the time of construction or issuance of a use permit. If annual fees are charged they can be collected with property taxes or individually. Calculation of fee amounts can be made using data from tax databases, data from storm water agencies that collect information on impervious surface area, site visits, and aerial photographs. Excluding properties that charge minimum parking rates from the taxes can encourage pricing of lots that would otherwise be free.

Feitelson and Rotem argue in support of taxing surface parking (2004). They suggest that a "flat surface parking tax should be considered as an alternative to minimal (or maximal) parking requirements" and note that, "A flat parking tax will clearly raise the cost of providing surface parking" (Feitelson and Rotem, p. 324). At least some of the increased cost will be passed on to users in the form of higher costs, which will affect parking patterns. Unfortunately, it is not clear what percentage of a parking tax will be passed onto employees (Calthrop et al., 2000). For parking taxes to affect the behavior of commuters, they must be passed onto the commuters (Gerard et al., 2001). Therefore, the effectiveness of parking taxes may be limited depending on the response of employers.

4.4 IMPLEMENTATION

To help employers implement commuter parking strategies, numerous tools and references exist, some of which were cited previously. This section focuses on implementation options and considerations for municipalities and States wishing to encourage employers to implement cash out and transportation allowance programs, encourage developers and property managers to offer unbundled parking, or institute parking fees or taxes.

California has been the most aggressive State when it comes to the implementation of commute options programs. In 1992, the State passed a parking cash-out law that requires employers with 50 or more employees in air basins designated as non-attainment areas and that provide subsidized parking to their employees to instead offer a cash allowance in lieu of the parking space. The law does not require that employers provide a commute subsidy of any type nor does it require them to raise the cost of parking—it simply requires that employers choosing to subsidize parking also offer a choice in their benefits package, thus removing some of the incentive to drive. A related California code requires cities or counties to grant appropriate reductions in parking requirements to new and existing commercial developments that offer parking cash-out programs.

Fairfax County, Virginia, encourages parking cash out and unbundled parking programs during the development review process. Certain developments are required to implement transportation demand management (TDM) programs and obtain specified vehicle trip reductions. TDM plans must be submitted to the county prior to development approval, and development proffers guarantee that promised cash out and unbundled parking programs (and other TDM strategies) are implemented. This policy is relatively new, and its long-term benefits are not yet known. Many other communities throughout the United States require developers and employers to implement TDM plans; however, inclusion of cash out, transportation allowances, or unbundled parking programs is typically voluntary.

San Francisco encourages unbundled parking through low parking maximums. In downtown San Francisco developers can build only 0.75 parking spaces per housing unit and that number drops as low as 0.5 in some neighborhoods. Preventing developers from constructing at least one parking space per housing unit can be a big inducement to unbundle parking at residential units. In such cases, developers failing to unbundle parking would be left with the unappealing prospect of having to sell or lease units that are guaranteed to lack access to off-street parking.

The mechanism through which parking taxes and fees can be implemented will vary by state and local government. The process should be well known to government officials, but careful consideration is recommended. The Ontario provincial government unsuccessfully attempted to implement a commercial concentration tax, similar to a property tax, that affected large-scale, paid-parking facilities. The tax had the adverse effect of causing those controlling suburban parking facilities that had charged low fees to discontinue those fees to avoid the tax. In most cases the tax exceeded the earned parking revenue, which made it cheaper for parking facilities to stop charging for parking than to pay the tax. This resulted in the majority of the tax's revenue being generated in the Toronto CBD where the tax represented a small cost in proportion to total parking revenue. While tax funds were coming primarily from the CBD they were being spent outside of Toronto, causing significant discontent. These negative impacts were not anticipated and the law was quickly repealed (IBI Group, et al. 2000).

When implementing commuter parking pricing strategies, government agencies need to consider a number of items that are described below.

- Any new policies should be developed in coordination with developers and employers.
- Many communities have regional or local commute options agencies that can assist with strategy development and program implementation.
- Developers should not be forced to construct and maintain more parking than there is demand for. The policies that fail to assure this will force developers to work to simultaneously reduce parking demand while financing and maintaining unused parking spaces. As is the case in California, developers should be allowed to decrease the number of available parking spaces if demand decreases.
- Parking cash-out policies are likely to create spill-over effects if nearby parking is not restricted or priced. Some sites have documented that occasionally employees who accept a parking cash out continue to drive but park in a nearby neighborhood where parking is free. Employers can help address this externality by developing policies that prohibit cash-out recipients from parking in residential neighborhoods and revoking program eligibility for employees who fail to comply. Government agencies can help address this issue by following the model of California's cash-out law, which explicitly allows employers the ability to revoke eligibility when employees fail to comply with company established cash-out guidelines. Charging or requiring permits for parking in affected residential neighborhoods, as discussed in the Residential Parking Permit section of this primer, can also address the issue.
- Programs must recognize that most employees will occasionally need their vehicle for errands before work, at mid-day, or after work and should provide parking options for these individuals. This can generally be done by providing commuters with a limited number of free parking days or allowing them to purchase parking on a daily basis.
- All programs should include measureable performance goals that are tracked after program implementation.

An effectively implemented commuter parking pricing strategy can reduce vehicle trips. The strategies discussed assign a value to parking that would otherwise be free or offered at an artificially low rate to the user. Overall, commuter parking pricing strategies offer some solutions to address the market distortions created by the supply of free commuter parking.

5.0 Preferred User Accommodations

Successful implementation of new parking pricing policies requires that cities address special parking needs and priorities that can undermine cities' ability to manage their overall parking system effectively. The preferred user accommodations reviewed in this section include residential parking permits, commercial loading, disabled parking, government employee parking, and car sharing.

Residential parking permit policy has seen little innovation, but a few programs show that on-street parking in affected neighborhoods can be better managed. Commercial loading zones, often free of both cost and time limits, have been known to fill, leading to double parking that blocks traffic during peak business hours. Special strategies or tools for disabled parking are important for improving access for the disabled, but fraudulent use of parking placards can monopolize spaces in high-demand areas, contributing to congestion, poor parking availability, and cruising for parking. Free government parking passes are a common benefit for public employees; however, this benefit impedes parking management by encouraging single-occupant vehicle commutes and the overuse of limited parking spaces in congested central civic locations. Allocation of parking for car-share vehicle storage is a recent consideration that is being addressed differently across the United States. Traditional exceptions to parking rules for preferred users, often meant to be small-scale solutions, have, over time, had large-scale implications and need review and reassessment.

5.1 RESIDENTIAL PARKING PERMITS

Photo credit: City of Boulder

The goal of residential parking permits (RPP) is to protect neighborhood parking by limiting its use to residents of a defined area. Innovation with RPP has been slow to evolve, especially when compared to the amount of innovation with other preferred user parking accommodations discussed later in this section. This could be the result of legislation found in many communities and some States that restricts the price of permits to the actual administrative cost of their issuance. Annual residential parking permits are $100 in San Francisco; $35 in Washington, DC; $25 in Chicago; and free in Boston. Cities have experimented with RPP by implementing various restrictions that range from the number of parking passes a household can receive to what types of households are eligible to receive a residential parking pass. Several cities limit the number of passes per household, which reduces the potential for abuse (e.g., residents reselling extra passes).

Aspen and Boulder provide examples of the monetization of excess residential parking spaces. While neither city charges its residents market-rate fees for parking permits, each city has found that it can monetize excess capacity in the neighborhoods and does so by allowing visitors to purchase parking passes. Aspen sells daily visitor passes for $7.00 and monitors parking occupancy rates to assure that sufficient parking capacity exists for neighborhood residents. (This program is discussed in more detail in the Case Studies section of this primer.) Boulder offers quarterly commuter parking passes that are good in residential parking zones. Area commuters who work in Boulder's downtown core are allowed to purchase these passes (City of Boulder, 2012). While the program has had success in maximizing the city's parking potential, at no harm to its residents, the guest-parking program currently has a wait list, indicating that its price does not reflect its true market value.

Cincinnati is considering applying advanced pricing and management principles to its residential parking. The CUF Neighborhood Association, which represents the Clifton Heights, University Heights, and Fairview neighborhoods, formed a committee in 2010 to address oversubscribed on-street parking and the excessive circling and congestion that result. The committee has completed its proposal to manage roughly 3,000 on-street parking spaces. Authority would be given to the Department of Transportation and Engineering to set both monthly residential permit prices and short-term meter prices to achieve an 85 to 90 percent occupancy rate. Prices would be set to be somewhat more favorable to residents than to short-term visitors.

Despite these advances, additional innovation is needed in the realm of RPP programs. Residents are being offered access to a community asset at little or no cost. In addition, the issuance of RPPs does not guarantee that access is maintained. Many cities refer to RPPs as a "hunting license" due to the limited availability of parking spaces, especially in high-density areas. The alternative to using RPP pricing to curtail parking spillover onto the curb in high-density residential areas, such as the above-noted Cincinnati proposal, is the imposition of minimum parking requirements, which raise housing prices by many tens of thousands of dollars per unit. Policies that improve neighborhood access, and recognize the true value of curb parking in residential neighborhoods need to be pursued.

5.2 COMMERCIAL LOADING

Delivery parking for commercial vehicles is at a premium on busy urban streets in the United States. In business districts, on-street commercial parking is seldom adequate to fully satisfy the volume of deliveries in a single day, and yet this finite resource is largely provided for free. The failure to supply and price commercial parking adequately impacts the mobility of cars, buses, and pedestrians alike, as delivery trucks will often park illegally if a space is not available. What results is a rippling effect of double parked commercial vehicles, cars, and buses taking over bike lanes combined with illegal curb parking that invades pedestrian space and blocks pedestrian crossings. Commercial loading zones and delivery parking are an essential component in any parking management plan; increasing availability and decreasing demand are two essential strategies that will alleviate congestion and improve service. Parking pricing can be an effective tool to encourage turnover of spaces and off-hour deliveries.

New York City implemented a pilot program along congested Midtown streets in 2000 to address commercial loading issues. The pilot was successful and subsequently expanded to include Chinatown and all commercial areas in Manhattan between 14th and 60th Streets. The program replaced unpaid commercial parking with hourly metered rates for all commercial loading zones and used an escalating pricing scale: the first and second hours cost $2.50 each and the third hour costs $4.00 (Schaller et al., 2010). Pre- and post-program measurements found an average reduction in minutes parked from 160 to 45, with only 25 percent of all commercial vehicles parking in the same space for more than 1 hour. The program has been particularly successful at improving mobility on narrow cross-town streets, which are commonly rife with double-parked vehicles and blocked traffic. The program is supported by the commercial delivery industry and has shown that escalating pricing is an effective tool for encouraging commercial parking turnover.

Photo credit: City of Seattle

New York City implemented an additional pilot program in 2009 to encourage commercial deliveries outside of regular business hours. The program targeted large freight companies with a demonstrated commitment to sustainability and that exceeded 100,000 trips per day into Manhattan (Solomonon & Gastel, 2010). The goal was to shift deliveries to times between 7:00 p.m. and 6:00 a.m., thereby reducing street congestion and illegal curb and double-parking practices. Originally eight delivery companies and 20 of their client businesses participated in the program; on-time delivery to first stops improved by 75 percent. Further results found carriers were able to save on fuel costs and time by making more total deliveries in off-hours. Businesses benefited by being able to focus staff time on customer service during peak business hours rather than on processing deliveries (Cassidy, 2010).

Philadelphia has taken alternative measures to address parking and congestion problems related to commercial vehicle deliveries. First, Philadelphia created commercial loading zones that allow deliveries on main streets from 6:00 a.m. to 10:00 a.m., with afternoon deliveries delegated to side streets. Designated loading zones were allocated only for delivery vehicles during morning hours but open to general parking later in the day. Then, to let commercial operators know that enforcement would be implemented, the city purchased vehicles capable of towing delivery trucks. Philadelphia stresses enforcement policies, and being able to tow delivery vehicles has greatly improved parking compliance among commercial vehicle drivers.

5.3 DISABLED PARKING

Photo credit: FHWA

Free disabled parking has been accepted practice in the United States for decades running; however, increased demand for parking, increasing occurrences of disabled placard abuse, and a general need for better parking management by cities has many rethinking the paradigm of free and unlimited parking benefits for disabled persons. During most of U.S. history, access to basic services was a daily challenge for individuals with a disability; public transit rarely accommodated wheelchairs, and parking spaces were often too far from services for disabled people to access easily. An attempt was made by policy makers during the post-World War II period to alleviate these barriers by allowing free parking without time limits at street meters to individuals with a disability. The sole requirement was that disabled persons register and display official placards, license plates, or other disabled identification documents while parking. These policies were enacted from coast to coast and often at the State level.

The American's with Disabilities Act of 1990 (ADA) ushered in a new era of increased accessibility for disabled persons. Public transit now is required to accommodate the needs of the disabled population, and off-street parking facilities must allocate 2 percent of total parking spaces for individuals with disabilities. ADA accessibility standards for transit and off-street parking are explicit; however, street and metered parking standards are vague. This vagueness has allowed free parking for disabled persons to remain a national standard practice.

As a result, the free parking benefit has made disabled placards a desired commodity, opening the door to abuse. In addition, since the inception of the ADA parking benefit standards, the definition of "disabled" has expanded, yielding a greater number of drivers who qualify for this benefit. Conversely, the stock of metered parking spaces, especially in dense, high-demand areas, has remained relatively constant. Many localities are now experiencing a disproportionate number of disabled drivers compared to the overall number of registered vehicles. The California Department of Motor Vehicles reported a 350 percent increase in the number of disabled placards issued in 2010 compared to 1990, a rate that is far higher than the population growth rate (Lopez, 2012).The baby boomer generation, now reaching retirement age, will only add to the total number of disabled drivers.

Beyond the expansion of eligibility, recent studies throughout the country have documented the fraudulent abuse of disabled parking by people without a disability, who are parking for free and without time limits in the most convenient and desirable parking places. In 2011 the City of Seattle published a report indicating that 30 to 40 percent of metered parking in its downtown core was occupied by vehicles displaying disabled parking placards (Seattle Department of Transportation, 2012). Violators see the value of free parking, especially in high-demand areas, and therefore use either a family member's or friend's placard illegally; additionally, placards of deceased persons are seldom collected, presenting another opportunity for fraudulent use. This abuse of disabled parking benefits affects disabled people and their ability to access services no differently than the population at large.

Parking experts are thinking anew about parking benefits for disabled persons. The goal of accommodation is still at the forefront, but with the understanding that this should not be allowed to interfere with the effectiveness of parking management strategies. Variable pricing and additional parking strategies will have limited impact if 10 to 40 percent of high-demand, metered spaces are occupied for an indefinite amount of time, at no cost, by drivers with disabled placards. Unfortunately, cities frequently lack jurisdiction over disabled parking. Many States, including California, Illinois, and Texas, offer disabled parking benefits as a statewide policy, leaving local jurisdictions with a limited ability to manage disabled parking.

Arlington County, Virginia, was one of the first communities nationwide to address disabled parking placard abuse and its impact on effective parking management. During the late 1990s, Arlington had a problem of low parking availability due to excessive and fraudulent placard use. The Arlington Disabled Commission approached Arlington County asking it to address these problems and offered support for the elimination of free metered parking altogether. According to an Arlington County parking manager, community support was garnered from inception, and local officials could therefore engage State officials in an attempt to revise State disabled parking ordinances, a necessary step as Virginia State law limited local jurisdictions' power in managing disabled parking. Through this process Arlington, and therefore other Virginia municipalities, gained greater flexibility and enforcement ability with regard to parking management practices. With the necessary structural changes in place, Arlington County rolled out its "All May Park, All Must Pay" program in 1998, which stopped all-day fraudulent use of disabled placards. Drivers with a placard were required to pay for parking but were allotted twice the time period to access services.

The District Department of Transportation (DDOT) in Washington, DC is building from Arlington's program and implemented a disabled parking pilot program in 2012. The goal of the program is to create better access for disabled persons. The District's old policy allowed disabled drivers to park for free at meters District wide (District Department of Transportation, 2012). Under the pilot program, a total of 400 meters, the domes of which are painted red to be visibly different from regular meters, provide two spaces per street block for better access for disabled drivers in commercial zones. Only disabled individuals displaying official placards are allowed to park at these red-domed meters. For the first time disabled drivers in the District will be charged to park, but with the new

meters they will be allotted twice the amount of parking time for the price. By replacing free parking, the program aims to discontinue the prime incentive for abuse, according to the DDOT. As a part of the pilot effort, District-wide informational campaigns were conducted by DDOT staff to elevate awareness about the change.

The State of Michigan has also implemented a change in its law, allowing only those individuals in a wheelchair or unable to operate street meters to qualify for free metered parking. All other disabled persons are allowed to park in handicapped spaces in off-street facilities. Prior to the law change, 500,000 disabled parking placards were in circulation, and each holder was allowed to park for free. After enactment of the new law, only 10,000 people, or 2 percent of the previous 500,000, were allowed to park for free. The Michigan law gives free parking only to those most in need, requires a doctor's certification with the application process, and uses a new yellow placard, a clear differentiation from the traditional blue disabled badge (Fusco and Maloney, 2012). Illinois State officials have initiated similar legislation that would revise the qualifications for free disabled parking in metered on-street spaces beginning in 2014.

States and cities are also increasing the penalties for placard abuse. The State of California granted municipalities the authority to increase fines for placard abuse from $250 to as much as $1,000. Beginning in 2012, Chicago began issuing fraudulent placard users fines, ranging between $500 and $1,000, while simultaneously impounding their vehicles at an additional cost of $1,500 to $3,000. Furthermore, people with a registered placard can be charged a $200 fine for allowing others to use their placard to park for free (City of Chicago, 2011). Each of these fines, noticeably more severe, are intended to deter people from misusing placards to park for free.

Best practices pertaining to disabled parking include:

(1) Verifying whether State legislation exists and, if so and it prevents implementing best practices, working to make changes;

(2) Determining what parking managers are legally allowed to do;

(3) Increasing fines (if parking managers don't have legislative approval to charge for parking);

(4) Eliminating free parking completely, limiting it to those in wheelchairs or who are unable to use a meter, or doubling the amount of allowed time.

Most importantly, parking managers should coordinate with the disabled community and seek its approval and support for any changes.

5.4 GOVERNMENT EMPLOYEE PARKING

Free parking benefits for government employees can easily undermine a city's transportation goals, particularly as parking near government offices is often at a premium. As with anyone offered free parking benefits, government employees are drawn to its convenience and economic advantage. The issue of free parking is complicated because many government employees work in CBDs where parking is in limited supply. A study was conducted in New York City to determine how free parking for government employees affects their travel behavior. The New York City Department of Transportation issues its workers parking placards that allow them to park for free at any legal, metered, on-street space while conducting official business. That study, based on 2000 Census data, found that government employees are significantly more likely to drive to work than their peers. If the studied employees drove alone at the same rate as their peer group, there would be 14,000 fewer cars entering the Manhattan CBD each day (Schaller Consulting, 2005). These findings are supported by an additional study of New York City commute behavior that found a positive correlation between government employment and the likelihood that a person will drive to work (Weinberger 2012).

Studies also found illegal parking by employees to be a common occurrence throughout busy civic areas, negatively impacting pedestrian safety, economic activity, emergency vehicle access, and public perception of government employees (Schaller Consulting, 2006).

There has been some discussion of addressing employee parking issues in New York City by offering employees recurring cash payments to relinquish their parking placards. This would be the equivalent of a parking cash-out program. It would be possible to price the cash out at a value lower than the revenue currently lost from employees parking at meters that could otherwise generate revenue. Another option that has been discussed is to offer employees in-car meters loaded with a negotiated value that allow employees to park throughout the city. The meters would be an employee benefit that would replace parking placards that offer unlimited free parking.

San Francisco has revised its employee-parking benefits as part of its larger parking program adjustments. In one initiative, San Francisco Municipal Transportation Agency (SFMTA) employees, many of whom were parking for free at off-street lots attached to various facilities (e.g., bus yards), lost the privilege to park for free. All SFMTA employees must now pay to park unless the right to free parking is in their labor agreement. In a second initiative, all city vehicles lost their exemption from paying meters and adhering to parking time limits. A few exceptions exist for vehicles such as police, fire, and maintenance.

The City of Austin, Texas is initiating a pilot parking cash-out program in the spring of 2012 in lieu of free employee garage parking. The goal of the program is to reduce peak traffic congestion and increase the availability of visitor parking. The volunteer program, with a one-year budget of $40,000, allows all 450 downtown city employees to register and receive a $50 a month incentive for leaving their car at home. Employees are offered a free Capital Metro transit pass, guaranteed rides home in emergencies, and personalized commute assistance. Downtown city employees currently are able to park for free at the Austin City Hall garage, which is leased by the city at a cost of $150,000 annually, or $100 per space per month (Coppola, 2012). The program goal is to encourage 100 employees who drove to work alone to commute to work differently, minimize downtown traffic congestion, promote transit alternatives for city workers, and increase visitor parking. The city will monitor employee compliance by requiring employees who drive and park to sign-in.

5.5 CAR SHARING

Car sharing is growing quickly in the United States. Users sign up for a membership and are able to rent cars for short time periods with gas and insurance included in the cost. Cars are stored in numerous locations throughout cities, and various methods are used to allow members to gain access to and start the vehicles. Car sharing differs from typical rental car services in that vehicles can be rented for a short period, as little as 30 minutes; vehicles are not stored at a central location; rental fees typically include gasoline and insurance; and users are typically required to purchase a membership. Zipcar, Hertz, and Enterprise operate car sharing nationally, while numerous smaller agencies or non-profits provide service to limited geographic areas.

Photo credit: City of Hoboken, NJ

It is estimated that one car-share vehicle can remove four to five vehicles from the road (Millard-Ball et al. 2005, 4-7). Unfortunately, finding locations where car-share vehicles can be stored between uses can be a challenge for both cities and car-share operators. Cars are typically stored in three types of locations:

(1) Within residential developments;

(2) In off-street commercial facilities; and

(3) On street.

Depending on the types of facilities it owns, a city can control access to all three of these locations. Options that cities can take to assure that parking spaces are available to car-share vehicles for storage between users are discussed below.

Supplying parking within residential developments is a relatively straightforward process for cities. In areas where car sharing exists, developers may seek out car-share agencies when constructing new residential buildings. The presence of a car-share vehicle can provide a marketing advantage, and contracting for car share earns a builder three points toward a Leadership in Energy and Environmental Design (LEED) designation. Unfortunately, not all cities have updated their zoning codes to allow car-share vehicles to be parked in residential buildings' parking areas. Making this change is a first step for any city seeking to encourage car sharing. Some cities have gone a step further and require developers to allocate parking spaces for car-share vehicles, but developers are typically not required to make the spaces available for free. Larger car-share agencies can provide sample ordinance language to cities seeking to update their zoning code.

When it comes to purely commercial parking facility operators and owners, cities have taken few actions to encourage the allocation of parking spaces for car-share vehicles. Zoning codes generally do not need to be changed to allow this, and the private market has shown itself to be capable of meeting demand. Car-share operators typically seek to park a large number of vehicles in a city and can therefore seek rate discounts by working with a particular parking operator.

The allocation of on-street parking is where cities have significant control. Two primary models have been developed by cities to allocate on-street parking to car-share agencies. The most used model is to designate on-street spaces for car-share vehicles and allow car-share operators to apply for those spaces. Portland, Oregon, works with the local car-share agencies to identify areas with demand for car sharing and available on-street space. Signs are installed to designate on-street spots, which are then allocated to the various operators at no cost. Pittsburgh, Pennsylvania, uses a similar model, but rather than providing the spaces at no cost, it charges a minimal fee.

The second model is to designate on-street spaces and auction them off to the highest bidder. In communities where multiple vendors compete, it can be difficult to decide who gets which spots, which this model can help address. Washington, DC makes operators bid for available parking spaces. Unfortunately, a successful auction process requires the presence of multiple bidders. If a car-share operator knows that a competitor will not want a space, it can provide a low bid to the city and secure the space at a very small cost. Thus, if this model is implemented to maximize a city's revenue, it may not accomplish that goal.

Regardless of the model chosen, cities that allow car-share vehicles to be placed on blocks where street sweeping is in place can require car-share operators to clean the street below and around the vehicle. This addresses the likelihood that a car-share vehicle will not be moved when street cleaning occurs.

Another consideration is that the allocation of on-street spaces in neighborhoods where parking demand is high may generate a negative community response. Hoboken, New Jersey implemented a Corner Cars program in which spaces on key corners throughout the city were designated for car-share vehicles only. The city suffers from a general shortage of on-street parking and public reaction to the set aside of spaces was negative. It is likely that other communities would experience similar concerns if they allocate on-street parking to car-share vehicles in high-demand areas. It may be possible to mitigate that concern by educating the public regarding the potential of car sharing to reduce parking demand.

Overall, the model for allocating car-share spaces is well developed within the private market. Cities need to do little in this area other than make sure it is legal for developers to allocate parking spaces for car-share vehicles. Allocation of on-street spaces is more difficult in areas where multiple car-share operators compete. Cities experiencing such competition and wishing to allocate on-street parking to promote car sharing need to identify an effective process through which spaces can be allocated among competitors.

Public Acceptance 6.0

Innovative parking pricing policies that do not gain political or public support either will not be enacted or will be quickly repealed. Taking the time to develop and implement an effective communication strategy, outreach plan, and, potentially, marketing plan, will go far toward advancing program goals and reducing the stress placed upon parking managers and planners. Inadequate outreach efforts may lead elected officials and parking managers to be blindsided by public opposition and leave them unable to respond adequately to complaints raised by vocal critics.

This section of the primer discusses the steps involved in the creation and implementation of an effective outreach plan. Depending on the type of pricing program being implemented, it may not be necessary to implement all of the steps discussed, but it is best to err on the side of extra community input and outreach to identify and address community concerns and develop a network of strong supporters. The sidebar on Ventura, California, discusses how unanticipated public concern can quickly force a city to repeal portions of a newly implemented, well thought-out parking policy. Conversely, SF*park*, whose outreach policy is discussed briefly, offers an example of a program that significantly changed parking policy and pricing without generating negative public reaction.

6.1 DEVELOPING A STRATEGY

The first question to ask when developing an outreach strategy is, "What problem is your parking policy trying to address?" Hopefully, this answer was developed with community input during the planning process. The answer to this question will help planners identify stakeholders and guide messaging decisions.

The target audience, or stakeholders, will likely consist of elected officials, commuters, residents, merchant groups, visitors, and neighborhood groups. Special attention may be needed to reach some stakeholders, such as older and disabled residents or those who do not speak English. From within the target audience it is necessary to determine who the decisionmakers and influencers are: decisionmakers are typically elected officials whose votes are needed to start or fund a program, and influencers are heads of merchant and homeowners' organizations, business leaders, advocates, and other individuals who can influence political decisions and public opinion. Influencers should be among the first people contacted. After the target audience has been identified it may be beneficial to track all communications with this audience. It is advisable to use a database to store information on contact names, areas of interest, and the communications that occur. In addition, a mailing service should be used that allows people to subscribe and unsubscribe to notifications and information. The database and mailing service should, ideally, be integrated and maintained throughout the outreach effort.

Attitudes and perceptions on the part of the target audience toward the parking project or policy should be assessed. This can be done with surveys, one-on-one interviews conducted in person and over the phone, door-to-door outreach, informal focus groups, small meetings with invitees, and attendance at merchant and neighborhood meetings. Stakeholder concerns and desired outcomes should be identified during this initial process, which is meant to develop trust with stakeholders and to gather information that can be used to develop a marketing message and tone. If the outreach process succeeds at building trust and leads to a constructive relationship with staff, stakeholders could subsequently be called upon to help address unanticipated concerns or objections that may arise during or after implementation of a new policy.

6.2 CREATING A MESSAGE

Effective messaging is important to public acceptance. Some time should be spent strategizing messaging prior to working with stakeholders, whose input can then be used to test and refine ideas. Simple, consistent messaging needs to be developed that resonates with the community. SF*park* defined its message with the following points:

1. SF*park* makes parking more convenient.
2. Reducing circling and double-parking benefits everyone.
3. SF*park* uses demand-responsive pricing to open up parking spaces on each block and ensure available spaces in city-owned garages.
4. SF*park* charges the lowest possible rate to achieve the right level of parking availability.
5. The SFMTA's primary goal with the project is not to raise parking revenue but to make the transportation system work better for everyone.

Photo credit: SF*park*

SF*park* marketing materials and community outreach stuck very closely to the above messages. Other messaging examples include:

- Reinvesting revenue in the community;
- Making sure space is available for customers;
- Making parking easier;
- Providing more time so that visitors can stay longer;
- Reducing accidents;
- Improving walkability;
- Helping transit become faster and more reliable; and
- Improving economic competitiveness and vitality.

In addition to defining a message, it is also necessary to decide on a tone for marketing materials. The tone of marketing efforts should be appropriate to the community, audience, and project.

6.3 MARKETING

Once a message and tone have been established, it is time to develop marketing materials. The types of materials developed will vary based on budget, target markets, chosen distribution channels, and level of change being sought. Minor programmatic or policy changes are unlikely to require a large marketing effort; however, programs such as SF*park*, in which a new concept in on-street parking is introduced in combination with new parking assets and enforcement regimes, require significant education and outreach.

A number of options exist for distributing marketing materials and disseminating messages. Low-cost but effective options include bus-shelter signs; municipal bill inserts; bus wraps; Web sites; emails; radio; flyers left with merchants; door-to-door outreach; press releases; press events; and social media including Facebook, Twitter, and YouTube. In some communities it may be necessary to develop marketing materials in multiple languages. This determination can be made based on city policy, analysis of census demographic data for the impacted area, and feedback received during the outreach stage. For significant changes the visual design of marketing materials will ideally extend to physical parking assets, garages, and off-street parking lots.

Supporters and influencers should be called upon during the marketing phase of the project to discuss actively the benefits of the proposed parking policy with community stakeholders and political leaders. Many individuals within the community may not take the time to understand the details of the proposed parking program. Instead, they will seek the opinions of other community members or try to determine the general level of support within the community. If a vocal minority is able to create the appearance of opposition, the opinions of less informed community members may also turn against the project. Supporters and influencers can help a project avoid this fate.

6.4 TRACKING

Marketing efforts should be monitored and tracked. Specific goals should be identified against which the success of marketing efforts should be measured. Examples may include the number of Web site visits, Twitter postings, "likes" to a Facebook page, newspaper articles published, and community meetings attended. Monitoring progress toward marketing goals facilitates making adjustments to correct an underperforming marketing plan.

After a program has been approved and implemented, communication with community stakeholders should be maintained. This will ensure that parking managers are able to address any concerns that may arise and maintain community connections and trust for the next time a policy change is pursued.

Ventura, California

Ventura, California, offers an example of the negative response that can occur to a parking policy change and how a city can successfully respond. In 2006, the city published the Downtown Ventura Mobility and Parking Plan, which verified that there was a downtown parking problem: peak parking occupancy exceeded 93 percent on Saturdays and occupancy was greater than 85 percent during 8 of 11 monitored hours. The plan recommended pricing strategies, time restrictions, parking benefit districts, and a series of transportation demand strategies.

Throughout the planning and implementation process, the city conducted a series of community outreach events, held merchant meetings, distributed print advertising, and conducted door-to-door outreach to discuss and inform residents and merchants about the benefits of parking strategies, including pricing, and the challenges facing the community that such strategies are designed to help overcome. They also asked merchants to speak with customers.

The implementation of pay stations was delayed from 2007 to 2011 to ensure the community was on board. To further garner public acceptance the city assured citizens that every dollar of parking revenue would go back to the downtown. The city also made the wireless Internet signal used to support the parking meters available at no cost to downtown computer users. City-owned or leased parking lots remained free, and additional signage was added to direct downtown visitors to these free parking locations.

Of the 2,915 public parking spaces in downtown Ventura, the city implemented pay stations for 342. The first strategy was tiered rates: $1.00 per hour for the first two hours and $1.50 per hour after the first two hours.

In October 2010 the system was reviewed and showed parking utilization dropping to 85 percent on Main Street during the midday and evenings. Unfortunately, businesses that were struggling due to the economy began to blame the parking meters for bad business and some customers found the tiered rates confusing. Local newspaper articles and blogs stated a dozen downtown business owners faced double-digit sales declines since the meters were initiated. At a merchant meeting, hosted by the mayor, businesses complained that the meters changed the welcoming nature of downtown and said that customers did not like the meters and struggled to use them.

Responding to these concerns, pricing was simplified with the removal of tiered pricing, a 4-hour limit in one parking lot was removed to allow employees more parking options, using loading zones was made free, and evening parking continued to be free. To further encourage public acceptance the city handed out 50,000 1-hour free coupons during the holidays, 14,000 of which were used.

While some vocal opposition remained to the parking policy changes, recent municipal elections favored candidates that supported the meters and most merchants report that they appreciate the new parking turnover, allowing easier curbside parking for customers on Main Street. The city continues to use the data from the meters to make determinations for future pricing adjustments and will use this data to provide information to the merchants and the community about the results of parking pricing downtown.

Case Studies 7.0

ASPEN, COLORADO

The City of Aspen is a well-known resort community in Colorado and offers an informative example of a town that has implemented paid, escalating parking charges; integrated numerous payment technologies; funded commuter programs with parking revenue; and priced parking in RPP zones. The town's population is relatively small, but its scenic location, access to multiple ski resorts, and high-end shopping and dining make it a major tourist destination. Faced with a significant number of vehicle trips, limited roadway and parking capacity, and a desire to reduce the environmental impacts associated with vehicle travel, the city turned to numerous parking management strategies to reduce vehicle trips.

Aspen implemented paid parking in its downtown in 1995 to increase parking availability. City planners recommended an hourly rate of $1.00, time limits of 2 hours, and residential parking permits to protect adjacent neighborhoods. It was further recommended that the parking changes be implemented concurrently with a doubling of bus service, expansion of high occupancy vehicle lane miles, and the establishment of convenient, mid-block pay stations and in-car meters. This plan generated a significant amount of negative public reaction. In response, the city council, while approving the plan, agreed to put it to a vote via a binding public referendum, but only after paid parking and the plan's other elements had been in place for 3 months. When the vote occurred, 75 percent of voters supported continuation of the program.

The manner in which Aspen handles its RPP zones is unique. The zones were created to prevent overflow parking from the city's downtown core. Residents are provided with parking permits and visitors are allowed to park for free for up to 2 hours in an 8-hour period. Those two policies alone would result in occupancy rates below 85 percent. To assure that its on-street parking facilities are appropriately utilized, the city allows visitors wishing to park for more than 2 hours to purchase $7.00 day passes at a local grocery store, through a pay-by-phone service, or at any of the 15 pay stations located within the neighborhoods. Businesses within the RPP neighborhoods are allowed to purchase business vehicle permits. Each permit can be used in any vehicle and costs $1,000 per year. Lodges within RPP neighborhoods are eligible to purchase parking permits for their guests' use. Employees at lodges were using the permits for personal parking, however, forcing the city to implement a "two strikes" policy in which any lodge whose employees are caught twice abusing the program are banned from participating; this dramatically increased compliance.

The city regularly monitors parking availability in residential neighborhoods. If average occupancy in the neighborhoods exceeds 85 percent over a 1-year period, rates are increased.

As the downtown parking policy matured, it became apparent that many visitors wanted to park for more than 2 hours. This demand was met through the implementation of a progressive rate structure that extended parking limits to 4 hours. The cost of the first 2 hours remained unchanged and drivers were allowed to purchase an additional 2 hours of parking for a premium charge. By keeping the cost of the first 2 hours of parking unchanged the city was able to avoid significant negative response from the community. While some individuals expressed concern regarding the higher rates for the third and fourth hours, the ability of the program to offer drivers more options

helped garner public support. Today, the cost of parking is $2.00 per hour for the first two hours, $3.00 for the third hour, and $4.00 for the fourth hour, with the average parking duration being 2.1 hours. Parking fees can be paid at pay stations or via pay-by-phone.

Aspen has used and integrated multiple parking payment and enforcement assets. In its early days the RPP program relied on chalking tires, and the city's staff of five enforcement officers was able to visit each parking space only two times per week. This system was time consuming and abused by people who would move their cars short distances to avoid time limits. The city responded to these issues by implementing license plate recognition technology. With LPR the city is able to check each of its 3,000 residential-zone parking spaces two to three times per day, even after reducing its enforcement staff by one. Aspen's LPR technology uses GPS and camera data to verify violations, which allows the city to identify cars that remain within a residential zone for more than 2 hours in an 8-hour period without either purchasing a day pass or holding an RPP. The enforcement vehicles access a database with information on all residential pass holders, which has made the need for physical passes unnecessary.

For a number of years within its downtown core, the city used in-car meters that were well received by residents; however, the city's vendor stopped supporting the technology, leaving the city scrambling for a new option. Not wanting to purchase another in-car meter system, the city decided to implement pay-by-phone. The pay-by-phone technology has allowed the city to implement parking promotions that allow people to park at reduced rates during different times of the year. The leftover in-car meters were used to support the city's commercial parking program. Companies with workers that must transport goods, such as plumbers and electricians, are eligible for in-car meters that allow them to park in the downtown area for $1.00 for the first hour and $0.50 for every subsequent hour. The in-car meters will soon be replaced by the pay-by-phone technology for commercial vehicles.

WASHINGTON, DISTRICT OF COLUMBIA

Photo credit: FHWA

Washington, DC is a parking innovator, and its leaders have shown a willingness to experiment with new ideas and programs. Partnerships between city leaders, the District Department of Transportation (DDOT), and the Metropolitan Washington Council of Governments have resulted in the implementation of multiple innovative parking strategies. This case study focuses on DC innovations and lessons learned in variable parking pricing, residential parking permits, license plate recognition technology, and paid disabled parking.

Performance Parking

The District of Columbia implemented a variable parking pricing program in 2008 in response to its Performance Parking Ordinance. The goal of the program is to stimulate on-street parking turnover and reduce occupancy rates to 85 percent in targeted neighborhoods. Two zones were identified as test areas for the program: the Ballpark District and Columbia Heights. Significant amounts of data were collected to help city officials set parking rates and policies. Data collection included a parking inventory and parking count for each zone and the creation of a database to track all collected data.

Within each neighborhood, every parking space was identified, labeled, and inventoried. LPR technology was used to conduct parking counts and estimate parking duration and turnover. Data from the inventory and count were analyzed to determine the zone-wide

hourly parking profile, which detailed the parking occupancy rate per peak hour, the average duration of stay, and the extent of vehicles parking beyond legal time limits for each block. This information established the parameters of Washington, DC's initial variable parking pricing rates for its system, which uses pay stations that are able to vary rates from block to block, by time of day and day of week and for special events. (Nevers & Gray, 2009).

The Ballpark District, which is one of the pilot neighborhoods affected by the city's Performance Parking Ordinance, is home to a recently constructed baseball stadium and experiences extreme increases in parking demand during games, which makes it an ideal area to implement a variable parking pricing program. The parking profile, not surprisingly, indicated a variation in occupancy rates between game and non-game days. Initial variable rates resulted in game-day occupancy of 34 percent for blocks that had previously been at or above 85 percent occupancy. The occupancy on non-game days was reduced to 24 percent (District Department of Transportation, 2010). Occupancy data indicated that initial rates were set too high. District parking managers, over time, have adjusted rates on specific blocks to achieve more appropriate occupancy levels by block and within the neighborhood. Adjustments included changing some metered rates on game days and implementing an escalating pay rate for meters on non-game days.

Residential Parking Permits

Washington, DC has had an RPP system since the 1970s, which was introduced to ensure residents have access to street parking in their neighborhoods. With the implementation of the Performance Parking Ordinance some changes were made to the Ballpark neighborhood's RPP program. Prior to variable parking rates, visitors in the neighborhood could park for free for up to 2 hours and residents were sent one visitor-parking pass each year. Under the new program, visitors receive no free parking, and free visitor passes for residents are being abolished. In the future, visitors and residents will be able to purchase visitor passes online. Visitor license plate information will be provided when purchasing the passes and LPR technology will be used for enforcement.

Permit boundaries in the District are not determined by street block or neighborhood, but rather by the ward in which the resident lives. The entirety of Washington, DC is divided into eight wards, allowing residents to travel within their ward and use on-street parking for free. In addition, RPPs cost only $35 per year, a cost significantly below market rate and one that does not discourage residents from using on-street parking. Large zones with cheap residential parking leads to over saturation of cars in many neighborhoods, causing many complaints, but thus far no citywide policy solutions have been adopted.

License Plate Recognition Technology

On the technology front, Washington, DC has begun widespread use of LPR technology to help determine parking occupancy rates and enforcement. LRP information can be referenced against a database containing violation, payment, and other pertinent enforcement information. Moreover, LPR technology is able to determine parking duration and occupancy data (Lum et al., 2010). More than 250 cameras, at a cost of $20,000 each, scan license plates in real time throughout the District, which is better than one LPR per square mile, the highest concentration in the nation. The technology was first introduced in the District in 2004 and is now able to collect more than a million data inputs a month. Driven by privacy concerns, the District has wrestled with the length of time LPR data information may be stored; currently the data collected is stored for 3 years (Klein and White, 2011).

Disabled Parking

Washington, DC is attending to disabled parking in a new way, addressing access for disabled drivers and fraudulent all-day abuse of disabled placards. Desiring better compliance with the ADA standards, in 2012 the District implemented, a metered on-street parking program that, with time, will replace free parking at any street meter for disabled drivers. The program is designating two disabled metered spaces for each block in high volume areas. The goal of the program is to determine if paid disabled metered parking provides better access, encourages turnover of disabled parking spaces, and eliminates or reduces all-day fraudulent placard abuse by individuals who do not have a disability but use disabled placards to park.

Disabled meters are designed with a red dome to distinguish them from regular meters. At these meters, disabled persons displaying registered placards pay regular parking rates, but are allowed to park for longer time periods (District Department of Transportation, 2012). Shortly after implementation, the program was suspended for 90 days to address concerns raised by the disabled community and increase awareness of the program rules.

SEATTLE, WASHINGTON

The City of Seattle adopted a performance-based parking program with variable rates for its many neighborhood business districts with paid on-street parking. The process began in late 2010 when the Seattle City Council adopted a new policy that focused on measurement and technical criteria for setting parking rates. The ordinance directed the Seattle Department of Transportation (SDOT) to collect on-street parking conditions data annually and determine whether changes should be made to parking rates and hours of operation to maintain specified availability targets.

The adopted ordinance sets rates between a minimum of $1.00 per hour and a maximum of $4.00 per hour. The SDOT director has the authority to set rates within these amounts by location, time of day, and other considerations. According to Seattle Municipal Code (11.16.121) rates are set based on technical analysis to maintain one or two open spaces on each block face throughout the day in order to:

1. Maintain adequate turnover of on-street parking spaces and reduce incidents of meter feeding in commercial districts;
2. Encourage an adequate amount of on-street parking availability for a variety of parking users, efficient use of off-street parking facilities, and enhanced use of transit and other transportation alternatives; and
3. Reduce congestion in travel lanes caused by drivers seeking on-street parking.

Since late 2010, the city has conducted four comprehensive parking studies using either consultant resources or internal staff. The studies have documented on-street parking conditions manually, including occupancy by hour, duration, and presence of exempt vehicles (namely, disabled parking permits). When the program started, SDOT used the collected data to look at parking availability during the peak hour, and set prices accordingly. Various stakeholders felt that the city was setting prices based on data from too short a time period. In response, SDOT staff began to instead set prices based on data from the peak 3-hour period between 9:00 a.m. and 3:00 p.m.

In 2011, SDOT made considerable changes to rates and hours of operation based on the results of a 2010 parking study and is making additional changes in 2012 based on results of a June 2011 study. The changes have varied depending on neighborhood conditions and include rate increases, rate decreases, maximum time limit increases, and evening hour extensions. In addition, "sub-areas" have been created with different rates or time limits. This recurring analysis and adjustment process has resulted in the creation of 23 parking districts, some of which have two sub-areas with different rates and maximum time limits. Prior to passage of the performance-based parking ordinance, Seattle had three pricing zones: downtown, center city, and outer areas.

Results from the 2011 rate adjustments found that in four districts where rates were increased, occupancy subsequently dropped. In seven districts where rates remained the same, occupancy sometimes went up and sometimes went down. In the eleven districts where rates were decreased, there was no significant change in occupancy. The city found that in areas where parking occupancy has traditionally been low, rate reductions did not attract new parkers. The city is now testing to see if increasing parking time limits from 2 to 4 hours in low-demand areas increases occupancy. Data from SDOT's most recent price and time limit adjustments will be available in the fall of 2012.

Photo credit: City of Seattle

Since implementing performance-based parking, the city has worked to identify more efficient ways in which to collect on-street parking condition data. While the city is not currently pursuing street-sensor technology, SDOT has investigated several other ways to collect occupancy data. In one effort, SDOT is examining payment transaction data to estimate occupancy. Unfortunately, in several areas, paid occupancy is lower than actual occupancy and the difference varies by time of day and area. The primary reason for the difference is disabled permit parking; vehicles with State-issued disabled parking permits are allowed to park for free and for an unlimited period in paid parking neighborhoods.

A second data collection effort involved the use of Seattle Police Department resources. Parking enforcement officers were trained in the data collection process and used for two of the four completed studies; however, it was determined that the time they spent assisting with the parking study pulled them unreasonably from their primary enforcement task. In a third effort, SDOT tried to use its LPR enforcement equipment to determine occupancy levels, but was unsuccessful. The match between the locations of license plate reads and the paid-parking block faces was too imprecise for use in a parking study.

Throughout development and implementation of the performance-based parking process, SDOT has actively engaged community stakeholders. This has been accomplished through the creation of a Parking Sounding Board made up of a wide variety of community stakeholders who discuss and comment on changes in paid-parking rates and hours of operation. SDOT has also involved local neighborhood groups and chambers of commerce and is producing neighborhood-specific information for distribution. Going forward, SDOT is also working to identify new ways to communicate parking rate changes to the public.

8.0 Conclusion

Today, parking management and pricing appears to be on the cusp of significant, innovative, and accelerated change. Performance-based parking has proven to be successful, and cities are beginning to develop data-driven parking policies based on clear, attainable goals. San Francisco and Seattle offer examples of performance-based strategies that have earned both public and political support.

Advances in parking policy are being made possible, in part, by improvements in parking technology. New tools make it easier for cities to adjust pricing and collect utilization data. Steps are also being taken to develop database tools that integrate the information provided by parking assets from different manufacturers, which allows for the implementation of complex and user-driven parking systems. These improvements make it easier for cities to enforce parking regulations and for users to pay and comply with parking rules and fees.

Photo credit: City of Seattle

Governments are also responding to the market distortions created by free employer-provided parking. Cities are implementing both mandatory and voluntary policies to encourage employers and developers to pass the cost of parking on to travelers, who in turn are then more likely to make travel decisions that are more economically efficient. Cities are also working to address issues associated with preferred users, including the disabled, city employees, and residents. Without carefully addressing these issues it will be difficult for performance-based parking policies to function effectively.

Cities interested in implementing new parking-pricing programs will soon benefit from large amounts of data from the Seattle and San Francisco performance-based pricing programs. Seattle is closely tracking the effect of pricing on utilization and is also experimenting with expanding time limits and making changes to policies for preferred users. San Francisco is collecting a wide array of data including information on the effects of performance pricing on parking search time, double parking, parking availability, air quality, sales tax revenue, parking tax revenue, and overall user experience. Data on efforts to address preferred users will also be forthcoming from Washington, DC; New York City; Chicago; Austin; and others.

In the end, cities rarely suffer from an absolute shortage of parking. Rather, it is their management processes that are often insufficient to provide drivers with reliable parking access and information. Moving forward, cities need to think broadly when developing solutions to parking and access issues. Parking and land use are closely intertwined, and parking policy decisions affect the physical environment, livability, and economic success of a city. Parking decisions cannot be fully separated from the political process, and each city must develop a solution that is appropriate to its needs. This primer is a guide in that process. The FHWA encourages planners, politicians, and community members to seek out additional information from other FHWA documents and events, published materials, and the cities whose programs were discussed in this document.

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