Moving to Our Future:

Pricing Options for ***Equitable Mobility***

PBOT
PORTLAND BUREAU OF TRANSPORTATION

Pricing Parking Best Practices: Background Memo

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Introduction

The concept of paid on-street parking emerged in 1935 with the installation of the first on-street parking meter in Oklahoma City. Portland installed its first single-space parking meters in 1938. Since then, Portland has implemented many policy changes to improve the basic tools and processes of parking pricing, including the recent development of a city-wide Performance-Based Parking Management program.

While Portland finds itself among the leaders of parking policy in the US, the City is exploring ways to further advance its parking strategies to help address equitable mobility and climate goals. Failure to price parking based on demand and underpriced or free parking distorts travel decisions and contributes to increased congestion, decreased access to businesses, climate impacts, air pollution, and inconveniences and safety hazards to travelers, while not adequately capturing the costs of these impacts.

Parking pricing is a type of congestion charge that, if properly implemented, can be used to:[1]

1. Allocate scarce transportation resources
2. Reduce market-distorting subsidies that induce auto travel
3. Generate revenue that can be reinvested in improving conditions for other modes

Why Price Parking?

Free and underpriced parking fails to reflect the true cost of driving alone. When parking is free, cheap, and/or abundant, the deterrents to driving are few and, when possible, people are more likely to drive to and from their destination.

Economic theory postulates that the more something costs, the less people will consume and vice versa. Parking is, and has the potential to be, an opportunity to send price signals to drivers that will influence their transportation choices. Studies find that free parking can increase the drive-alone rate for commute trips. A 2001 Portland mode choice modeling study found that with free parking, 62% of commuters would drive alone, 16% would commute in carpools and 22% would ride transit; however, if a $6.00 parking charge in the Portland Central Business District was implemented, drive alone rates would drop and transit rates increase, with 46% driving alone, 4% carpooling, and 50% riding transit.[2] A review of empirical studies across a variety of circumstances (central city, suburbs, public and private employers, and clerical and professional employees) also found that parking subsidies greatly increase solo driving and that when parking subsidies are reduced or removed, 19% to 81% fewer employees drive to work alone and instead shift to carpooling and/or transit.[3]

Additionally, pricing parking can help manage occupancy of parking spaces on the curb and reduce circling among people looking for a place to park. It is estimated that around a third of downtown traffic is the result of people looking for a parking spot.[4] A Los Angeles-based study found that, on average, vehicles cruise around 3.3 minutes (about 2.5 times around the block) when looking for parking. In a 15-block meter district with 470 parking meters and turnover rates of around 17 cars per space per day, it was determined that over the course of a year, the search for curb parking creates about 950,000 excess

vehicle miles of travel (VMT), resulting in an estimated 47,000 gallons of gasoline and 730 tons of climate forcing pollutant carbon dioxide (CO_2).[5]

System Benefits of Parking Pricing

Pricing parking can have numerous system-level benefits, including:

- **Reduced VMT and congestion** – Pricing parking can encourage people to choose other modes of travel to avoid paying parking fees, which in turn can reduce VMT. Pricing that more accurately reflects demand (e.g. higher prices that encourage faster turnover where parking is in high demand, and lower prices where demand for parking is lower) can also increase the chances that a parking spot is available in a given block, thereby reducing the amount of time drivers spend looking for parking.
- **Support commercial activity and neighborhood livability –** By managing the curb space and encouraging appropriate vehicle turnover instead of long-term storage, parking pricing can help more people efficiently access stores and services. Parking management in residential or mixed-use areas can also ensure adequate parking is reserved for residents.
- **Improved efficiency & safety for other modes**- Co-benefits of reduced congestion and fewer distracted drivers looking for parking spaces can include: more free-flowing transit vehicles and safer streets as reduced circling can help reduce collisions with pedestrians, cyclists and other cars.[6]
- **Climate & health co-benefits**- Reductions in VMT and associated fuel consumption have climate and air quality benefits.
- **Local revenue reinvestment-** Revenue generated from pricing parking can be reinvested in areas around metered streets to fund projects such as: safety and/or capital projects for walking, bicycling, and transit and investments to improve the movement and delivery of goods and services.

Equity Considerations

While pricing parking can help deliver the above-listed system level benefits, it is important to examine the equity implications of parking pricing systems.

Pricing parking has the potential to reduce the negative impacts of high levels of VMT, including air pollution, carbon emissions, higher traffic safety risks and long, unreliable travel times due to congestion. These symptoms of high VMT disproportionately impact BIPOC communities and low-income individuals who are more likely to live further from the city center, near congested roadways and high-crash corridors.

On the other hand, despite these potential equity benefits, pricing can often serve to increase the cost of driving. Steps must be taken to ensure rates are flexible and responsive enough to provide options for those who may be disproportionately burdened by these costs.

Flat-rate parking fees are regressive, meaning that flat fees have a proportionally greater burden on people with lower incomes. A flat-rate parking fee is one that costs the same amount regardless of time of day, level of congestion, and/or users' means. For example, if parking costs $10 on a 24/7 basis without consideration for who is parking and the level of demand based on the time of day when they

are parking, then there is no alternative option for lower-income drivers, for whom $10 is a much higher cost relative to income than for a higher-income driver. Some options to consider when trying to make pricing strategies more equitable include:

- **Dynamic Pricing-** dynamic pricing varies prices based on either time of day or demand. As dynamic prices are often more responsive to how people are using parking spaces, they are generally more efficient at moderating demand, increasing parking availability, and reducing congestion than flat rate fees. These benefits can have ripple effects that make the system more equitable (e.g. less traffic can improve transit performance and safety for people walking and cycling); however, they may still be regressive for those driving.
- **Means-Based Discounts, Rebates, and Exemptions-** means-based affordability options reduce the costs for low-income drivers and can include strategies such as: subsidies, discounts, caps, and exemptions for drivers.
- **Revenue Reinvestment-** funds generated from parking pricing can be reinvested to advance equitable mobility through projects, programs and subsidies that alleviate disproportionate costs or impacts.

Parking Pricing

Key Terms

Table 1 | **Parking Key Terms**

TERM	DEFINITION
Public Parking	Parking that is publicly provided by the City, either in off-street garages or on-street in the City's right-of-way; can be priced, permitted or free
Private Parking	Parking that is privately provided by landowners or private operators; can be free or available at a cost to customers or general public, or limited to permit holders, employees, residents, etc.
On-Street Parking	Parking that is in the street, can be free or metered
Off-Street Parking	Parking that if not on the street (e.g. garage, parking lot, driveway, etc.), can be free or metered
Metered	Has a parking meter (and an associated cost)
Non-Metered	Does not have a parking meter; parking is free
Fixed-Rate Parking	Charges users a static rate for parking, regardless of demand that may vary based on location and/or time of day
Performance-Based Pricing	Performance-based parking is a pricing structure that involves monitoring parking occupancy rates and adjusting prices based on demand. Prices can be adjusted at different frequencies; some systems are more dynamic and responsive to real-time situations, while others involve changing parking rates less often (e.g. quarterly or annually)

Types of Parking Management

Many strategies exist to manage both public and private parking, including: changing the cost of parking through taxes and fees, removing and/or reducing parking requirements for buildings, encouraging employers to offer parking cash out programs that incent use of non-vehicular modes by offering payments for employees that forgo using parking. Four approaches will be examined in further detail:

1. Performance-Based Parking Pricing
2. Parking Cash-Out
3. Parking Requirements & Unbundled Parking
4. Preferred User Accommodations

Performance-Based Parking Pricing

Other Names:

- Demand-responsive parking pricing
- Dynamic parking pricing
- Flexible parking pricing

Description

Performance-based pricing seeks to balance the varying demand for parking with the fixed supply of spaces by regularly adjusting the price of parking based on occupancy rates. Performance-based parking generally aims to achieve an occupancy rate of 85%, which yields one to two available parking stalls per block face throughout the day, allowing visitors to easily find a parking space near their destination. Sometimes referred to as the "Goldilocks principle," performance-based parking regularly adjusts rates based on occupancy, so that if the price is too high, many spaces are vacant, if the price is too low, no spaces are vacant, and if there are a few vacant spaces available everywhere, then the prices are just right.[7]

Opportunities

In addition to the system level benefits of parking pricing noted above, performance-based pricing can help:

- **Optimize User Experience**- prices that produce an 85% parking occupancy rate will improve system efficiency as most spaces will be occupied, yet there will always be vacant spaces, reducing the need for drivers to circle the block looking for parking. By making visitors' parking experience more convenient and reliable, users' parking experience will be optimized.[8]
- **Increase Business Patronage**- higher demand for parking spots will yield higher prices, which in turn, will encourage rapid parking turnover. When parking is more expensive, drivers will park, buy something, and leave quickly so that other drivers can use the spaces.

Limitations

- **Enforcement-** It is estimated that parking enforcement today only captures about 20% of overstays or non-payments. Without additional enforcement, the variability of performance-based systems may have less of an impact.[9]
- **Parking Data & Rate Adjustment-** regularly adjusting parking rates will require PBOT to collect more robust parking data and evaluate it with greater frequency to ensure parking rates are responsive to demand.

- **Regressive-** parking fees that are not means-based are regressive (i.e. they disproportionately burden low income drivers) ; however, Professor Michael Manville highlights that high income workers are often twice as likely to drive alone than those that are low-income.[10] This is the case in Portland where workers earning $75,000 or more drive alone to work at a rate of 25.9% and take transit at a rate of 16.9%; whereas, among those earning less than $25,000, 8% drive alone and 14.43% take transit.[11] Manville also notes that in 16 of 20 American cities analyzed, the highest one hour parking price is lower than two one-way transit fares.

Status in Portland

- In April 2016, City Council adopted Resolution 37204,[12] which directed PBOT to develop a Performance-Based Parking Management Program based on adopted parking policies, accepted performance targets, and defined program parameters. Portland's Performance-Based Parking Management Manual, adopted in 2018, translates policy into operational guidelines for implementation by PBOT. PBOT is currently in the process of implementing the Management Manual guidelines.

Examples

- San Francisco, CA: http://sfpark.org/
- Seattle, WA:
    - https://www.seattle.gov/transportation/projects-and-programs/programs/parking-program/performance-based-parking-pricing-program
    - https://www.seattle.gov/Documents/Departments/SDOT/About/DocumentLibrary/Reports/SDOT_AnnualReport2017.pdf
- Washington, DC: https://ddot.dc.gov/service/performance-based-parking-pilots

Parking Cash-Out

Description

Parking cash-out is a commuter benefit that can be implemented effectively at workplaces that offer free parking by offering employees a choice to keep a free, subsidized parking space at work, or to give up their parking space and receive a payment in return, which can be used to purchase other modes of transportation, such as transit fares, or kept as cash. Parking cash out can be offered on a daily and/or monthly basis.

Opportunities

In addition to the system level benefits of parking pricing noted above, parking cash-out presents the following potential benefits:

- **Often better Received than Parking Pricing**- parking cash out programs are often more palatable and better received by employees when implemented than introducing paid parking.
- **Reduced Vehicle Trips & Parking Demand**- Parking cash out programs are proven to significantly reduce drive alone trips. An evaluation of eight employer cash-out programs in California finds that on average, they reduce drive alone commute trips from 76% to 63%, increase carpooling from 14% to 23%, increase transit trips from 6% to 9%, and increase walking from 2% to 3%.[13]
- **Benefits for Businesses**- by reducing employee demand for parking through cash out programs, employers can reduce costs associated with leasing or owning and maintaining parking facilities.

Reduced demand for employee parking can also eliminate the need to acquire additional parking and in some instances, may free up parking for customers.[14]

Limitations

- **Not Applicable to All Employers-** Parking cash out programs are designed as an alternative to free parking that is often offered by employers; however, viability may differ by geography and employer as not all employers offer free parking. Though, a 2005 study estimates that 95% of automobile commuters in the Portland metro area park free at work.[15]

Status in Portland

- Parking cash-outs can be implemented at any time; however, they depend on voluntary employer action that is currently not required by the city. To require parking cash out in more circumstances, code changes to Title 33, which governs parking and transportation and parking demand management in the City of Portland, would be needed to expand requirements for transportation demand management programs, which are currently only required in new or existing developments that add more than 10 dwelling units.[16]
- At the state level, changes to Chapter 340, Division 242 of the Administrative Code, which governs the Portland area's Employee Commute Options (ECO) program could also provide an avenue to require greater transportation demand management initiatives, such as parking cash out, among employers in Portland. Currently the legislation only applies to large employers with more than 100 employees at a given work site.[17]

Examples

Government Ordinances:

- California State Law: https://ww2.arb.ca.gov/resources/documents/californias-parking-cash-out-law
- Rhode Island State Law: http://webserver.rilin.state.ri.us/BillText02/SenateText02/S2436.pdf
- Washington, DC Law (under Congressional review): https://lims.dccouncil.us/Legislation/B23-0148

Employer Provided:

- Seattle Children's Hospital: https://www.seattlechildrens.org/about/sustainability/
- University of Maryland: https://transportation.umd.edu/about-us/updates/parking-cash-out-1920

Parking Requirements & Unbundled Parking

Description

The combination of parking requirements and "bundled" parking creates a landscape that internalizes the cost of parking and passes it onto residents and employees.

Parking requirements, often manifested as parking minimums and/or maximums, set upper and lower bounds for the amount of parking to be provided in a given development. Movements to waive parking minimums and instead implement parking maximums seek to shift the established parking paradigm and limit the construction of new parking.

Relatedly, unbundling parking separates the cost of renting or owning parking spaces from the cost of renting or owning a residence or commercial space. Decoupling real estate transaction costs from parking costs gives building occupants the choice of whether to pay for the use of parking spaces and helps to mitigate parking oversupply. Unbundling parking from real estate can reduce car ownership and solo driving rates. A 2018 study finds that when parking is bundled, auto-ownership is higher and solo driving is 12.5% higher for commute trips and 40% higher for non-commute trips.[18]

Opportunities

In addition to the system level benefits of parking pricing noted above, changing parking requirements and/or unbundling parking can present the following additional opportunities:

- **Reduce Development Costs & Increase Housing Construction**- Parking minimums are often cited as increasing the costs of construction with some studies suggesting that parking requirements increase the cost of constructing a shopping center by up to 67% if the parking is above ground and by up to 93% if the parking is below ground.[19] Reducing parking requirements can lower development costs and reduce the amount of land allocated to parking, which may ultimately enable more dwelling units to be constructed.[20]
- **Reduce Costs of Living**- As Donald Shoup notes in his seminal work *The High Cost of Free Parking* (2005) and follow-up work *Parking and the City* (2018), parking inflates the cost of housing and goods because developers fold it into property costs and pass those costs along to residents and consumers. By reducing and eliminating parking requirements and unbundling parking from housing and commercial space, tenants have greater autonomy to decide whether or not to pay for parking or have greater funds available to cover other household costs.
- **Place a Clear Cost on Parking**- by unbundling parking from developments, real estate purchasers and tenants have the choice whether or not to pay for parking. A clear price on parking can trigger behavior change and the knock-on effects of reduced vehicle ownership and associated VMT, congestion, and pollution.
- **Reduce Vehicle Ownership & Promote Car-Free Living-** reducing the amount of parking available and separating the cost of parking from lease and purchasing costs, enables people to consider other transportation options. Additionally, a San Francisco study examining the effect of unbundling parking finds that when parking is leased or sold separately from property, household vehicle ownership decreases and carshare membership increases.[21]

Limitations

- **Exemptions and site-specific needs** – policies around parking maximums or unbundling may create burdens for certain kinds of properties that require significant parking (e.g. hospitals).
- **Parking displacement into nearby streets** – reduced parking requirements may lead to office or residential tenants parking personal vehicles on nearby streets if parking is not provided on site.

Status in Portland

- The April 2020 Central City 2035 Transportation System Plan (TSP) amendments includes an amendment to the TSP to limit growth of overall parking supply by waiving minimum parking requirements in the Central City and setting maximum parking ratios to encourage other modes,

only allowing for new long-term parking if associated with new development or to serve buildings with little parking.[22]

- Portland's Title 33, which governs parking and transportation and parking demand management in the City of Portland, details parking requirements for the City and notes exceptions to parking minimums, which include: waiving parking requirements if developments meet affordable housing dwelling unit requirements and reduced parking requirements where large trees are preserved, additional bicycle parking is provided, a transit plaza meeting specific requirements is present, motorcycle parking is partially substituted for car parking, and carshare parking and/or bikeshare stations are included.[23] Regarding unbundling parking in Title 33, parking can be voluntarily unbundled from existing developments at any time; however requiring parking to be unbundled from new development would require amendments to Title 33.

Examples

- Buffalo, NY: https://usa.streetsblog.org/2017/01/03/buffalo-becomes-first-major-city-to-eliminate-damaging-parking-rules/
- Hartford, CT: https://usa.streetsblog.org/2017/12/13/hartford-eliminates-parking-minimums-citywide/
- Mexico City, Mexico: https://usa.streetsblog.org/2017/07/19/its-official-mexico-city-eliminates-mandatory-parking-minimums/
- Portland, OR: https://www.portlandoregon.gov/bps/article/53320
- San Francisco, CA: https://sfgov.legistar.com/LegislationDetail.aspx?ID=3709260&GUID=C36405A9-974A-4B08-8EDB-56DDFAC6CEEA

Parking Taxes & Fees

Description

Parking taxes and fees increase the construction and/or maintenance costs of parking and may increase parking rates when passed along to consumers. Taxes can be applied in two primary ways: (1) as a charge to users and (2) as a charge to facility owners (on the basis of land value, surface area, or number of available parking spaces). Parking taxes are typically charged on a per-transaction basis and may reflect either a flat amount or a percentage of the cost. Given that parking taxes generally occur at the point of transaction, they may prompt some employers to move from paid to free parking to avoid the tax.

Parking-facility-owner fees are based on the number, type, or surface area of parking spaces in a parking facility. Parking fees may be applied as a flat fee per parking space, a variable fee based on use, or as a fee based on type of parking space, such as those designated for long-term use. Fees can be applied annually, during construction, and/or upon issuance of a use permit. Fees can be an effective way to price parking that would otherwise be free. Ultimately, the effectiveness of parking fees on shifting travel behavior depends on how much of the cost is passed onto consumers.

Status in Portland

- To date, there are no parking taxes in the City of Portland.

Examples

- Chicago, IL: https://www.chicago.gov/city/en/depts/fin/supp_info/revenue/tax_list/parking_tax.html
- Illinois: https://www2.illinois.gov/rev/research/taxinformation/excise/Pages/Parking%20Excise%20Tax.aspx

Preferred User Accommodations

Description
Preferred user parking involves accommodations to meet the specific needs and priorities of different groups, such as residents, people living with a disability, government employees, commercial delivery vehicles, zero emission vehicles, and carshare vehicles. Parking policies for many of these user groups lack innovation to date; however better management of these parking assets could facilitate many of the benefits afforded by other parking management programs.

- **Residential Parking Permits**- Designed to preserve neighborhood parking by limiting the use of local parking to residents.
    - *Status in Portland*- Portland's Area Parking Permit program is an annual parking permit program designed to help alleviate commuter parking in residential areas. Parking permits are purchased by residents or businesses within Area Parking Permit (APP) zones that allow permit holders to park on local streets past posted visitor time limits.[24]
    - *Examples*
        - Aspen, CO: https://www.aspentimes.com/section-front/city-of-aspen-putting-the-brakes-on-parking-privleges/
        - Boulder, CO: https://bouldercolorado.gov/parking-services/neighborhood-parking-program
        - Chicago, IL: https://www.chicityclerk.com/city-stickers-parking/about-parking-permits
        - San Francisco, CA: https://www.sfmta.com/permits/residential-parking-permits-rpp
        - Washington, DC: https://ddot.dc.gov/service/residential-permit-parking
- **Commercial Loading**- delivery parking for commercial vehicles, especially in business districts where on-street parking is seldom adequate to fully satisfy the volume of deliveries in a single day, can be an effective tool to encourage turnover of spaces and off-hour deliveries that reduce instances of double parking and conflicts with other road users.
    - *Status in Portland*- Portland City Code and Charter establishes truck loading zones designed to prevent double and/or illegal parking by only allowing designated vehicles in truck loading zones for no more than 30 minutes while being actively loaded or unloaded.[25]
    - *Examples*
        - New York City, NY: https://www1.nyc.gov/html/dot/html/motorist/parktruck.shtml
        - Philadelphia, PA: https://www.phila.gov/2019-09-04-city-announces-chestnut-street-loading-zone-pilot/

- **Disability Parking**- since the end of World War II, free disability parking has been accepted common practice in the US; however increased demand for parking, increased occurrences of disabled placard abuse, expansion of the definition and eligibility of disability parking, an aging baby boomer generation, and a general need for better parking management in cities is leading some jurisdictions to rethink the paradigm of free and unlimited parking benefits for people living with a disability. Current best practices around disabled parking reform include: increasing fines for fraudulent placard use, eliminating free parking completely, limiting disability parking to those in wheelchairs or who are unable to use a meter, or doubling the amount of allowed time, and coordination with local community members living with a disability to reach consensus and approval for any changes.
    - *Status in Portland*- in 2014, City Council adopted a resolution that overhauled on-street parking for the disability community, including charging for parking, allowing placard holders to stay for twice the maximum time limit, scratch off permits to allow drivers to pay from their vehicle rather than having to walk to the meter, discounted monthly parking permits in meter districts, installation of 50 additional parking spaces around downtown for people using disability placards, and 30 free parking spaces reserved for patrons possessing a wheelchair placard.[26, 27, 28]
    - *Examples*
        - Arlington County, VA: https://transportation.arlingtonva.us/parking/disability-parking/
        - California: https://www.dmv.ca.gov/portal/dmv/detail/pubs/brochures/fast_facts/ffvr07
        - Chicago, IL: https://www.chicago.gov/city/en/depts/mopd/supp_info/information_for_motoristswithdisabilities.html
        - Illinois: https://www.cyberdriveillinois.com/services/persons_with_disabilities/disabilitiesfaq.html
        - Michigan: https://www.michigan.gov/sos/0,4670,7-127-96435_49898---,00.html
        - Washington, DC: https://ddot.dc.gov/page/disability-parking
- **Carshare Parking**- carshare parking involves the allocation of on- and off-street parking to carshare company vehicles. Typically carshare vehicles are stored in the following three types of locations: residential areas, off-street commercial facilities, and on-street. Carshare parking models are generally well established within the private market and often follow one of two primary models: designation of on-street spaces for carshare vehicles and allow carshare operators to apply for those spaces (as is the case in Portland), or a bidding process that auctions off designated on-street parking spaces to the highest bidding carshare company.
    - *Status in Portland*- Portland City Code & Charter sets the administrative rules that govern carshare parking in Portland. While carshare currently does not have a presence in Portland after Car2Go ceased operations here in 2019, carshare regulations still stand and offer robust parking guidance in metered and non-metered districts.[29]
    - *Examples*
        - Study reviewing carsharing and public parking best practices in: Philadelphia, Portland, Washington, DC, and San Francisco Bay Area: http://innovativemobility.org/wp-content/uploads/2015/03/Carsharing-and-Public-Parking-Best-Practices.pdf

        - Access Magazine. 2010. “On-Street Parking Spaces for Shared Cars.”: https://www.accessmagazine.org/spring-2010/street-parking-spaces-shared-cars/
- **Electric Vehicle Parking-** As some cities work to create fertile charging environments for the burgeoning electric vehicle market, cities are experimenting with regulations and charging station criteria that prioritize space for electric vehicles.
    - *Status in Portland*- Portland General Electric (PGE) is leading City efforts to expand electric vehicle charging, resulting in projects such as Electric Avenue in downtown Portland and utility pole charging in Southeast Portland. These charging projects reserve parking spaces for electric vehicles and set time limits based on capacity of installed chargers.
    - *Examples*
        - Great Plains Institute. 2019. “Summary of Best Practices in Electric Vehicle Ordinances.” https://www.betterenergy.org/wp-content/uploads/2019/06/GPI_EV_Ordinance_Summary_web.pdf.

Available Parking Technologies

Parking management tools are rapidly advancing, providing benefits to both users and manager of parking systems. New technologies allow parking managers and governments to collect large quantities of data at relatively low costs, which can allow for dynamic pricing, increased revenue generation, real-time reporting, more efficient parking enforcement, and more transparent decision-making.

Starting in 2002, Portland was the first large city in North America to convert the majority of its meters to pay stations. Since then, electronic parking meters have essentially replaced mechanical meters, providing improved security, multiple payment options, convenience of remotely extending parking time using a phone or computer, more robust and easily compiled revenue and utilization information, and the option for real-time pricing updates.

This section offers a brief summary of available parking technologies that can facilitate parking reform policies.

TECHNOLOGY	DESCIRPTION
Single-Space Meters	Single space parking meters, traditionally paid for with coins, are the oldest type of parking asset. Intelligent solar-powered meter retrofits increase functionality of traditional parking meters and accept coin and credit card payments. They are also connected to wireless networks allowing for real-time reporting of parking violations and system failures, as well as dynamic pricing.
Multi-Space Meters	Multi-space meters are common in both on- and off-street facilities and can support pay and display, pay by space, and pay by license plate. Multi-space meters are located in a central location and reduce the amount of space occupied by parking meters. They are capable of accepting coin and card payments, real-time reporting, and dynamic pricing.
In-Car Meters	In-car meters are small, programmable devices that hang in cars and are pre-loaded with funds that are deducted based on a vehicle’s location and how long

	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 a user's account based on the time a vehicle is parked. In-car meters allow users to pay only for the time they use, yield higher levels of compliance, and reduce the threat of on-street meter vandalism. Parking departments have the dual benefit of receiving revenue up front while reducing collection costs; however they do not provide real-time information to parking managers and may be subject to theft.
Pay-by-Phone	Pay-by-phone technology allows users to pay for parking by phone, text message, or with a smartphone application, such as Portland's Parking Kitty. Users are typically required to preregister and provide credit card and license plate number, which then enables them to pay by phone, receive notifications when they are running out of time or if there are attempting to park at a time when special restrictions are in place, and add additional time remotely. Pay-by-phone systems reduce the costs associated with cash collection, helps enforce compliance with parking time limits, and allows operators to easily adjust rates and see utilization data.
Automated Technologies for Off-Street Facilities	Automated technologies at off-street facilities can include pay on foot and pay in lane kiosks. Both technologies reduce staffing needs and can support real-time reporting. Pay on foot allows users to make payments at a pay station before returning to their vehicle and exiting, which can speed up the exit process. Pay in lane requires users to pay for parking at an automated kiosk in the exit lane of a parking facility. Pay in lane systems can reduce confusion among drivers, but may significantly reduce exit flow.
License Plate Recognition Technology	License plate recognition technology uses cameras and optical character recognition to read license plates. Once read, license plates are referenced against a database containing violation, payment, and other pertinent information. License plate recognition can help with enforcement, data collection, understanding occupancy rates, and can be integrated with payment system in off-street parking facilities.
Parking Space Sensors	Parking space sensors use ultrasonic, magnetometer, or digital camera technology to determine if a space is occupied. Sensors can be placed in pavement, affixed to parking meters, or hung from ceilings in parking garages. They are used for enforcement, data collection, and informing users of the location of available spaces.
Databases	No single company or system currently exists to streamline the use of multiple parking technologies. As a result, cities using multiple technologies must develop database tools to integrate data from various systems and are encouraged to develop application programming interfaces (APIs) that enable parking data to be shared with developers who can create applications for the public.

Case Studies

Performance-based Parking | San Francisco, CA

PARAMTER	DETAIL
Program Name	SF*park*
Location	San Francisco, California
Type	Performance-based parking
Year Implemented	**Pilot Program**: 2011 - 2017 **Permanent Program**: 2018 - present
Overview	SF*park* is the largest and most sophisticated performance-based pricing scheme in the US. The program uses the basic economic principle of supply and demand to vary the price of curb parking by location and time of day.
Parameters	Initially piloted with federal funding for six years on 6,000 on-street metered spaces, 12,250 off-street spaces in 14 of 20 city-managed parking garages, and one transit-agency-managed parking lot in San Francisco, SF*park* was adopted as permanent city policy in 2018. The permanent program applies to all of San Francisco's 28,000 on-street parking meters and to the city's metered surface parking lots. Rate adjustments occur no more than once a month.
Stated Goals	- Increase parking availability & make it easier to find a parking space- use price signals to redistribute demand and ensure at least one parking space is available per block and some parking is available in garages - Change public attitudes toward metered, on-street parking by providing better parking information and customer service - Occupancy goals of 60% to 80% with prices ranging from $0.25 to $6.00 per hour - Increase patronage for local businesses - Safer streets for all users (reduce conflicts between cars cruising for parking and other road users) - Reduce traffic and congestion (circling the block for parking accounts for a third of urban traffic, SFpark aims to reduce the time required to find a space)
Technology	- On-street parking sensors detect when a space is available - Real-time data of parking availability available online, via smartphone app, or text message - Digital parking meters that accept coins, credit cards, and prepaid parking meter cards - Dynamic prices that make parking garages attractive alternatives to on-street parking
Outcomes	Primary Benefits 1. **Improved parking availability:** Reported parking search time went down by 43% under the SFpark pilot as parking availability improved and drivers reported that it was easier to find a parking space 2. **Lower parking rates**: Average hourly meter rates were reduced by 4% (down $0.11/hour) in SFpark on-street pilot areas. City-owned garage rates went down by 12% (down $0.42/hour.) Secondary Benefits 3. **Increased business for local businesses**: Sales tax revenues rose over 35% in SFpark areas during the compared to less than 20% in the other parts of the city.

	4. **Decreased daily vehicle miles traveled & greenhouse gas emissions:** Reduced circling for parking led to a 30% decrease in miles traveled in SFpark areas, benefiting safety, easing congestion and reducing neighborhood pollution. 5. **Safer streets**: because of reduced VMT and less distracted driving 6. **Improved public perception of parking policy and pricing** without generating negative public reaction 7. **Easier to pay and avoid citations:** by lengthening time limits and making it easier to pay, users of SFpark reported it was easier to avoid parking tickets and citations 8. **Peak period congestion decreased & traffic speeds improved:** by encouraging people to drive a non-peak time and improving parking availability when it mattered most, on-street parking availability improved by 22% during peak periods, compared to 12% during off-peak 9. **Reduced Illegal parking:** double parking decreased when parking availability improved 10. **Slight increase in net parking revenue-** while parking rates on average decreased, facilitating longer parking times resulted in greater net revenue for the city
Enabling Policy & Politics	Initial legislation approved that defined SFpark pilot areas, specified ranges and limits for rates, time limits, and parking availability targets. Subsequent policy documents elaborated and refined initial legislation.
Costs	$46,236,000
Funding	$19,800,000 grant from US Department of Transportation $22,000,000 loan from Bay Area's Metropolitan Transportation Commission $4,950,000 local matching funds
Revenues & Investment	On average, parking rates for on-and off-street parking decreased, while parking revenues increased by $1.9M per year. From FY2011 to FY2014, net annual revenues increased by approximately $3.3M, while annual citation revenues decreased by approximately $0.5M. (a 10% greater decrease than non-SFpark areas). Revenue from garages was slightly slowed, accounting for around $0.9M annual revenue
Equity Considerations	**Accessible Parking** - In response to public feedback that low income people with disabilities who travel by private vehicle may be negatively impacted by the shift from free parking to meter payment, the transportation board of directors directed staff to develop a discount program for low income people with disabled parking placards. - Reserved more parking spaces for people with disabilities ensuring 4% of metered spaces are blue zones, representing a 70% increase and the installation of 470 new zones **Improve Performance of other Modes** - By reducing congestion and pollution associated with people circling the block looking for parking, SFpark helps make transit faster and more reliable and makes streets safer for pedestrians and bicyclists
Key Takeaways & Lessons Learned	**Project Planning** - Scope of work is expansive and easy to underestimate - Dedicated executive transportation leadership is critical - Clear understanding of existing parking supply is a critical first step

	- Strong and coherent intellectual foundations make it easier to develop and communicate necessary policies, goals, and tools - Balance complexity and simplicity in communication and implementation - Commitment to data collection and project evaluation improves project credibility **Institutional** - Transportation agency management of parking assets allows greater focus on project delivery than interagency coordination - Significant time and effort required to reach consensus around policy, organizational, and technological changes - In-house parking meter expertise is critical to manage and advise program **Communications** - Slogan: "live more, circle less" - Narrative framed around parking management being a powerful tool for achieving transportation goals - Clear explanation of how parking revenue from SFpark would be used to fund transit was important and typically well-received - Effective communications team passionate about the project was part of project success - Extensive outreach with community leaders from the start of the project was essential to project's reception. Project outreach required a large amount of time and effort - Transparency, clarity, and full information sharing about SFpark's goals, policies, and methods was helpful **Contracting Administration** - Flexible contract and procurement approach important to move quickly in an unpredictable environment - A collaborative and interactive Agile methodology enabled agency to be nimble while operating in an uncertain, immature, and unknown environment - Permitting and regulations took much more time than expected - Procurement logistics presented significant challenges and required resources **Implementation & Operation** - Parking policies require effective enforcement - Federal project deadlines created urgency and aggressive goals to work towards - Custom technology development required significant collaboration and data governance reform - Organizational changes and challenges faced to set up a real-time information and data management system - Most technology used did not meet initial expectations - Parking sensor data is new, subtle, and complex and was a learning process for staff - Targeted pilot approach was sound and avoided risk of unacceptably high risk of failure of pursuing a citywide program from the outset
Additional Resources	SFpark Pilot Evaluation Homepage: https://www.sfmta.com/getting-around/drive-park/demand-responsive-pricing/sfpark-evaluation SFpark Pilot Evaluation: https://www.sfmta.com/sites/default/files/reports-and-documents/2018/08/sfpark_pilot_project_evaluation.pdf SF Park Project Summary & Lessons Learned: https://www.sfmta.com/sites/default/files/reports-and-documents/2018/08/sfpark_pilot_overview.pdf

Parking Cash Out | California

PARAMTER	DETAIL
Program Name	California Parking Cash-Out (Assembly Bill 2109)
Location	California
Type	Parking cash-out
Year Implemented	1993
Overview	California parking cash our legislation requires many employers throughout the state to offer a parking cash-out program, whereby employees have an option to choose between free parking subsidy or its cash equivalent, rewarding commuters that opt to carpool, walk, bike or ride public transit to work.
Parameters	Only applies employers (public or private) that: - Employ more than 50 people - Have worksites in an air basin designated nonattainment for any state air quality standard - Subsidize rented employee parking (so that a firm's avoided cost for the rented parking spaces pay non-driving commuters cash allowances) - Can calculate the out-of-pocket expense of parking subsidies they provide - Can reduce the number of parking spaces without penalty in any lease agreements Compliance with the cash-out law requires employers to subsidize any alternative to solo driving (e.g. walking, biking, taking transit) at the same as it subsidizes parking. A simple cash-out test, determines whether employers are in compliance by ensuring policies have one of the following: (1) no parking subsidy, (2) offer a choice between a parking subsidy or its cash value, or (3) provide a transportation allowance that can be spent on any form of commuting.
Stated Goals	- Give commuters alternative choices to solo driving - Reward alternatives to solo driving - Reduce vehicle trips - Treat all commuters equally - Little cost to employers - Strengthens city centers - Converts economic waste into public revenue - Sidesteps employees' opposition to charging for parking - Is not a tax on parking
Outcomes	Many employers have not heard of the California parking cash-out requirement because the state government has don't little to publicize or enforce it. A 2002 report by California's Legislative Analyst's Office (LAO) concluded that almost ten years after the program was established the state did nothing to enforce the law and very little outreach to make employers aware of it. LAO estimates that full compliance with the law would reduce VMT by 113 and 226 million miles per year, reduce gasoline consumption by between 5 and 11 million gallons

	per year and reduce vehicle emissions associated with commuting by at least 730 tons per year. Additionally, each parking space cashed out per year is estimated to generate an additional $258 in federal tax revenue and $50 in state tax revenue. Given this analysis was done in 2002, one might expect these values to be far greater in 2020. An analysis of eight employers in the LA-region offering cash-out programs under the state regulation suggest promising outcomes: ○ 13% reduction in drive alone rates (from 76% to 63%) ○ 11% reduction in daily vehicle trips to work ○ 652 VMT reduction per year per employee ○ 12% GHG emissions reduction ○ 26 gallons of gasoline saved per year per employee
Enabling Policy & Politics	Four factors contributed to the passage of California's cash-out law: - Prior research showing employer-paid parking consistently increases solo driving - An existing parking cash out program in Los Angeles that provided a legal precedent for the state policy - Close collaboration between state officials and university researchers to develop the policy proposal - Negotiations between legislative drafters and employers to resolve objections and forestall potential opposition to the law
Costs	- Costs for employers should be roughly net neutral as money that was initially going towards subsidizing free parking is instead offered as a cash bonus. - Costs may be incurred if commuters that are already using non-vehicular modes and were previously undercompensated begin to receive equivalent payments to solo drivers. - Administrative costs are reported to be low as parking cash out is simple, easy to administer, and almost automatic
Funding	Parking cash out programs should not require substantial additional funding, given they are largely a transfer of existing costs for an employer
Revenues & Investment	- As a relatively net neutral policy, substantial revenues are not anticipated from parking cash out programs. - At a federal and state level, VMT reductions associated with parking cash out programs may be assumed to reduce gasoline consumption, thereby reducing federal and state gas tax revenue. These differences will diminish as fuel efficiency increases and greater adoption of electric vehicles reduces baseline revenues from gas taxes. - Additionally, depending on whether the parking cash out is offered as a pre- or post-tax commuter benefit will affect state and federal revenues
Equity Considerations	Employer paid parking favors and over-subsidizes solo drivers at the expense of commuters that take alternative modes. Given research showing that greater proportions of higher income people drive than their low-income counterparts, parking cash-out programs provide leveled subsidies to employees, regardless of commute mode.
Key Takeaways & Lessons Learned	Analysis and experience with California's cash out program suggest that a state agency like Air Resources Board is ill-equipped to enforce a parking cash-out requirement
Additional Resources	California's Parking Cash-Out Law Website: https://ww2.arb.ca.gov/resources/documents/californias-parking-cash-out-law

	Informational Guide for Employers on California's Parking Cash-Out Program: https://ww2.arb.ca.gov/sites/default/files/2020-05/CA_Parking_Cash-Out_Program_An_Informational_Guide_For_Employers_2009.pdf Analysis of California's Parking Cash Out Program: Shoup, D. 2005. "Parking Cash Out." http://shoup.bol.ucla.edu/Parking%20Cash%20Out%20Report.pdf.

Parking Tax or Parking Fee | Sydney, Australia

PARAMTER	DETAIL
Program Name	Parking Space Levy (PSL)
Location	Sydney, Australia (part of New South Wales)
Type	Parking Fee/Tax
Year Implemented	1992
Overview	Sydney's Parking Space Levy (PSL) is a tax/fee imposed on owners of off-street commercial and office parking spaces in certain business districts within the Sydney metropolitan area. The aim of the PSL is to reduce traffic congestion in key business districts by discouraging car use and encouraging public transport by funding around $100 million AUD (~$69 million USD) of improvements to essential infrastructure each year.
Parameters	Applies to taxable buildings/properties in key commercial centers in Sydney's central city. There are two designations of parking levy areas, Category 1 and Category 2. Category 1 areas are those identified in the initial PSL, including Sydney CBD, North Sydney, and Milson's Point. Category 2 areas are shopping centers that were added in an expansion of the PSL in 2000 and include Bondi Junction, Chatswood, Parramatta, and St. Leonards. Category 1 areas are taxed at a higher rate than Category 2 areas. As of July 2016, PSL rates are: • Category 1: $2,350 AUD ($1,619 USD) per space per year ($6.45 AUD ($4.44 USD)/day) • Category 2: $840 AUD ($579 USD) per space per year ($2.30 AUD ($1.58 USD)/day) Some exemptions to the PSL exist, such as: loading and unloading goods or passengers, parking lots owned by religious or charitable institutions, emergency vehicles, and resident parking.
Stated Goals	- Reduce congestion by discouraging car trips to commercial areas - Help meet the cost of building better public transport so that it replaces car trips

Technology	Low-tech: Parking facility owners register parking spaces and/or claim exemptions annually with New South Wales revenue division, who assesses the amount owed. Parking facility owners can then pay their fees online with a credit or debit card.
Outcomes	- According to 2014 research, the implementation of the PSL had not led to a decrease in total number of available parking places in the City of Sydney - The revenue from the PSL has been dedicated to improvements in public transport infrastructure, primarily interchanges and commuter car parks
Enabling Policy & Politics	- The Parking Space Levy Regulation (2009, 2019) guide the implementation of the PSL program - The New South Wales government passed the PSL regulation, which was met with opposition from parking lot operators, skeptical that the tax would ease congestion[30]
Revenues & Investment	- PSL raises around $100 million AUD (~$69 million USD) each year - The majority of revenue is used to fund public transit infrastructure projects, such as commuter car parks, bus stations, bicycle parking, and new light rail lines. - All revenue from the PSL goes into the Public Transport Fund and can only be used for specific purposes, including funding: o Public transport services o Projects that facilitiate access by public transit to and from or within PSL districts, including the construction, maintenance, and ongoing management of parking facilities and other such infrastructure o Communications efforts to provide commuters with information
Equity Considerations	When a parking tax is passed along to consumers, the price of driving increases. Without adequate exemptions and/or protections in place for low-income drivers, they will be more affected by the price increase and may be the ones forced to switch to other modes, while those able to afford it continue driving.
Key Takeaways & Lessons Learned	The New South Wales government conducted a review and solicited public comment from 2016-2018 on how to improve administration of the PSL program. The following proposed changes reflect lessons learned: - Improve administration of the PSL - Simplify the requirements for annual returns - Review the guidelines for claiming exemptions - Amend the PSL legislation to reflect proportional liability for the annual tax if a property changes hands - Improve transparency of revenue collected and spending applications
Additional Resources	Parking Space Levy Regulation 2009: https://www.legislation.nsw.gov.au/#/view/regulation/2009/219 Parking Space Levy Regulation 2019: https://www.legislation.nsw.gov.au/#/view/regulation/2019/390 NSW- Parking Space Levy- https://www.transport.nsw.gov.au/programs/parking-space-levy NSW Revenue- Parking Levy: https://www.revenue.nsw.gov.au/taxes-duties-levies-royalties/parking-space-levy 2009 Levy Act: https://www.parliament.nsw.gov.au/la/papers/Pages/tabled-paper-details.aspx?pk=74742

2018 Review of 2009 Levy Act: https://www.parliament.nsw.gov.au/tp/files/74742/Parking%20Space%20Levy%20Legislation%20Final%20Review%20Oct%202018.pdf
Article- how much does it cost to park in Australian cities? https://www.savings.com.au/car-loans/cost-of-car-park
RACQ Reports: https://www.racq.com.au/cars-and-driving/representing-queensland-drivers/ways-we-advocate/consumer-issues

Further Reading

Parking in Portland:

- City of Portland Parking ArcGIS interactive map
- City of Portland Performance-Based Parking Management Manual (adopted by City Council in April 2018)
- Parking Pricing: TDM Encyclopedia (Victoria Transport Policy Institute)
- "Parking facilities and the built environment: Impacts on travel behavior" (Transportation Research, 2017)

Ongoing City policy development projects and programs related to parking:

- Transportation Demand Management (TDM) Action Plan (The Way to Go: People Moving in Portland)
- Net Meter Revenue Policy Review
- Transportation Wallet program

Further reading on public parking strategies

- TDM Encyclopedia: Parking Price Elasticities
- "Getting the Prices Right: An Evaluation of Pricing Parking by Demand in San Francisco" (Pierce and Shoup, 2013)
- Seattle DOT annual report on performance-based parking and rate adjustments
- "Every City with 'Goldilocks' Parking Fees" (Reinventing Parking, 2018)
- Sightline.org series of blog posts about parking pricing

Private parking strategies

- Parking taxes: Evaluating options and impacts (Victoria Transport Policy Institute, 2013)

- Higher-level summary: Parking Cash Out (Best Workplaces for Commuters, 2005)
- Deeper Dive: Parking Cash Out (Donald Shoup)
- California's Parking Cash Out Law
- "Flexible commuter benefits: The push for transit, walking, & bicycling parity in Washington DC" (Coalition for Smarter Growth, 2020)
- "'Unbundling' parking costs is a top way to promote transportation options" (Mobility Lab, 2018)
- "The Hidden Cost of Bundled Parking" (Access, 2017)

Endnotes

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