On-Street Parking Pricing

A GUIDE TO MANAGEMENT, ENFORCEMENT, AND EVALUATION

ITDP

FOREWORD

Rapid motorization has been a global trend in recent decades and has presented troubling consequences, such as air and noise pollution, traffic-related injuries and deaths, and inequity. As vehicle use increases, so does demand for storing vehicles, both for short-term stays on the street near drivers' destinations and longer-term stays in off-street lots and garages. Managing and pricing parking is therefore critical to ensure equitable use of public space among high-volume, low-polluting transport modes like public transport, cycling, and walking. However, efforts to regulate and price parking in cities have generated controversy, as drivers tend to come from higher-income, vocal groups who believe they have a right to ample, free-of-charge or very low-cost parking wherever and whenever they need it.

The COVID-19 pandemic turned long-standing driving and vehicle use trends on their heads. Lockdowns, shelter-in-place orders, and similar restrictions transformed bustling city streets into empty thoroughfares overnight. Public transit ridership dropped dramatically early on. Walking and cycling emerged as key transport solutions. In Chinese cities, data showed that those who owned a car chose to drive instead of returning to public transport to commute when the most extreme restrictions on travel were eased. Meanwhile, those who did not own a car also reduced their use of public transportation, but this group replaced metro and bus trips with personal and shared bicycles at a high rate.[1]

The pandemic also demonstrated the possibility of **reallocating space** in ways that work for more people: Many cities allowed restaurants to repurpose on-street parking into outdoor dining space, expanded sidewalks, or temporary cycle lanes. While these types of changes can take a long time to implement, this meant people were able to experience their cities in a new way almost overnight. As we begin to emerge from pandemic-imposed restrictions, this reality where more space and priority are given to people over parked cars is still possible with effective parking management.

Cities that take action to address long-standing parking management issues now may be able to shift some of the **increased demand for vehicles** expected in the aftermath of the pandemic to other modes. Parking management that includes pricing enables cities to reallocate space for bus lanes, bicycle lanes, wider sidewalks, and flexible pickup zones—which are also seeing high demand as low-contact, physically distanced solutions—and the revenue from pricing parking can help fund these improvements. High-quality public transport, cycling, and walking infrastructure benefits users of these modes as well as drivers by reducing congestion as demand shifts away from driving.

MORE EFFICIENT PARKING MANAGEMENT AND PRICING ENABLES CITIES TO PRIORITIZE VALUABLE URBAN SPACE FOR PEOPLE AND LOCAL BUSINESSES INSTEAD OF CARS, RESULTING IN MORE EFFICIENT, EQUITABLE, HEALTHY COMMUNITIES.

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1   Liu, R. 2020. The impact of COVID-19 epidemic on urban traffic in China.

CONTENTS

1 INTRODUCTION

Parking in cities is not just about vehicle storage: How a city prices—and ultimately manages—parking has direct and indirect effects on how people travel and therefore impacts related issues like congestion, air pollution and emissions, road safety, land use development patterns, and street design. Together, these contribute to the quality and livability of public space.

A basic economic principle is that prices (what consumers pay for goods or services) should reflect the full cost of producing goods and services, unless a subsidy is specifically justified. Most goods—housing, food, clothing—are priced based on their costs; parking is a glaring exception.

Public rights-of-way and curb space are valuable assets, and drivers receive more than their fair share of these assets compared to other road users, like bus riders, cyclists, and pedestrians.[2] Furthermore, cities often undervalue and therefore underprice public parking facilities. Current practices exacerbate this undervaluing of curb space, dedicating a majority of street space to private vehicle storage and much less space for more efficient, sustainable transport modes and other productive, healthy activities that occur in public rights-of-way.

1.1 REDEFINING THE PROBLEM

During the last half-century, most cities struggled to accommodate the growth in vehicle ownership they experienced, often dedicating more and more public space to vehicle throughput and storage. The primary goal of transport planners and engineers has been to facilitate fast, convenient automobile travel. In fact, parking has been referred to as "an under-researched area of transport."[3] Planners often assumed that "parking problems" stemmed from a shortage of parking spaces, which justified policies to increase supply. And cities did just that, dedicating curb space to (free or underpriced) on-street parking and requiring developers to provide abundant off-street parking at each destination. People—particularly drivers—have come to believe that free parking is the optimal scenario, when in fact it is only optimal for the first person who finds a free-of-charge space and it is dysfunctional for everyone else.

IN OTHER WORDS, PARKING MANAGEMENT HAS NOT ALWAYS BEEN VIEWED AS A TOOL TO HELP CITIES ACHIEVE A MORE SUSTAINABLE TRANSPORTATION SYSTEM. Rules related to parking can be buried in regulatory ordinances and overseen by different agencies. Further, a lack of communication between parking managers (who tend to focus on operational aspects) and transportation or urban planners (who focus more on strategic integration between different elements within the transport system) can cause tensions.[4] Together, these factors lead to a fractured approach to handling the transport, land use, and street-level-access aspects of parking. Without an overall goal for parking management, agency efforts may end

2   Gosling et al. 2015. Urban space distribution and sustainable transport.
3   Mingardo et al. 2015. Urban parking policy in Europe: A conceptualization of past and possible future trends.
4   Mingardo et al. 2015. Urban parking policy in Europe: A conceptualization of past and possible future trends.

up contradicting one another. A nuanced approach is required to manage parking well, but nuances are often lost when too many departments have a hand in setting policy objectives without proper coordination.

The long-standing trend of local governments and businesses supplying roads and ample parking has subsidized vehicle use and storage, encouraging residents who can afford it to own more vehicles and drive more often and for longer distances. This, of course, generates a host of related issues that impact everyone, not just drivers, including:

Traffic congestion

Drivers looking for bargain parking spaces create traffic and add unnecessary vehicle kilometers traveled (VKT) in neighborhoods. The act of cruising for parking can lead to more neighborhood congestion because the chance of finding a bargain space induces vehicle trips.[5]

Poor air quality

Exposure to harmful air pollution is exacerbated by city policies that subsidize parking (and, thus, encourage private vehicle use) instead of improving walking, cycling, and public transit integrated with mixed-use, dense development.[6] Responding to national air quality regulations set in the United States in the 1970s, cities like New York and Boston capped the amount of parking that could be built in central districts where air quality was so poor it was deemed detrimental to human health.[7]

Inequity

The availability of free or low-cost parking results in an implicit subsidy for trips made by car or motorbike. In other words, public space that should be usable by everyone is being allocated narrowly to those wealthy enough to own cars and those who currently use two- or three-wheelers and aspire to own a car. This subsidy also shifts priority away from bicycle use, walking, and transit, thus tilting the choice toward driving even for short trips.[8] Shifting demand away from these modes makes them more costly, arduous, and dangerous.

Unafford-ability

Where developers are required to provide a minimum number of off-street parking spaces, their costs drive up rents, making housing and businesses less affordable. These additional costs may be modest for higher-priced housing, but they represent a large portion of costs for lower-priced housing, especially in areas with higher land prices. After São Paulo removed parking minimums, developers reported being able to finance affordable housing projects closer to the city center because they did not have to factor in costs related to providing parking.[9]

5   TransitCenter & Frontier Group. 2014. Subsidizing congestion: The multibillion-dollar tax subsidy that's making your commute worse.
6   Goel, Anju. 2015. Characterisation of nanoparticle emissions and exposure at traffic intersections through fast-response mobile and sequential measurements.
7   Ross, Casey. 2013. *Boston Globe*. Boston limiting new parking as number of residences soars.
8   Knoflacher, Hermann. 2006. A new way to organize parking: The key to a successful sustainable transport system for the future.
9   Pojani et al. 2000. *Parking: An International Perspective*, p. 56.

Maintaining free-of-charge or underpriced parking encourages vehicle trips and congestion because drivers will cruise around the area in the hopes of finding a "bargain" space as opposed to parking in the first available space.
SOURCE: ITDP India

More recently, however, a fundamental change is occurring in the way parking problems are defined and potential solutions are evaluated. This new paradigm acknowledges a wider range of problems: too much space and too many resources devoted to parking, inefficient parking management, and underpriced parking facilities. A wider range of problems catalyzes a wider range of possible solutions, including transportation and parking management strategies that result in more efficient use of streets and public space. Notably, the new paradigm does not seek to eliminate parking supply; rather, it aims to ensure that every vehicle trip and parking space provides maximum value to drivers and nondrivers alike.

SOME CITIES HAVE BEGUN TO RECOGNIZE THE NEED TO BOTH PRICE AND USE THEIR PARKING SUPPLY MORE EFFICIENTLY (INSTEAD OF BUILDING MORE TO MEET DEMAND), AND EVEN POSITION PARKING POLICIES WITHIN THE GOALS OF TRANSPORTATION PLANNING.

Price of parking (y-axis)

Demand

Supply

At the equilibrium price, the parking supply is able to meet demand without increasing the supply

When the price increases, demand decreases, becoming closer to supply

Equilibrium price

Under-priced

$0

Quantity of parking spaces (x-axis)

When the price is $0, demand is much greater than supply, and there seems to be a shortage of parking spaces

As shown in the graph above, when parking is underpriced, demand greatly outweighs supply, and people who can afford to will choose to drive, even for short trips. But when the price of parking increases, some people will be prompted to make different choices, such as parking nearby or off-street, parking for a shorter period, or arriving by a different mode. Those who cannot or do not wish to shift away from driving will have a better chance of finding a parking space but will pay the full price for what that space represents.

In Tirana, Albania, a housing boom and rapidly expanding private vehicle ownership led to chaotic parking scenarios because there were so few designated on-street parking spaces. In cases like this, parking spaces may need to be added as part of the parking management strategy, however these spaces must be priced.
SOURCE: Dorina Pojani

While the preferred solution to address parking issues is improving management–implementing pricing mechanisms, time limits that encourage short stays, enforcement, etc.–in some cases, increasing parking supply is part of the initial management equation. Cities that have seen rapid growth in both housing density and private vehicle ownership may see significant illegal parking due to a complete lack of designated parking spaces. To ensure that drivers are parking in appropriate places and are not blocking building entrances, sidewalks, etc., parking spaces may need to be added. These should be priced, however, and the number of additional spaces should be informed by local **parking inventory and occupancy data**. This was the case in **Moscow**: When the city implemented its priced parking pilot in 2012, a shortage of spaces was identified. All parking spaces added to the supply as part of the pilot were priced.

Well-designed parking regulations save everyone time and money and make public space more livable. Similarly, when on-street and off-street parking are managed in tandem, there is greater potential to improve transport networks and optimize public street space.

This guide focuses narrowly on implementing a well-managed on-street parking program, but off-street parking policies are also critical to reducing demand for parking more broadly. Off-street parking reforms rely heavily on successful on-street parking management: Off-street lots or garages will be underutilized as long as on-street parking is free or priced very low. Recognizing this connection, some cities, like Pune, India, recommend that on- and off-street parking be managed together at the district level by a single private operator.

Cities that manage on-street parking successfully may not need to maintain their existing supply of off-street parking. In fact, some cities gain enough confidence in their parking management that they realize they can cap or even reduce total parking supply in congested areas. This can help to reduce traffic and increase the role of public transport and other space-efficient modes by repurposing space from parking to support those modes. However, this type of progression is unlikely without effective management of on-street parking.

1.2 WHO IS THIS GUIDE FOR?

WELL-MANAGED PRICED PARKING PROGRAMS ARE THE EXCEPTION, NOT THE RULE. Most cities have not conducted neighborhood-level parking supply evaluations (that is, the number and location of parking spaces of different types) or established a system for pricing on-street parking.

This implementation guide is intended for use by municipal planners, practitioners, and decision-makers tasked with implementing a priced on-street parking program. The guide aims to provide practical implementation steps and recommended actions, with a particular focus on implementing a well-managed parking program despite limited capacity (see **Section 2**).

In Pune, India, regulated on-street parking ensures that footpaths and public spaces are free of vehicles. **SOURCE:** ITDP India

The focus of this guide is on parking management and operations, including developing a management structure, contracting, planning for enforcement, and evaluating and adjusting system performance. This is indeed a narrow focus when considering the many interconnected elements of an urban parking system as shown on the next page.

THE URBAN PARKING ECOSYSTEM

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ON-STREET PARKING IMPLEMENTATION GUIDE

MANAGE	FINANCE
ENFORCE	EVALUATE

OFF-STREET PRIVATE

OFF-STREET SURFACE

ON-STREET PRICED

ON-STREET INFORMAL

ON-STREET PROHIBITED

OFF-STREET PUBLIC UNDERGROUND

OFF-STREET RESIDENTIAL / COMMERCIAL UNDERGROUND
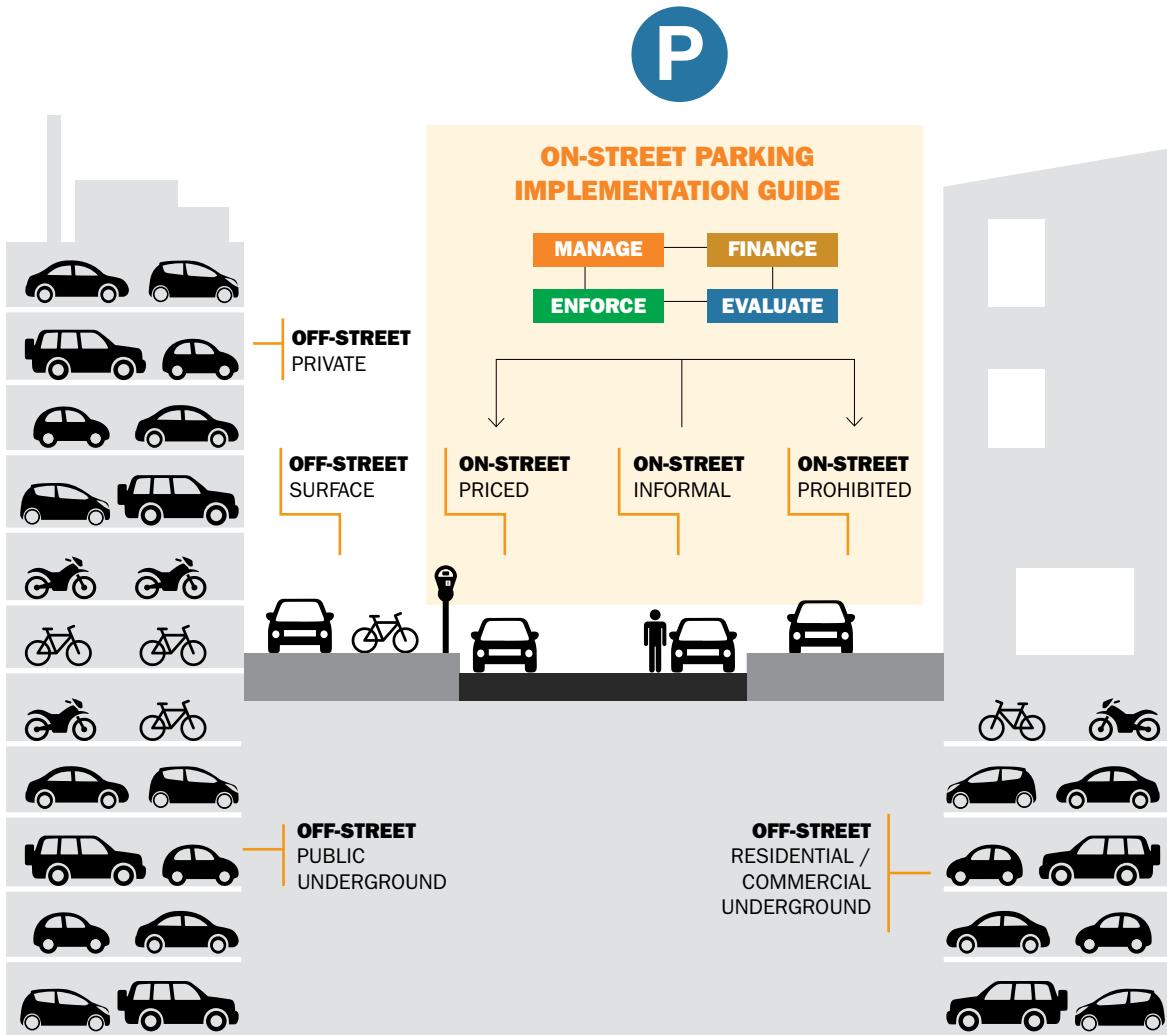
RELATED ELEMENTS TO CONSIDER

- Congestion pricing
- Public transport quality
- Trip avoidance
- Freight logistics

- Parking minimums/maximums
- Emmisions-based pricing (LEZ)
- Land use

This guide does not discuss the different policy and design approaches for establishing a priced parking system. A number of resources are available that provide helpful guidance on these concepts. These are noted throughout the guide, where appropriate, and also listed in the Appendix.

This guide assumes that users have already gone through the initial phases of setting up this system, including conducting a feasibility study and parking space audit, as well as deciding which parking locations or zones will be priced, the technology that will be used, and fee structures. Additionally, cities should have already considered:

How to approach motorcycle parking, especially if motorcycles make up a large share of trips. Motorcycles require much less parking space than cars, and thus on-street motorcycle parking should be priced at a lower rate. Motorcycles can also more easily fit into spaces not intended for parking (such as on sidewalks or in bicycle lanes) and may pose higher enforcement requirements, particularly in cities where they account for a large share of trips. Many of the approaches discussed in this guide can be applied to urban contexts where motorcycles are more widely used than cars, but it is important to acknowledge that certain strategies will not be universally applicable.

Cities with large shares of trips made by motorcycle must consider how motorcycle parking will be addressed since motos can more easily fit into spaces not intended for parking, and may pose higher enforcement requirements.
SOURCE: ITDP

How the transition from an informal parking system to a formal priced system will impact drivers as well as parking attendants. Cities should work with local communities to understand parking needs and opportunities to ease this transition. If illegal parking is rampant, more time and attention for public outreach and educational programs may be required (see **Section 3.4**).

In Mexico City, backlash from informal parking attendants threatened successful implementation of the priced on-street parking program, ecoParq.
SOURCE: ITDP

These insights will enable city planners or practitioners to better understand how the system should be operated, enforced, and evaluated.

1.3 HOW DID WE DEVELOP THIS GUIDE?

ITDP took a comprehensive approach to developing this guide. Interviews with external experts and parking managers were conducted in 2018, and they produced examples and data referenced throughout the guide. These interviews were supplemented by a review of on-street parking pricing literature, both academic and gray. The intention of this review was to understand what was covered well by the literature and also what knowledge and technical gaps exist. This mapping exercise, which can be found in **Appendix 6.1**, helped to narrow the scope of this guide on on-street parking contracting, operations, enforcement, and evaluation. Furthermore, detailed guidance on operational topics is *not* as easy to find as information on scoping and design, because parking managers can be hesitant to share this information publicly. We also discussed the structure and scope of the guide with ITDP staff based in Mexico, Brazil, Kenya, Indonesia, India, and China to understand and integrate needs expressed by city officials and other local partners. ITDP staff also contributed to the selection of case study cities for Section 5. All contributors to this guide are noted on the Acknowledgments page at the beginning of the guide.

Parking management frees up space for uses, like bikeshare stations, that benefit everyone.
SOURCE: ITDP

1.4 RECOMMENDATIONS

This guide aims to give cities the tools to manage parking more efficiently, with a focus on how to contract for and operate, enforce, and evaluate success of on-street parking. Under each of these categories, we offer actions and recommendations (summarized below) based on lessons learned from other cities, consultations with experts, and our own work helping cities to manage their parking. This guide also provides the foundation cities need to develop a parking program that operates in tandem with broader transportation demand management, public space, and livability goals.

SET GOALS

- Align on-street parking program implementation with city-wide goals.

- Communicate program-specific and citywide goals to parking operator(s) and require operators to share data that will help to track progress.

- Ensure the primary purpose for pricing on-street parking is to improve parking management, not to generate revenue.

MANAGE

- On-street parking management responsibilities should be centralized under one municipal entity to ensure a comprehensive vision and accountability, and to enable connections to other transport decision-making.

- The operating structure should reflect capacity, while allowing for growth and adaptation.

- Privatizing on-street parking is not a recommended contract approach because of the significant restrictions it places on cities to effectively manage their curbs and streets.

FINANCE

- Develop a financial model to estimate capital and operating costs as well as revenue streams, which can vary significantly depending on the size and sophistication of the parking program.

- Surplus revenue should be allocated to a fund used exclusively for sustainable transport and related public space improvement projects.

- Revenue sharing, particularly among parking districts, can help to encourage local support for priced parking because businesses and residents will benefit directly from the revenue generated in their district.

ENGAGE

- Develop an outreach plan to communicate both the vision of the parking program and the new parking rules to the public.

- Develop a communications strategy that includes branding the parking system in line with a broader vision and/or taking part in already established global or regional campaigns around parking.

- Consider assigning a staff member within the implementing agency to oversee public education and outreach. This person should liaise with local organizations and stakeholders to prepare them for the transition to a priced parking program and ensure implementation of the outreach plan.

ENFORCE

- Develop a parking enforcement plan that considers the role of informal parking attendants in the new parking system and includes: an appropriate number of enforcement agents, technological and/or physical support mechanisms, and penalties that encourage parking compliance.

- Parking enforcement should remain independent of police operations.

- Set parking fines high enough to be a deterrent but no higher, and offer payment plans or other mechanisms that relieve disproportionate economic burden on low-income drivers.

- Generate a vehicle registration database, if one does not exist, to enable more effective enforcement and payment of penalties.

- Consider adopting technological solutions that support enforcement, reduce corruption, and allow for easy and transparent data collection on parking infractions, payments, occupancy rates, and related behavior trends.

- Understand and anticipate challenges to enforcing parking with special statuses, such as government vehicle or disabled parking.

EVALUATE

- Define indicators that will be used to evaluate impacts of the parking program and related progress toward broader public goals.

- Establish a process to collect and analyze data on operator performance to compare against level of service standards.

- Publish operations and financial indicators, as well as public support, in an annual report.

2 MANAGING PRICED PARKING WITH LIMITED CAPACITY

Throughout this guide, we discuss options for cities interested in implementing a priced on-street parking program. Designing, operating, and enforcing such a program is a complex challenge, and it requires local governments to demonstrate effective management and problem-solving capabilities, including:

● Awareness and buy-in from decision-makers ("having a vision");

● Technical ability of city staff (or ability to hire qualified consultants) to facilitate policy design and implementation, write contracts, and conduct related program planning, design, and implementation tasks;

● Strong institutions and/or the ability to create structures, when appropriate, to coordinate and plan actions; and

● Funding for project implementation, operations, and maintenance.

This section reviews the political, technical, and funding requirements of pricing parking, and aims to help cities think through potential capacity constraints. Political complexity, upfront capital investment, technology needs, and data privacy concerns are a few key topics that need to be evaluated and addressed, particularly if institutional capacity is limited.

Before and after: In Chennai, ample space for on-street motorcycle parking ensures that motos do not park on the footpath, making the pedestrian space safer and more accessible for all. **SOURCE:** ITDP India

POLITICAL COMPLEXITY

Political will to formalize and manage on-street parking is critical. Political pressure can prevent implementation of a priced system, or, if a system is in place, political pressure can block parking prices from being raised (and thus effective management of parking demand) over time. In some cases, the design of the parking program and the entity responsible for implementation can separate decisions about pricing from shifting political views (see **Section 3.2**). Some public pushback against pricing parking has been documented where it is perceived that the city government is implementing such a program to boost municipal revenues (see sidebar on Revenue Generation in **Section 3.1**) or in places where corruption is high and parking revenues are perceived to "line pockets" rather than support public improvements. Backlash may also arise around the idea that drivers will be charged for something (parking) that they perceive to be "free" or priced very low. These critiques can be countered if governments are transparent about—and release public reports that detail—the share of revenues needed to operate the system and their commitment to dedicate surplus revenues to specific programs that benefit all residents, not just drivers. For example, Mexico City's ecoParq program allocated surplus revenue from parking fees to be used for sidewalk and other pedestrian infrastructure improvements in the neighborhoods where parking revenues were generated. This type of local reinvestment of revenues helped to build public acceptance and political will.

Another political complexity to consider is whether or not existing informal parking attendants will be integrated into the formal priced parking system and how this would impact their livelihood. Developing a clear **outreach plan** that includes consultation with informal parking attendants throughout the formalization process will help key groups understand the city's motivations for moving away from an informal parking system. While these initial conversations should be coordinated by the city, funding and coordination for continued outreach and public engagement can be conducted by the parking system operator(s), as written in the contract.

In Mexico City, surplus revenue from the ecoParq priced parking program has been invested hyper-locally to improve streetscapes and public spaces in the communities where revenues are generated. **SOURCE:** ITDP Mexico

CAPITAL INVESTMENT

Establishing a priced parking system requires some upfront capital investment by the city, namely for parking meters or pay stations and any installation costs. The city may also need to invest in streetscape changes, such as repaving, street markings and signage, and physical barriers needed to effectively communicate new parking areas and rules. Other capital costs, such as setting up and staffing a control center or equipment needed to support enforcement (vehicles, technology, labor costs), may be passed on to a contracted or concessioned operator. However, this may result in the city having less influence over the quality of these services. Alternatively, if funding for capital investments is very limited or if the city cannot assume the risk associated with establishing a parking system, a build-operate-transfer model may be considered (see sidebar in **Section 3.2**). This enables a concessioned operator to cover all capital and operating costs for a set time, after which assets and management of the system transfer to the city.

TECHNOLOGY NEEDS

A priced parking program may require upfront investment in technology to encourage payment (such as through a mobile application) and to support more effective enforcement (such as smart parking meters, sensors, or Automated License Plate Recognition [ALPR] cameras). These technologies vary in cost. It is important to consider how technologies with higher up-front costs can improve the efficiency of enforcement and payment compliance, which could reduce the number of parking control officers needed as well as associated labor costs. If the city cannot afford to purchase certain desired technologies outright, it should consider contracting with a **private operator** or **concessionaire** that can provide and operate them.

DATA PRIVACY

If one does not exist, governments should create and maintain an up-to-date **vehicle registration database** that parking operators can access (with proper safeguards) to follow up on unpaid parking fines. The existence of this type of database, however, has raised concerns around cities' ability to protect personal information (namely, the addresses of vehicle owners). If a city does not have the capacity to ensure protection of such data, it should consider partnering with a (public) third-party organization, such as a university or nongovernmental organization, that has experience managing large datasets that include personal data. In this case, vehicle registration data would be maintained by the third party and operators, enforcement agents, and the city could be given limited access, but the data would not be housed on city servers.

3 IMPLEMENTATION GUIDANCE

Implementation of a priced parking program depends on several elements that are not unique to parking and are common across large projects managed by a municipal agency and operated by that agency or a private operator. Different cities will require different system structures to meet their specific needs, and these should be informed by a feasibility analysis (see sections 1.2 and 1.3 for more).

In this section, we discuss six steps to implementing a priced on-street parking program:

| Set citywide goals | Generate financial model | Develop enforcement strategy |

Section 3.1 — Section 3.3 — Section 3.5

Section 3.2 — Section 3.4 — Section 3.6

| Choose management structure | Produce outreach plan | Prepare for system evaluation |
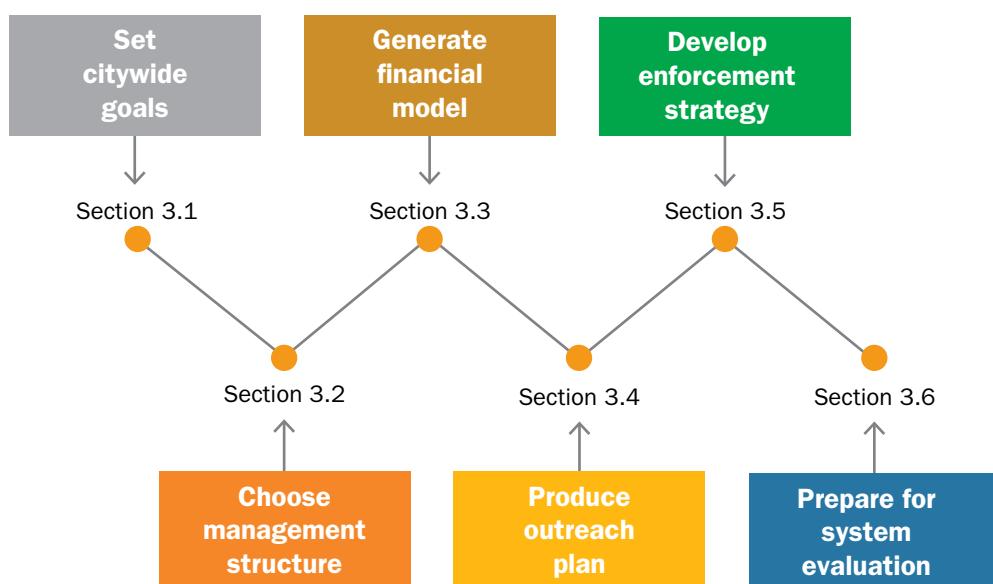
3.1 SET CITYWIDE GOALS FOR ON-STREET PARKING

Priced on-street parking is typically introduced to help control demand. To that end, a managed parking program should:

- Control on-street parking supply and price spaces to favor high-value uses, such as by pedestrians and buses, parking for people with disabilities, short-stay parking, and freight loading;

- Enable cities to better allocate and prioritize curb space;

- Ensure off-street parking supply is market-driven, publicly accessible, and limited; and

- Use parking revenue to improve sustainable transportation and related public projects that benefits drivers and nondrivers.

Cities should also be intentional and transparent about linking parking reform with citywide transport goals such as:

- **Improving access**, including by public transport, cycling, walking, and driving;

- **Improving equity** by reallocating space on public roads for uses that benefit more people, particularly those who have been historically marginalized by the transport system;

- **Improving health and the environment** by minimizing air and noise pollution;

- **Improving safety** by reducing injuries and deaths resulting from distracted driving while searching for parking and by providing ample space for clear sidewalks, crosswalks, and cycle lanes;[11] and

- **Establishing a reliable revenue stream** to finance sustainable transport improvements.

Cities should clearly communicate these system-level outcomes with parking operators and other stakeholders to ensure that all parties are working toward them. Additional resources related to setting goals for on-street parking are included in Appendix 5.1.

REVENUE GENERATION

Pricing on-street parking has been shown to generate significant revenue for cities (see **Revenue streams**), and this can support a number of services, from streetscape improvements, to public bikeshare operation, to major public transportation projects. For example, in Fortaleza, Brazil, 100% of surplus parking revenues support the city's bikeshare program and maintaining and expanding cycling infrastructure. Notably, pricing on-street parking is one of the few ways that local governments can collect revenue from nonresident drivers, which helps to offset the environmental and societal costs these visiting drivers impose.

It is important, however, for cities to be clear about the primary purpose of pricing parking: managing parking demand and related traffic challenges. In other words, decisions related to siting, installing, and otherwise managing parking meters (or other pricing devices) should not be made solely to generate revenue. In some cases, allocating parking revenues to non-transport-related programs can make it difficult to remove parking spaces in the future— which would decrease funds for those programs—unless the difference in revenue can be covered by slightly higher fees. Similarly, if revenues are allocated to a general operating fund, priced parking can be perceived as another tax as opposed to smart transportation management.

11   SFMTA. 2014. SFpark pilot project evaluation."

Indeed, cities that have managed to implement outcome-oriented parking systems have seen success both in terms of improved parking management and in progressing toward broader goals:

Reducing air pollution in Paris

Paris has an explicit goal of removing private cars from the city center to combat dangerous levels of air pollution. As a result, the city has been removing thousands of on-street car parking spaces and replacing them with public bikeshare stations; bicycle parking; motorbike parking; parking for carshare, electric, and hybrid vehicles; and sidewalk extensions.[12] Building off the 2015–2020 *Plan Velo*, Paris plans to remove at least 60,000 of its 83,500 on-street spaces downtown and reallocate that space for public uses.[13]

Paris has replaced thousands of on-street vehicle parking spaces in an effort to improve air quality, like on this street where a public bikeshare station has been installed in what was previously a parking lane.
SOURCE: Didio, Flickr

Reallocating public space in San Francisco

Anticipating improved parking efficiency from SFpark, which uses sensors built into the street to facilitate performance pricing based on occupancy targets, one of the City of San Francisco's goals was to repurpose "extra" parking spaces as parklets.

San Francisco envisioned repurposing on-street parking spaces for parklets and other public spaces, like this outdoor dining area.
SOURCE: Paul Krueger, Flickr

12   Henley, J. 2015. *Guardian*. Electric 'Boris Cars' are coming to London—how do they work in Paris?
13   Reid, C. 2020. Forbes. Anne Hidalgo reelected as mayor of Paris vowing to remove cars and boost bicycling and walking.

Reducing local traffic congestion in Mexico City

Mexico City saw parking reform as a traffic reduction strategy and installed priced parking meters to improve traffic flows. After parking meters were installed in Mexico City's Polanco neighborhood, cruising time fell significantly—from 13 minutes to four—and turnover increased from 3.5 to 4.5 cars per day.[14] Occupancy rates during peak hours fell from 98% to 80% after the program's first year in operation, which helped to reduce instances of double-parking and other parking violations that contribute to traffic congestion.[15]

In Mexico City, on-street parking pricing was initially implemented as a strategy to reduce traffic congestion.
SOURCE: ITDP Mexico

Even in cities where there is not yet enough support for visionary transport transformations, the goals of order and safety in the streets and of improved street conditions for everyone (drivers, bus riders, pedestrians, and cyclists) are a realistic starting point.

SET GOALS

ACTIONS & RECOMMENDATIONS

Align on-street parking program implementation with citywide goals.

Communicate program-specific and citywide goals to parking operator(s) and require operators to share data that will help to track progress.

Ensure the primary purpose for pricing on-street parking is to improve parking management, not to generate revenue.

14   Perez, I. 2013. Mexico City makes dramatic recovery from gridlock.
15   Sañudo et al. 2013. Impacts of the ecoParq program on Polanco.

3.2 CHOOSE A PARKING MANAGEMENT STRUCTURE

A fully functioning parking management program requires coordination between spatial planners, transport modelers, financial divisions, traffic police, and other related government bureaus. Parking management may be especially challenging for cities to prioritize if it requires internal government restructuring. It also poses political risks by angering drivers, who will likely pay more under a managed parking system and who are often elites with ties to (or are themselves) key decision-makers. It is usually impossible to undertake an on-street parking reform campaign without full support from the highest elected official, such as the mayor or city manager.

Different operational elements of on-street parking might be distributed among many government agencies and divisions, often without an intergovernmental coordinating mechanism. For example, in Ahmedabad, India, several city departments have jurisdiction over aspects of parking (see organizational chart). Vehicle registration is done by the state-level Regional Transport Office (part of the Ports and Transport Department), while parking enforcement is overseen by the Traffic Police (part of the state-level Home Department). Thus, for traffic police to accurately identify a violating vehicle's owner and issue the penalty to that individual rather than the current driver, there needs to be coordination between the Home Department and the Ports and Transport Department.

When many departments are managing different aspects of the parking system, the bigger-picture perspective and comprehensive understanding of how the system should work can be lost. This can lead to a lack of accountability for the system as a whole. **TO COMBAT THIS PROBLEM, PARKING FUNCTIONS SHOULD BE INTEGRATED AND MANAGED BY ONE IMPLEMENTING AGENCY.** In this section, we explore different options for implementing and operating a parking management program.

AGENCIES IN AHMEDABAD, INDIA THAT OVERSEE PARKING ELEMENTS

Chief Minister, Gujarat

Ports and Transport

- **Regional Transport Office, Ahmedabad**
  Issues driving licenses, vehicle registrations

Urban Development and Housing

- **Urban Development Authority, Ahmedabad**
  Constructs, maintains streets
  Designates land for off-street parking in new town planning

- **Ahmedabad Municipal Corporation**
  Constructs, maintains streets
  Contracts for parking fee collection on CG Road, walled city

  - **Ahmedabad Janmarg Ltd (SPV)**
    Contracts for on-street parking fee
    collection along BRT corridor

Home Department

- **Ahmedabad Police**

  - **Ahmedabad Traffic Police**
    Enforces on-street parking

IMPLEMENTING AGENCY
The implementing agency is responsible for the design and implementation of the priced parking program, which may include tasks such as generating a feasibility study and/or neighborhood parking space audit, developing a comprehensive parking plan, preparing requests for proposals (RFPs) and contract(s), and setting program goals and evaluation metrics. The implementing agency is typically a department or agency within the municipal government or an entity created by the government. The implementing agency can manage and operate the parking system directly, or it can create a process wherein one or more private operators will be responsible for day-to-day operations (management contract or concession agreement).

MUNICIPAL DEPARTMENT

PARKING AUTHORITY

Benefits

Allows for integration between parking and other transportation plans and programs

Budget integration between parking and other transport programs can yield financial predictability

Allows for political independence from municipal government

City elected officials shielded from unpopular decisions (e.g., increasing parking rates)

Challenges

May be difficult to establish if parking responsibilities are currently housed under various different agencies

May require legislative changes at higher levels of government to legally create a parking authority

Can be isolated from municipal agencies responsible for transportation programs or decisions

May not have the authority to carry out certain parking tasks, like enforcement

Municipal department

Under a municipal department structure, a department head and support staff are responsible for managing the parking program. This is the most integrated approach to not only on-street parking management but also to related areas overseen by the municipal government, such as transportation demand management, curb management, community and economic development, etc. Sometimes this department is housed within a larger municipal transportation, consumer affairs, or public works department that oversees more than just parking.

BUDAPEST
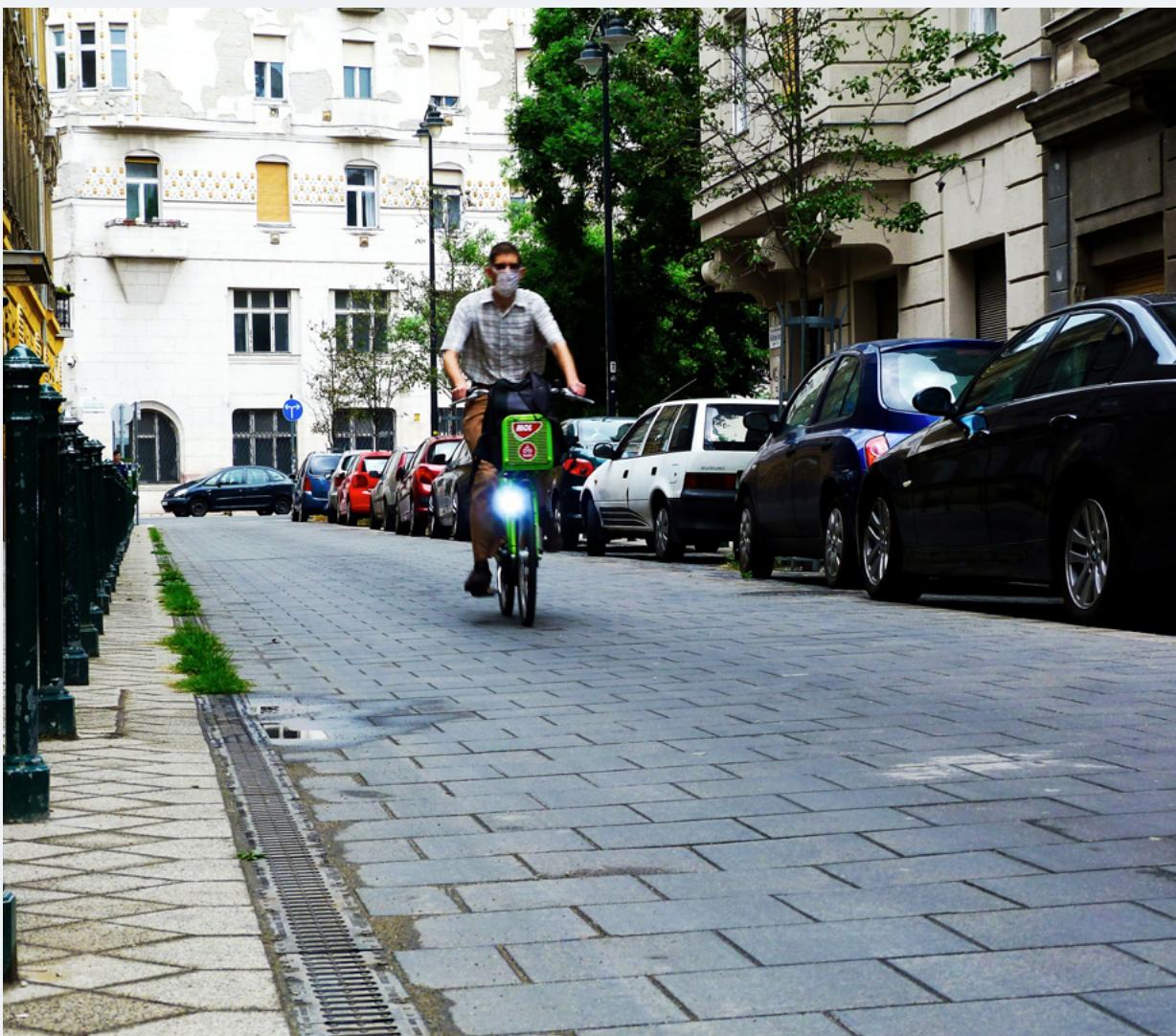
In Budapest, the Centre for Budapest Transport (BKK) oversees parking management in addition to other aspects of urban transport, allowing for coordination across efforts to reduce private vehicle use and fund and improve cycling, walking, and public transport.
SOURCE: Blue Corner Studio/shutterstock

In 2010, the city of Budapest established the BKK Centre for Budapest Transport, a municipal entity that oversees all aspects of urban transport, including public transportation, road management, bicycle and pedestrian infrastructure, taxis, and parking. BKK is also responsible for comprehensive transport planning, integrating equity and sustainability across these program areas.[16] In regards to parking, BKK took over responsibilities for parking organization, strategic planning, development, fee collection, and parking management from Parking Kft., which had previously been operating the system in a parking authority–style arrangement, isolated from other urban transport departments.[17] BKK enabled Budapest to develop an integrated transport budget, which helped to make funding for transport operations more predictable. As such, parking revenues, as well as other revenues, are directed to BKK and distributed across the entity's areas of responsibility.[18] Over the past decade, BKK has worked to implement elements of the city's Balázs Mór Plan (2014–2030) to reduce private vehicle use and improve public transport. BKK is now working closely with the municipal government on the Cities-4-People project, which aims to use participatory planning to improve active and public transportation options citywide.[19]

16   Budapesti Közlekedési Központ. Who we are.
17   MTI. 2011. Fővárosi Közgyűlés - Beolvad a BKK-ba a Parking Kft. - Budapesti Közlekedési Központ.
18   Budapesti Közlekedési Központ. 2020. Budapest Mobility Plan 2030.
19   Cities4People. Budapest, Hungary.

Parking Authority

A parking authority is a corporatized entity fully owned by a municipal (or county/district) government. Typically, the government creates (through a resolution or legally binding ordinance) a parking authority to oversee the management of a parking system, including on-street parking, enforcement, and rate setting, on behalf of the municipality. This may require legislation to be passed at a higher level of government, such as a county or state/province.[20] Parking authorities can also oversee off-street parking facility ownership, planning, and maintenance. Sometimes, particularly if staff capacity is limited, parking authority staff will work with an external parking management firm to carry out daily operations.

Parking authorities are typically overseen by a board or commission and not the local municipal government. This can be preferable to municipal management because it allows the parking authority to be politically independent—to establish a clear mission that is shielded from political interference or may not be supported by the majority in government. This can enable consistent market rate prices in spite of any short-term political opposition. However, parking authorities that are shielded from political influence can run the risk of operating rigidly, without much reason to adjust or evolve.

Parking authorities can also bring in other groups aside from city staff, such as private developers and the business community, to make decisions regarding system operation. Parking authorities are often led by a president or executive director who can bring extensive experience in parking management to the organization. This person reports directly to the parking authority board. Cities with the legal framework of a parking authority include Antwerp, Amsterdam, Barcelona, and the district of Ixelles in Brussels.[21]

OPERATING STRUCTURES

Once the implementing agency is decided, the next step is to determine whether that agency will be responsible for direct operation of the parking program or if operations will be contracted out to a private firm.

The city must decide which type of operating structure is most relevant depending on local conditions. For example, a small city with limited resources may not have the staff time or technical knowledge to run the day-to-day operations of a parking program and could benefit from contracting that responsibility to an experienced private firm. The operating structure should enable efficient operations and enforcement and, as a result, greater user compliance with parking regulations. Benefits and challenges of common operating structures are included in the table on page 28 and discussed in detail in this section.

20   New Jersey Government Parking Authorities. New Jersey Act on Parking Authorities.
21   Kodransky & Hermann. 2011. Europe's parking U-turn: From accommodation to regulation.

BARCELONA

In Barcelona, a public limited company manages on-street parking and the city's bikeshare system. Many bikeshare stations are located in what was once on-street parking space.
SOURCE: travellifestyle/ shutterstock

Citing worsening traffic congestion, Barcelona implemented pricing and limited the duration of on-street parking stays to improve the efficiency of existing parking spaces. The city council mandated that Barcelona de Serveis Municipals (BSM), a municipal public limited company (PLC), oversee on-street parking, off-street car parks, and parking enforcement and towing in Barcelona. BSM also manages Barcelona's public bikeshare system, Bicing, as well as several cultural spaces in the city, including the historic Park Güell, the Olympic Stadium, and Barcelona Zoo. Thus, BSM provides these services as an entity of the government of Barcelona, but it also holds municipal shares in other companies.

In 1984, the BSM-operated regulated parking area included 648 nonresident spaces and 34 parking meters, growing to 7,000 priced spaces by 2005 and over 10,000 by 2013.[22] Nearly 400 BSM agents perform parking enforcement duties under the management of the city police.[23]

Starting in 2005, revenue from parking fees was directed to a fund to support mobility projects. Initially this fund was used to implement street calming, then it financed the launch of Bicing in 2006. BSM reported on-street parking revenues of nearly €35.6 million in 2018.[24] As of 2020, the Barcelona city government is working to further reduce the number of free on-street parking spaces that remain in the city center and implemented an emissions-based pricing structure for parking that discounts (or eliminates, depending on the zone) fees for zero-emission and eco vehicles.[25]

22   Barcelona City Council. The Barcelona area: Background.
23   Barcelona City Council. The Barcelona area: Management.
24   Esteve, A. 2019. Caen los ingresos de la zona azul y verde de Barcelona.
25   Subirana, J. 2020. Las caras tarifas del área azul y verde, el 11 de mayo.

OPERATING STRUCTURE	BENEFITS (for city)	DOWNSIDES (for city)
↓	↓	↓
DIRECT OPERATION Parking system operated directly by city department, parking authority, or similar entity	• City/authority has complete control over parking management, staffing, training, and quality of service • Can align parking program branding with other city services • City receives and maintains all system revenues	• Can be subject to political interference • Requires highest administrative and managerial capacity among city staff • Strict rules for government hiring can lead to high staff costs • City assumes maximum financial risk (capital and operating costs) • City responsible for customer service
PRIVATE OPERATION **Management contract** Parking system operated by a contracted management firm; city/parking authority reimburses operations expenses	• Maintain some control of day-to-day system operations • Leverage experience of parking service provider • May be cost-efficient compared to direct management because operator has lower staffing, administrative, and insurance costs	• May require high upfront administrative capacity (CSOs or similar may provide support as partners) to develop a contract and facilitate an RFP process that attracts high-quality service providers • Strong public backlash may emerge if inexperienced and/or nonlocal operators are awarded contracts • Poorly written contract can lead to disproportionate risk for the city • Less oversight over labor protections • Can be difficult to coordinate parking with other city-managed programs (e.g., transit, bikeshare)
Concession agreement Parking system operated by a contracted management firm that is responsible for all expenses and pays a set fee to the government	• Requires minimal ongoing administrative capacity on the city's part • Requires little internal technical knowledge about parking operations • Lowest financial risk to city	• "Hands-off" approach could lead to low quality of service • Limited ability for government to respond to resident feedback on parking program, which could degrade trust in government • City misses out on potentially large revenue stream • Limited understanding by city about parking system expenses • No oversight over labor protections

Direct Operation

A direct operating structure means the system is fully owned and operated by a municipal department or other designated government entity, such as a parking authority. The administrative body has complete control over daily operations, staffing, training, and customer service, as well as responsibility for the costs associated with these, which are typically covered by parking revenues. For this structure to be successful, the city must have significant administrative and managerial capacity, including well-trained, experienced staff. If the program is under the complete control of the city, it can be easily integrated—in terms of branding and capabilities—with other city services. Such integration can benefit users by creating a more seamless experience.

If the system is run by a municipal department, there is usually no need for contracting because all operations activities are undertaken by city staff. Parking systems run by a parking authority or business district, which tend to have smaller staffs than a city department, may contract out certain activities or services beyond what the staff can manage directly.

FEE COLLECTION

Whether the parking program is operated directly by the municipality or a parking authority or if one of those entities enters into a management contract for operations, it is important to consider who actually collects the money generated by parking fees and fines. If the operator both collects the money and operates the system, they hold an enormous amount of unchecked power and it becomes very difficult to ensure effective oversight. Similar to how public transit contracts are sometimes structured[26], parking operations could include bringing on a separate vendor responsible for fee collection. This way the fee collector and operator serve as a check on each other, which limits the possibility of corrupt behavior.

Private Operation: Management Contract
In this model, a private operator is contracted to finance all upfront costs for setting up the parking management regimen or to operate the system. However, if parking meters or kiosks are being used, these are typically financed and owned by the government. The municipal government takes in the revenue from the parking system (user fees) and uses a portion of it to pay the operator to manage the system, including maintaining assets, collecting data, conducting baseline studies, and other tasks. The operator may, in some cases, subcontract some of these responsibilities to other private companies.
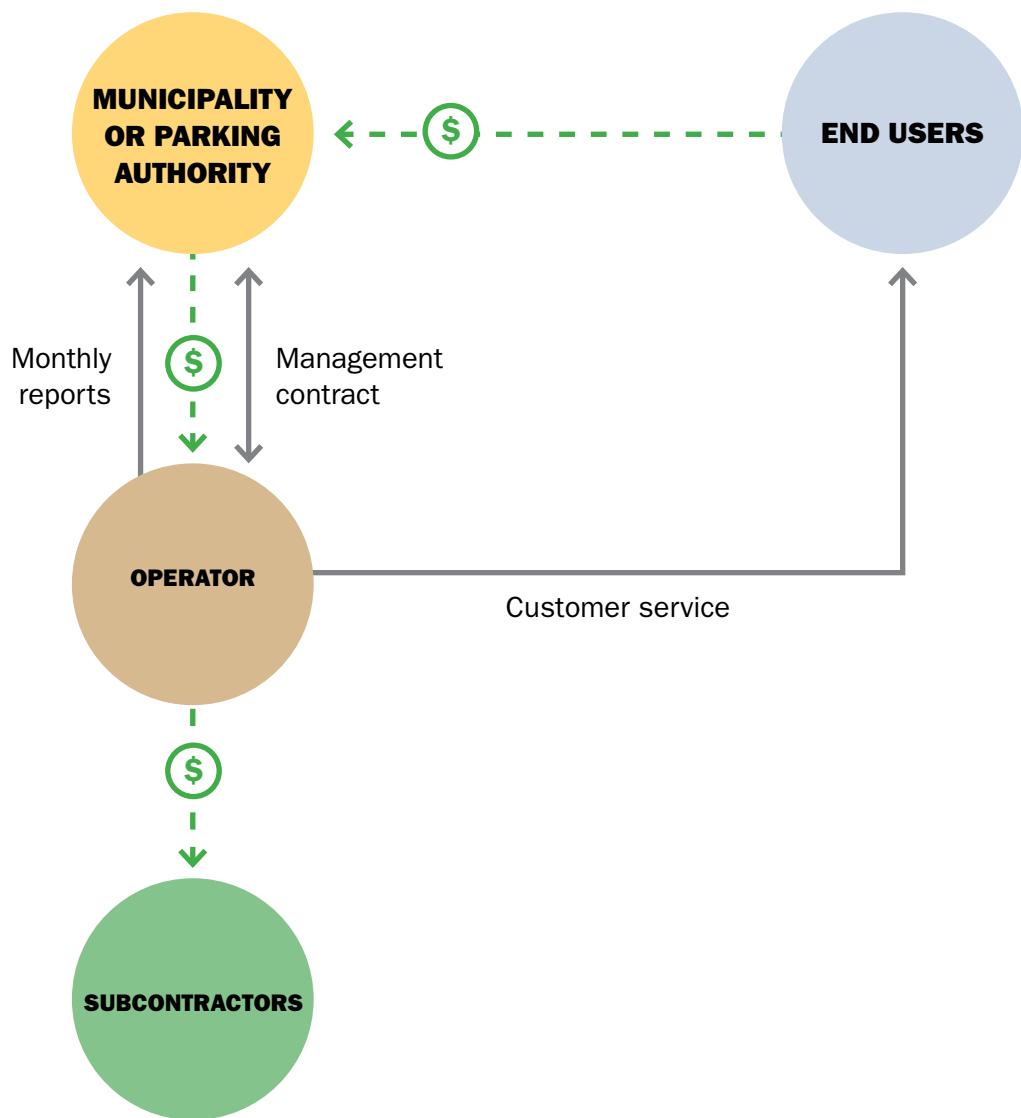
The implementing agency should follow the existing municipal procurement process for selecting a private operator. This may include developing and releasing a request for proposals (RFP) that lays out minimum requirements that bidding operators must meet and evaluation criteria the city will use to select the winning bid. Preference may be given to operators able to demonstrate having a minimum number of years of experience with the duties prescribed in the RFP—namely, implementing and/or running a priced on-street parking program. The city may also want to stipulate that operators have ongoing parking contracts with other entities in the region or country, or that they are already operating locally.[27] Strong public backlash has been observed in cities where inexperienced operators were awarded contracts, as was the case in Mexico City. In Ranchi, India, contracting with nonlocal "expert" operators irritated not only local operators but local politicians, which generated backlash. If local informal operators are already in place, the city should consider opportunities to bring them into the new parking system, perhaps boosting their capacity as part of the contract.

Additional qualifications necessary for operators to be considered could include the ability to:

- **Set up a control center** to monitor the parking system, especially the cash flow data from fee collection mechanisms; develop and dispatch any real-time interventions into daily operations; and analyze operational data and share it with the city;

- **Monitor daily parking activity** using vehicles and a dispatcher service, and monitor parking enforcement (fining, wheel-clamping, and/or vehicle removal) using adequate information technology;

- **Collect and process payments in a timely and accurate manner** (especially if a cash payment option exists), replace tickets, issue receipts, and clean the parking machines;

- **Properly collect, store, and handle data** from parking monitoring and enforcement;

- **Monitor and record customer issues** for review; data regarding customer issues is easily searchable, filterable, and backed up to prevent loss;

- **Choose software that provides customers with reliable information** and allows the parking system to respond quickly to customer issues;

- **Ensure mutual compatibility** between all the machinery (tools, devices, equipment) and information technology;

- **Troubleshoot or replace malfunctioning hardware** (especially for parking machines) within a target time period;

- **Provide a hardware damage protocol.**

27   SFMTA. 2020. Request for proposals for single- and multi-space parking meter hardware and associated meter management systems.

Once proposals are submitted, city staff should review them based on criteria included in the RFP instructions. If capacity allows, city staff should consider conducting in-person interviews to supplement the written proposals of short-listed candidates—this can help to clarify operators' responses before a final selection is made.

Cities that pursue the management contract approach must also consider whether to contract for all services using a single provider or to create separate RFPs and contracts for different services. Multiple providers could also be contracted to operate parking in different areas or districts, as is done in Mexico City.

Single service provider

A single service provider brings together operations, enforcement, and monitoring, which can increase efficiency and lower costs. For example, a government can negotiate to purchase parking meters with other hardware (such as handheld devices for enforcement personnel), software, or service provisions under one umbrella contract to get better prices or interest rates. Contracting a single provider to operate all parking services across the city could establish consistency from the perspective of users and may attract operators interested in having an exclusive contract.
In addition to parking activities and services, a single service provider can provide consistency and compatibility when it comes to technology—both hardware and software. Since operations are often dependent on technology, the government can set technology specifications that the service provider must meet.

Using a single provider for operations, enforcement, and technology can pose a risk to the city if that operator is not able to provide high-quality service, engages in corrupt behavior, or otherwise ceases operating.

Multiple service providers

Contracting with multiple service providers enables the city to procure the most experienced providers for individual system elements, such as managing operations, hardware and software provision, enforcement, and prepayment or pay-by-phone transactions if those options are included (see sidebar). In several European cities including Paris, Amsterdam, and Barcelona, one operator holds the contract for on-street parking equipment and operations, but there are multiple mobile payment operators. Multiple providers may also be contracted to operate parking by district or other service area instead of one operator being responsible for the entire program citywide.

Separating service provider and equipment contracts can reduce overall risks and the likelihood of corruption, increasing

public benefits. For example, if multiple service providers are contracted and one provider is unable to provide service, the program may still be able to operate in the interim; however, if one provider is supplying all aspects of the program, the entire program's ability to operate rests on that single provider. Entering into multiple contracts can also enable the city to partner with the most cost-effective or qualified provider for each operational aspect to achieve a higher-quality system overall. However, in that case the city may miss out on economies-of-scale advantages for equipment.

Separating the operations and technology providers can also create a problem of accountability—when there are problems with the system, the providers could blame one another and not assume responsibility. This could increase risk for the city. Furthermore, managing multiple contracts—whether for different services or different districts/service areas—adds an administrative burden for city staff and will likely require additional time and capacity to oversee.

PREPAYMENT & PAY-BY-APP

Municipalities may want to offer prepayment or pay-by-phone options for on-street parking. If the system operator cannot provide these services, the implementing agency may need to develop agreements with specific pay-by-app providers. Often the city will pay a mobile application provider a fee for each transaction made on their platform. It is important, however, to ensure that revenues generated through pre-payment or pay-by-phone/mobile application are managed by the municipality.

PREPAYMENT
Prepayment typically enables parking users to add money to a digital wallet that is connected to an RFID card that the user inserts into a parking meter to deduct the appropriate fee at the start of their parking stay. This can be useful for frequent parking users, and it eliminates the need to have exact change or a credit card to pay for parking. In some cases, like Rosario, Argentina, the same card can be used to access a city's public transport and to pay for parking. Prepayment can also be offered in the form of tear-and-display coupons, which are purchased from local retailers and torn or pierced to designate the parking start time. These are used in Singapore and some cities in Brazil, but although operational costs are low, there is high potential for counterfeiting and driver error in display. Given technological innovations in recent years, prepayment is being replaced by pay-by-app systems in many cities. New York City, which previously offered prepayment for parking using an RFID card, is shifting to pay-by-phone/mobile app. Similarly, Singapore, which had solely used tear-and-display coupons, is offering a mobile-app payment option for all existing priced parking.

PAY-BY-PHONE/MOBILE APPLICATION
A pay-by-phone system lets users pay for parking by calling or sending an SMS message to a designated number or by using a mobile application instead of paying with a credit card or cash at a physical meter or kiosk. Pay-by-phone and SMS payments can be a useful alternative for drivers who do not have a

credit card. Typically, users are charged by the pay-by-phone provider, including a small transaction fee, and the provider reimburses the parking fee to the city or system operator.

Pay-by-app systems enable users to more easily and accurately pay for parking and, if needed, extend parking time without having to return to a meter or kiosk. The easier it is for users to pay, the more willing they will probably be to comply, resulting in higher revenues and more effectively managed space. Pay-by-phone/mobile app capability has, in some cases, eliminated the need for parking meters: Singapore has never had parking meters, and Tel Aviv and Shenzhen have fully mobile-app-based payment systems. In cities that have never had parking meters, the best option might be to avoid installing them at all. Before deciding to forego parking meters, cities should consider the percentage of the population without access to compatible mobile phones and other groups who may not be able to pay for parking if physical meters are not available.

App-based payment has also enabled cities to cheaply expand paid parking zones beyond initial areas with meters. For example, app-based payment can add a paid option for visitors to park in low-demand on-street spaces that are otherwise not priced, such as residential spaces, and where it would not be cost-effective to install parking meters. Mobile-app-based payment systems also present an opportunity for payment integration with other city services, such as public transport or bikeshare. For example, parking meters in Rosario, Argentina, are linked to the city's MOVI app, where users can plan trips and pay for public transport, bikeshare, and taxis.

Private Operation: Concession Agreement

In a concession agreement, the government transfers the management of a public good—in this case, on-street parking—to a private operator for a determined period of time. The operator is responsible for all aspects of the parking program: capital costs, daily operations, staffing, training, and customer service. With this structure, the municipality has the least involvement in parking management.

This may be the only option for cities with a lack of technical or institutional capacity to manage a priced parking system to offer one. In some cases, outsourcing parking operations to a private operator can provide a level of service efficiency and quality that would not be possible if the government were responsible for operating the system. However, in a concession agreement, the city has no involvement in how the operator runs or staffs the program because all expenses are covered—and all financial risk is assumed—by the operator. Therefore, the operator, not the city, is responsible for maintaining a certain level of service.

While this type of arrangement may be attractive to municipalities that have budget constraints, it is not always an optimal arrangement from an urban planning and traffic management perspective for two reasons: the lack of accountability on behalf of the city and the city's inability to benefit from any growth in revenue generated by the parking program. Even though
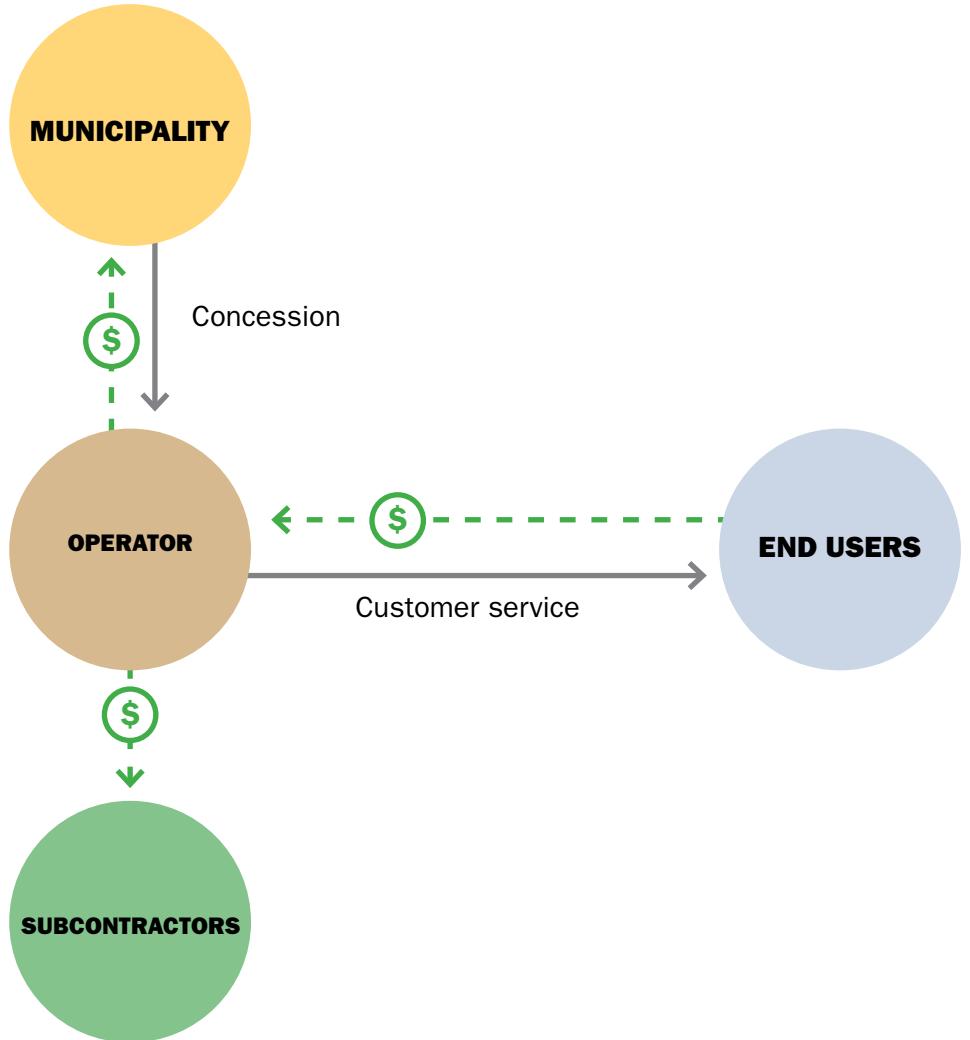
the city is not responsible for program operations, staff may still need to maintain close regulatory oversight to ensure the operator is meeting its contractual obligations. Furthermore, if contractual obligations are not being met, the city's only recourse is to terminate the concession. This is extremely disruptive to service provision.

Most often, the private operator will collect the parking fees from users and retain a percentage of the revenue. The remainder of the revenues are paid to the municipality. In this case, the percentage retained by the operator acts as a performance incentive, and can help to maintain a minimum level of service. Because it can be difficult for the city to track expenditures related to the parking system (since these expenditures are internal to the operator), cities should require consistent reporting from the concessioned operator to increase transparency. This, however, requires capacity and coordination on the part of city staff.

Mexico City used a type of concession agreement known as Temporary Revocable Administrative Permits (PATRs) to establish its parking program. Under a PATR, the operator owned the parking assets for an initial 10-year period. After the first 10 years, ownership of the assets transferred

to the public sector, at which point PATRs were transitioned to concession agreements. This model is referred to as "build-operate-transfer" (**see sidebar on the next page**).

The city of Rosario, Argentina, uses a concession for on-street parking operation and enforcement. The concessionaire, Tránsito Rosario, was awarded the contract in 2009 and will operate the system until 2026. Tránsito Rosario owns the parking meters and committed Mex. $45 million to update the meters as part of its 2018 re-tendering.[28] The new meters are now compatible with the city's MOVI card, which is used to access public transport, bikeshare, taxis, and other transport services.

PARKING PRIVATIZATION

An extreme case of the concession model is known as "parking privatization" or "parking monetization." In this model, a private company and not the government owns the parking meters or other assets for a longer time period—typically more than 35 years—before ownership is transferred back to the public sector. Therefore, in later years the government absorbs the depreciation costs. This can be an attractive option for cities with budget deficits; however, some cities will not have the legal authority to engage in parking monetization. Furthermore, privatization inverts the curbside parking paradigm wherein parking is underpriced, which leads to shortages. Privatization aims to maximize revenue, driving up parking rates and, likely, resulting in a surplus of parking spaces. At the same time, there is a strong disincentive to remove or repurpose surplus spaces.

One of the most notable examples of parking privatization occurred in Chicago in 2009, when the city leased to investment bank Morgan Stanley its 34,500 on-street parking meters for 75 years in exchange for a one-time payment of US$1.2 billion to fill a budget gap.[29] Parking rates increased year-over-year until they were the highest in the US in 2013. Another key element of the deal severely restricts the city's ability to manage its streets: The city must pay a penalty to Morgan Stanley anytime on-street parking spaces are removed permanently or blocked temporarily, such as during public parades. This makes it extremely difficult for the city to replace on-street parking with bus-only lanes, cycle lanes, parklets, or other uses. Recent estimates show that in 2021, 13 years into the 75-year agreement, Morgan Stanley will break even on its initial investment, accruing profits for the final 62 years. Meanwhile, the City of Chicago is not receiving that revenue and cannot effectively manage its curb space.

28 Rivera Basulto, D. 2019. Metropolis in motion.
29 Weinberger et al. 2010. U.S. parking policies: An overview of management strategies.

BUILD-OPERATE-TRANSFER

The build-operate-transfer (BOT) model is common across large infrastructure projects and, in the context of parking, can be used to establish a new on-street pricing system in a neighborhood or citywide. In this model, the government issues a concession to a private operator where, in exchange for program revenues, the operator covers all capital financing (including parking meters or pay stations) and operational costs for a set period of time. The time period must be long enough for the operator to collect enough in revenue to recover its investment—typically at least 15 years; however, if the contract period is very long, the city could be limited by what the operator is able to offer during that time. After the contract period expires, ownership of the parking system assets is transferred to the city, which will then need to decide to continue with another concession agreement or move to a more hands-on structure, such as a management contract with a private operator or direct management.

The BOT model enables governments to provide an efficient, quality parking system that they may not have been able to provide using public funds. And the operator, not the city, assumes a significant amount of risk during the initial years of the project. However, this model can be problematic, resulting in low-quality construction, duplicated functions, and unclear distribution of responsibilities between the operator and subcontractors.[30]

Alternatively, in cities where parking meters or pay stations do not exist and public funds to establish a parking program are limited, a fully app-based fee collection system could eliminate the need to enter into a BOT contract. While this payment approach presents limitations, such as for those who do not have access to mobile data or smartphones (see Pay-by-Phone sidebar, above), it is less capital intensive than installing new parking meters.

MANAGE

ACTIONS & RECOMMENDATIONS

On-street parking management responsibilities should be centralized under one municipal entity to ensure a comprehensive vision and accountability and to enable connections to other transport decision-making.

The operating structure should reflect capacity, while allowing for growth and adaptation.

- Cities with limited capacity should minimize the number of contracts by using a single private operator or build-operate-transfer model, reducing administrative overhead and financial risk.

- As capacity grows, cities should reevaluate the operating structure and their ability to take on more financial risk or direct operations, if necessary, to ensure the system progresses toward established goals.

Privatizing on-street parking is not a recommended contract approach because of the significant restrictions it places on cities to effectively manage their curbs and streets.

30   Pastor, A. G. 2006. Tramways of Barcelona: Advantages and disadvantages of BOT and its influence in concession contracts in Spain.

3.3 GENERATE A FINANCIAL MODEL

The financial model for an on-street parking program includes two types of costs—capital (fixed, one-time costs) and operating (variable costs incurred during program operation)—as well as revenue streams. Capital and operating costs for operating a parking program are included below. The financial model is important for predicting and maximizing the long-term financial sustainability of the system: For example, capital costs to establish a priced parking system can range from USD $8 million to USD $12 million or more. However, these costs do not necessarily need to be paid upfront if the city is using a concessionaire or debt financing.

CAPITAL COSTS	OPERATING COSTS
Parking meters or pay stations	Meter maintenance/repair
Meter/pay station installation	Enforcement staff
Streetscape changes (paving, marking/signage, physical barriers, etc.)	Control center/customer service staff
Control center setup	Enforcement vehicle fuel/maintenance
Enforcement equipment (vehicles, technology, etc.)	Administrative costs
	Marketing, education, community engagement

In most cases, the public sector owns the parking meters or spaces. One way to minimize capital costs is to forgo meters and instead use a tear-and-display or pay-by-mobile-app system, though these have downsides (see **sidebar** on page 40). The government must decide how to finance additional capital costs and pay for any ongoing operational expenditures not covered by the operator(s). Operational costs of the program can be paid by a specific agency budget, the city general fund, parking program revenues, or a combination of these. If the government is contracting out certain services, the expectations detailed in the financial model must be written into the contract.

CAPITAL COSTS

Capital costs are important to calculate because some or all of these costs will fall to the city, because of the operating structure and contract terms. Capital costs will vary significantly depending on the meters or pay stations used (if at all), amount of streetscape adjustments needed to facilitate on-street parking, and whether and which technology will be used for enforcement.

Capital costs to establish a priced on-street parking program may be financed through one or a combination of the following avenues:

- **Local funding:**
Cities with the legal authority and good financial standing to do so may issue municipal bonds to fund on-street parking infrastructure, which can be backed by municipal tax revenue or a portion of the revenue generated from the parking program.

- **State/national funding**
Cities may be able to apply for state or federal grants that can be used to establish a paid on-street parking program. This type of funding may carry specific requirements or outcomes the city will need to demonstrate the ability to meet.

- **Public–private partnership**
If cities are not willing or able to pay for capital costs upfront, they may partner with a private company to cover certain costs. For example, a parking meter company may lease meters to a city. This will likely cost the city more money over the life of the meters, but it presents an alternative to paying the full cost upfront. A management contract or concession agreement may include full or partial coverage of capital costs by the private operator.

OPERATING COSTS

Operating costs for an on-street parking program will reflect the program's size and level of sophistication. Operating costs can vary widely across regions because of differences in the cost of labor. For example, operating costs for São Paulo's on-street parking program are an estimated $6.4 million, while Westminster, England's program costs $22.1 million to operate.[31][32] The city will need to estimate (and work to minimize) operating costs if it plans to operate the system outright or through a public–private partnership that includes some cost-sharing. Otherwise, operating costs fall completely to the operator(s), and the level of transparency around those costs will vary depending on how the contract is structured. As discussed previously, concessioned operators typically do not share operating cost information with the city because it is the sole responsibility of the operator to cover those costs. Operating costs are typically paid for using parking revenues, which can include on-street parking fees, off-street parking fees, and/or parking fines, or through a city agency budget.

31   Diário Oficial do Estado de São Paulo. 2019. Página 107 da Cidade do Diário Oficial do Estado de São Paulo (DOSP) de 26 de Novembro de 2019.
32   City of Westminster. 2018–2019. Westminster Annual Parking Report.

Some cities are replacing some or all traditional coin- or card-operated parking meters with pay stations that require users to pay at a kiosk and enter their license plate number (pay by plate) or display a receipt on their dashboard (pay and display). Pay stations eliminate the need to install or maintain a meter at every single parking space, reducing the profile of parking infrastructure on the street and lowering costs. In Portland, Oregon it costs $450 to install one parking pay station which covers one parking block, compared to $700 to install single-space meters along the same block.

Cities looking to minimize meter purchase, installation, or service costs can consider the pay station alternative for some or all single-space meters. Procurement for single-space meters and pay stations may be done separately, as was done by San Francisco.[33] Another alternative to minimize capital costs for cities with no existing parking payment infrastructure is to forgo on-street meters or pay stations altogether, instead implementing a mobile-app-based payment system (**more on pay-by-app in the sidebar in Section 3.2**).

In 2015, the Seattle Department of Transportation replaced single-space parking meters with pay stations, which also enable on-street parking rates to vary throughout the day based on demand.
SOURCE: Seattle Department of Transportation, Flickr

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See
Parking Pricing Implementation for more on capital and operating costs of different parking pricing types.

REVENUE STREAMS

The final component of the financial model is to determine revenue streams—namely, parking fees and penalty fines. The financial model for a publicly funded system must be clear on where any revenue generated through the system will go, and this must be defined in any contracts. As shown in the table on the next page, most parking programs generate more revenue than is required to operate them, enabling cities to direct surplus revenue to sustainable transport and public space improvements.

33 SFMTA. 2020. Request for proposals for single- and multi-space parking meter hardware and associated meter management systems.

CITY	ON-STREET PARKING RENEVUE* INCLUDING FEES + FINES	SURPLUS REVENUE (% OF TOTAL)	WHERE ARE SURPLUS REVENUES DIRECTED?
Westminster (ENG)	$111.7 million (2019)	$89.6 million (80%)	Parking Places Reserve Account (PPRA) • 69% to environment and city management, remainder to placemaking, public health, and family services
São Paulo (BRA)	$17 million (2019)	$10.6 million (62%)	Data not available
Ottawa (CAN)	$7.1 million (2018)	Data not available	Data not available
San Francisco (US)	$79.7 million	$47 million (59%)	Subsidies for public transportation (MUNI)
Guadalajara (MEX)	$1.03 million	$577,000 (56%)	• Communications campaign to educate the public about the system • Public space improvement (reinvestment program not yet established)
Mexico City (MEX)	$6.4 million (2018)	N/A	30% allocated to mobility and urban infrastructure projects in parking districts
Fortaleza (BRA)	Data not available	$652,908	100% of surplus revenues allocated to the city's bikeshare program and the maintenance and expansion of bicycle lanes
Antwerp (BEL)	$28.7 million (2019)	$3.6 million (13%)	Data not available

DIRECTING REVENUE IN CONTRACTS

In the case of a municipal department, parking authority, or management-contracted private operator managing the parking system, revenues from parking fees, penalties, etc., will go directly to the city. In Stockholm, for example, all revenues are received by the city, which then pays its contracted operator a fixed fee per transaction (rather than a percentage). Stockholm has also established a system where various mobile-based parking providers can purchase parking time from the city. However, in this case, the revenue generated goes directly to the mobile app provider.[34] A number of cities take a similar approach, where an operator is contracted to operate metered spaces, while mobile app companies are permitted using a shorter, more flexible agreement. For example, in Warsaw, the company operating the parking meters is paid a fixed fee per transaction as part of a 10-year contract, while mobile providers are paid a percentage of the revenue generated as part of a three-year contract.[35]

REVENUE ALLOCATION

Revenues may be housed in different places depending on the city. In some cases, revenue is placed in a municipality's general operating fund. In others, all parking revenues are directed to the transportation department. This is the case in Portland, Oregon, where parking meters generate about $36 million annually. This accounts for approximately 10% of the total transportation department budget and 25% of the discretionary budget, which has fewer restrictions on how funds are spent.[36] This flexibility has enabled Portland to require that 51% of net parking revenues fund transportation projects within the district where the funds were generated, while the remaining 49% is placed in the transportation department's general revenue fund.[37] Parking enforcement in Portland is also funded from this general revenue fund.

Alternatively, a municipal department may oversee a publicly owned trust that guards all the revenue generated by the on-street parking system. For example, in **Chennai, India**, the Greater Chennai Corporation established an escrow account, overseen by an independent financial manager, where parking revenues are deposited. The parking operator's fee is paid from this account, and surplus revenue is directed to walking, cycling, and public transport improvements. In some cases, a private operator may find this arrangement—where they do not receive revenues directly from users—unsuitable, especially if the government is not able to make timely disbursements to them. Using an independent party to manage the account and disburse payments to the operator, as is the case in Chennai, can mitigate operators' concerns. This can, in turn, ensure more accurate revenue reporting and discourage corruption.

If a concessioned operator is managing the program, revenues will be received by the operator. As part of the concession agreement, the operator keeps a percentage of the revenues and the rest is remitted to the municipality. The municipality can peg the percentage retained by the operator to its level of service. It may be difficult, however, for the city to accurately track expenditures and revenues in a concessioned parking system (as those financials are internal to the operator), which could

34   Interview with Jacob Jonsson, Trafikkontoret, Stockholm City, 2018.
35   Interview with Michał Lejk, Warsaw Parking Department, 2018.
36   Portland Bureau of Transportation. 2019. Net Meter Revenue Policy Presentation.
37   Portland Bureau of Transportation. 2020. Net Meter Revenue Policy Review.

result in underreporting of revenue by the concessionaire. Anticipating this, cities should require, as part of the concession agreement, consistent reporting from the concessioned operator and be able to keep confidential any proprietary commercial or financial information. The city may also include in the concession agreement the ability to conduct an audit of the concessionaire's financial records.

When using a concessioned operator, there is still an opportunity to allocate revenue from parking to support public transit and other sustainable modes. This is the case in Rosario, where the city passed an ordinance in 2013 that requires 20% of parking revenue to be allocated to public transportation.[38]

REVENUE SHARING

Revenue sharing refers to the practice of sharing operating profits (and in some cases losses) among designated stakeholders. In the context of parking, revenue generated from the whole parking program can be shared:

● **Between the city and private operator(s).**
In most cases, the share of revenues allocated to the operator(s) remains a fixed percentage over the length of the contract. However, some cities, like Guangzhou, have negotiated variable revenue shares, so the operator's share will start high and decrease over the length of the contract (see example below). This increases the average share of revenue the government receives over the course of the contract.

	GOVERNMENT SHARE ↓	PRIVATE OPERATOR SHARE ↓
Years 1–3	30%	70%
Years 4-8	40%	60%
Years 9–10	50%	50%
Avg share	**39%**	**61%**

● **Across municipal agencies** responsible for the management of parking program elements. For example, in Pune, revenues from parking fines are shared between the Pune Parking Authority and the Traffic Police.

38   Municipalidad de Rosario. 2014. Ordenanza № 9150/2013.

● **Among parking districts**, as is the case in Portland and Mexico City. Parking benefit districts can help to encourage local support for priced parking because local businesses and residents benefit directly from the revenue generated in their district.[39] Demand (and fees to be collected) for parking spaces varies by location and time. Some operations costs (maintenance, enforcement) also vary by location, with central business districts and other high-demand areas requiring a larger share of revenues compared to districts with lower demand.

In Portland, average costs to the city for parking vary based on the district, and how revenues are distributed reflects those costs. As shown on the map below, the downtown neighborhood district receives an average of $357 per resident from parking revenues, while north and northeast Portland receive just over half that amount.
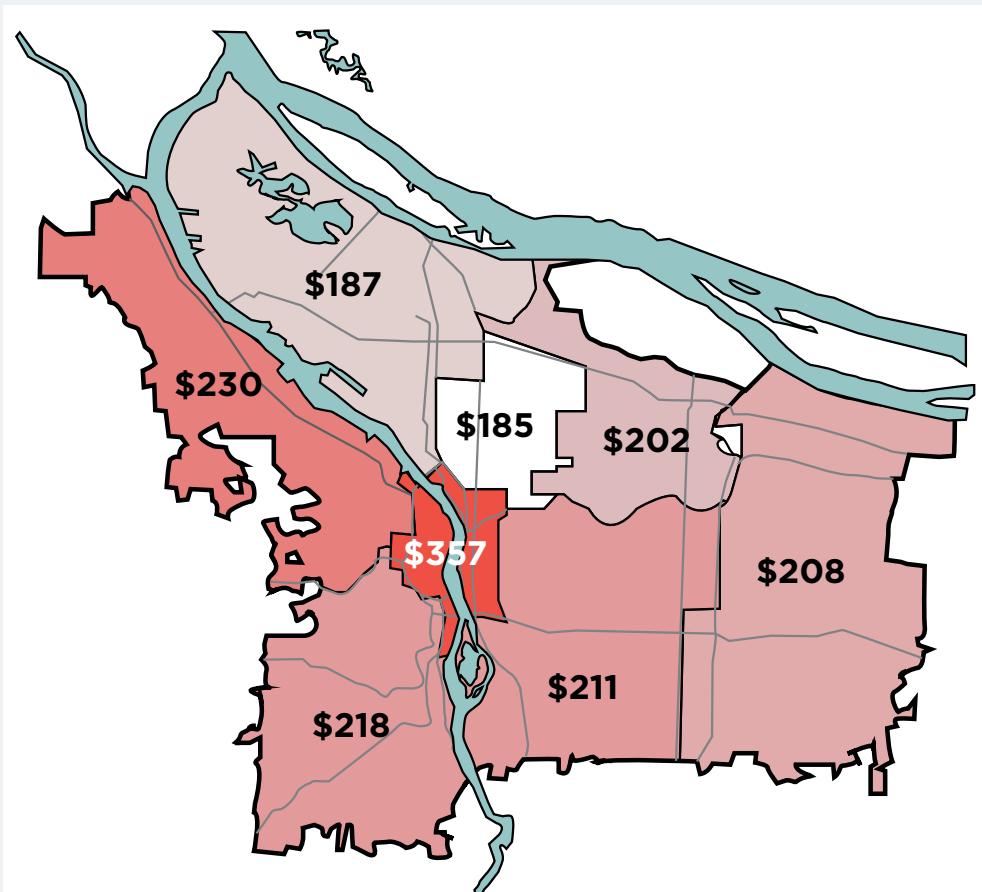
In Portland, OR, average operating costs and capital spending for parking varies by neighborhood.
SOURCE: Portland Bureau of Transportation

39   Shoup, D. 2016. Parking benefit districts.

ACTIONS & RECOMMENDATIONS

Develop a financial model to estimate capital and operating costs as well as revenue streams, which can vary significantly depending on the size and sophistication of the parking program.

Surplus revenue should be allocated to a fund used exclusively for sustainable transport and related public space improvement projects.

Revenue sharing, particularly among parking districts, can help to encourage local support for priced parking because businesses and residents will benefit directly from the revenue generated in their district.

3.4 PRODUCE AN OUTREACH PLAN

The success of an on-street parking management system is highly contingent on communicating to drivers and the general public about the program's purpose. Coupled with coalition-building efforts, a strong outreach plan that includes community engagement, education, and marketing can drum up enthusiasm for the improved parking services and higher-quality neighborhood streets that can be expected. In cities with few or no existing rules around parking or that rely on informal rules and agents, the transition to a formal system can be challenging and confusing. An outreach plan can play an important role in helping people understand what the city is doing, why, and how the program works. The plan could also include a "grace period" so people can get used to the idea of paying for parking and understand the new parking rules before fines or other penalties are fully enforced. Cities should consider assigning staff within the municipal department that oversees on-street parking or working with the contracted parking operator(s) to designate staff responsible for implementing the outreach plan. Funding for outreach can come from parking revenues, as in Guadalajara, where a portion of system revenue is allocated to communications campaigns to educate the public.

COMMUNITY ENGAGEMENT

To ease the transition to more formal on-street parking management, community engagement can align community and government expectations for a priced and managed parking program. Cities should identify and engage with frequent parking patrons, such as daily driving commuters. A key goal of parking management is to nudge daily all-day parkers towards alternatives, such as lower-demand parking locations, off-street parking, or other modes. Outreach should focus on helping commuters understand and choose these alternatives.

Starting early on in the planning process, setting up focus groups with businesses, organizations, and entities that will interact with the paid parking system can help inform program roll-out and ensure it aligns with community needs. Commercial stakeholders often feel some sense of ownership over local parking adjacent to their businesses. While this is not a legal claim, city officials should be mindful that challenging this perception of ownership is likely to weaken relationships with these groups. To avoid such an outcome, city governments must strike a balance, ensuring that commercial and residential stakeholders feel meaningfully included in the process without catering to demands that could jeopardize the effectiveness of a parking management program.

EDUCATION

Educating the public about new parking rules, rates, penalties, and the city's broader vision for parking management creates transparency. Education can be conducted through various channels, and the city should work with parking operators to carry out a coordinated outreach effort. In some cases, the operator(s) or a third-party consultant may be tasked with preparing an education strategy that informs the public of the new parking system and how it works. A website that explains all parking rules, rates, and penalties of the new program should be part of any outreach or education effort. Transparency of the rules and enforcement aims to minimize instances of drivers feeling taken advantage of by a system they do not understand. Opt-in SMS messaging or newsletters that update users on parking rate or enforcement changes after the program launches can be helpful in maintaining transparency over time.

A parklet in the Leblon neighborhood of Rio de Janeiro provides a shady, comfortable public space to relax in what used to be a vehicle parking space.
SOURCE: ITDP Brazil

MARKETING AND BRANDING

Successful marketing and branding of a new parking system can help communicate the connection between parking management and a broader vision of livability and prioritization of space for people over vehicles. Some cities, such as Mexico City, develop specific branding around the parking system to capture the imagination of the public about the system's goals. Known as ecoParq (see **Mexico City case study**), Mexico City's parking management system uses green branding and the "eco" in its name to communicate to the public that it is part of a larger environmental program to improve air quality and other health outcomes. The name ecoParq was also intentionally distanced from the government and bureaucracy, which tend to be resisted in Mexico.[40] The branding of ecoParq was part of a larger outreach plan that included sending flyers to notify residents of parking changes, distributing informational kits in public parks, and developing a user-friendly website.

Marketing does not necessarily end with the launch of the new parking program. Taking part in global campaigns such as PARK(ing) day, where artists and organizations temporarily transform parking spaces into more productive uses (e.g., parklets, outdoor restaurant seating, play spaces, etc.), can help people visualize and experience the changes that are possible as a result of managing parking.[41]

On-street parking was repurposed to create a pedestrian plaza on Shamian Island in Guangzhou, China
SOURCE: ITDP China

40   Ríos et.al. 2013. Parking and demand management policies in Latin America, Inter-American Bank.
41   Such ideas were introduced as part of the communications plan for Provo, Utah.

ACTIONS & RECOMMENDATIONS

Develop an outreach plan to communicate both the vision of the parking program and the new parking rules with the public.

- Use focus groups and other engagement strategies to involve local community stakeholders in the process of planning and transitioning to a priced parking system.

- Work, with operators if applicable, to educate the public about new parking rules by setting up a website and distributing flyers and other resources.

Develop a communications strategy that includes branding the parking system in line with a broader vision and/or taking part in already established global or regional campaigns around parking.

Consider assigning a staff member within the **implementing agency** to oversee public education and outreach. This person should liaise with local organizations and stakeholders to prepare them for the transition to a priced parking program and ensure implementation of the outreach plan.

3.5 DEVELOP AN ENFORCEMENT STRATEGY

Enforcement is a key piece of a successful priced on-street parking program because it establishes norms for orderly parking and disincentivizes violating parking rules. However, parking enforcement is often a major challenge for cities. Cities that have been unable or unwilling to enforce parking rules tend to experience significant violations and disorderliness, and they may not see progress toward the **citywide goals** connected to the parking program.

A range of common barriers to successful parking enforcement include:

- **Parking rules not clearly communicated** (lack of signage, delineated spaces, etc.)

- **Multiple agencies responsible** for different elements of street space management

- **Lack of legal standing** to enforce parking violations

- **Nonexistent or unreliable vehicle registries**

- **Lower social status of enforcement agents** compared to drivers

- **Use of police officers for enforcement**, which officers view as a low priority, an opportunity for corrupt behavior,[42] or where police priorities do not align with parking management (e.g., focusing enforcement only on main roads or on parking violations that obstruct traffic)

- **Information technology (IT) system used for fee collection does not extend to enforcement**, leaving issuing citations up to individual attendants and open to corrupt behavior.

- **Negotiating a role for informal parking managers** within a formally managed system

An enforcement official checks on-street parking payment in Moscow, Russia
SOURCE: Ultraskrip/shutterstock

Understanding these and related barriers to enforcement can help cities design an enforcement plan that proactively addresses challenges. The first step is to ensure that enforcement actions are lawful and will not be subject to legal challenges that could undermine the program. An enforcement plan should enable the city to identify and issue penalty notices for illegal parking activities. Such activities should be categorized as part of a hierarchy, where the most severe violations carry the highest penalties:

VIOLATION	PENALTY RATE	VEHICLE REMOVED (TOWED)
Illegally parked in a no-parking zone Parked in a loading zone, cycle lane, bus lane or stop, on a sidewalk, double-parked, or blocking a fire hydrant or other emergency access	Highest	✔️
Did not pay to park or parked in illegal parking space Parked in a priced space and did not pay, in a space not designated for vehicle parking, or in a space restricted to certain permitted drivers (e.g., disabled driver space)	High	✖️
Exceeding maximum time permitted Overstayed time allotted for a paid space or a parking space that is free of charge for a certain time (e.g., up to 2 hours)	Low	✖️

See [On-Street Parking Management: An International Toolkit](#) for more information.

Penalty rates and towing should align with the severity of the violation. For example, parking in an illegal zone carries the highest penalty, and the vehicle will be towed because it is actively blocking the flow of traffic or putting vulnerable users like cyclists using a bicycle lane at risk. These penalties serve as a strong disincentive to park in an illegal zone. However, while neglecting to pay to park in a priced space is also a violation and carries a penalty, doing so does not inconvenience other road users and does not necessarily warrant the vehicle being towed. The aim of enforcement is to ensure a well-functioning system, not to aggravate or target drivers.

ENFORCEMENT AGENTS

Enforcement agents are responsible for canvassing regulated parking zones and issuing citations for violations of parking rules. Depending on the contract and data-sharing agreement with the parking operator(s), cities may consider requiring the ability to monitor the movement of enforcement agents and their inspection activity. This can help to ensure oversight and be a way to better understand and adapt enforcement protocols. When making decisions about enforcement staff, city officials should also consider the following questions:

- Who is being employed as an enforcement agent?

- What are the duties of an enforcement agent?

- What is needed for enforcement agents to do their job effectively and safely?

- What criteria can be used to evaluate enforcement agent performance?

- How many enforcement agents are needed?

- What is the cost of enforcement per parked vehicle per hour?

- How can technology be used to enhance services and minimize costs?

Enforcement agents can be police officers, privately contracted agents, or existing traffic officials. The entity responsible for providing enforcement agents will likely determine what agents' duties will be. For example, if enforcement is contracted out to a private company, the full range of duties—from monitoring spaces, to issuing citations, to wheel clamping and towing—may be conducted by the enforcement agents. Alternatively, if enforcement is being conducted by the police, enforcement agents may only be able to identify infractions, requiring a police officer to actually issue the ticket.

In cities where parking management is being transitioned from informal (e.g., unsanctioned parking attendants) to formal, it is important to consider integrating existing parking attendants into the formal enforcement structure. For example, Mexico City set up an employment program for *franeleros*, independent attendants who collected fees for parking before the city's ecoParq program was implemented. It is also necessary to anticipate and mitigate potential harassment that may occur as a result of enforcement: In informal parking systems, attendants may harass drivers, exploiting them through bribes or slashing tires if drivers refuse to pay a gratuity. In formal parking systems, drivers may harass or threaten enforcement officers, perceiving them as representatives of a new system that penalizes them for what was previously understood to be "free."

The number of enforcement agents needed depends on several factors: the number of parking spaces, how spread out parking areas are, rates of turnover and parking durations (areas with short-duration parking will require more consistent enforcement), and to what degree technology can be employed to support enforcement and reduce the need for human enforcement agents. In Amsterdam, where human enforcement is supplemented with automated license plate reader (ALPR) technology, the ratio of spaces per enforcement agent is very high, at more than 1,800 spaces. In Mexico City, there are approximately 500 spaces per enforcement agent, but in Manhattan, New York City, enforcement agents cover about 10% of that, or around 55 spaces. In other words, Amsterdam has very few enforcement agents compared to New York City, which has many.

REGULATED SPACES PER ENFORCEMENT AGENT
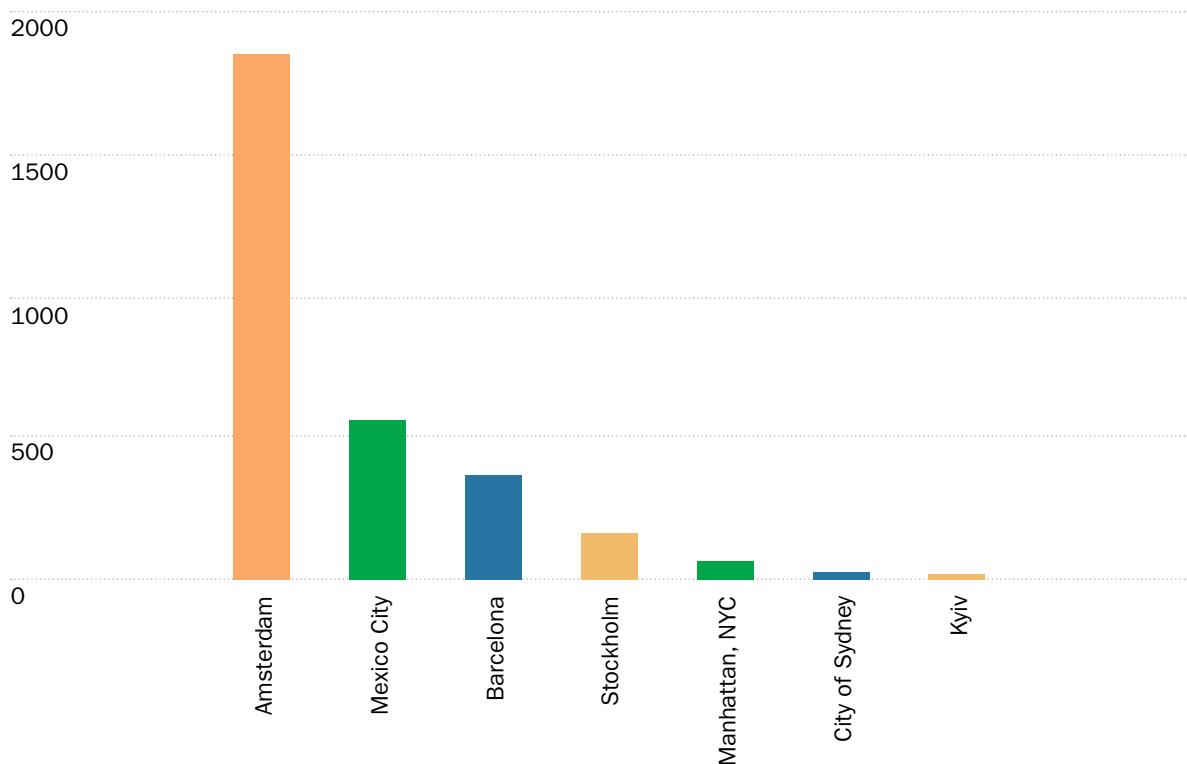
The rate, accuracy, and efficiency level at which enforcement agents can monitor and report on parking heavily depends on other compliance reinforcement decisions. Efficiency also depends on the parking fees and time allotments: Setting parking fees high enough that demand does not exceed supply can actually reduce the burden on enforcement and minimize the stress and resentment from drivers that enforcement officers may face. In other words, if there are only a few convenient places to park legally, drivers will be tempted to park illegally, taking their chance of being ticketed and creating an incident where enforcement is needed. Enforcement agents' ability to encourage compliance with parking rules can also be supported by technological and physical solutions as well as by penalty strategies.

VEHICLE REGISTRATION DATABASES

A vehicle registration database is a consistently updated dataset that includes information on vehicles and their current owners, namely including the home address of the vehicle owner. Many places lack reliable vehicle registration records linked with home addresses. This can pose a barrier to using technologies designed to make parking enforcement more efficient and less costly, as these technologies rely on the ability to issue a citation for a parking violation to the vehicle owner and to follow up if it goes unpaid. Without a vehicle registration database, enforcement agents are limited to leaving a written citation on the vehicle and have no recourse to follow up on outstanding citations, which results in drivers' feeling that they do not have to pay tickets and therefore lower revenues for the parking program. The other alternative is relying heavily on wheel clamping and towing.

If a reliable vehicle registration database does not exist, generating one should be a key priority of an enforcement plan. In some cases, information on vehicle registrations is housed within a higher level of government and cannot be accessed by local governments. Barriers such as this should be identified and mitigated, where possible. A combination of written citations and clamping/towing may be able to substitute for a vehicle registration database in the short term, with clamping or towing triggered by a repeat violation (without fine payment) by the same vehicle. This would require a database of vehicles and their outstanding fines but would not require owners' addresses.

Public concerns around the government's ability to protect personal privacy and prevent improper or unauthorized use of vehicle registration data may also arise. These concerns can be eased by establishing transparent standards for using vehicle registration data, and employing strategies that protect data privacy, such as data minimization (only collecting critical data needed to complete the task or study), restricting data (removing identifiers), and controlling access (through licensing agreements).[43]

SUPPORTIVE SOLUTIONS FOR ENFORCEMENT

There are a variety of options and combinations of technological or "smart" solutions (such as parking sensors) and physical solutions that cities can leverage to support human-powered enforcement and, ultimately, improve compliance with parking rules. Choosing to implement these supportive solutions will depend on existing conditions, resources, and capacity, as well as parking-adjacent goals such as traffic reduction or predicting user behavior to improve system efficiency. Depending on the city's goals, the solutions described in this section can be combined as part of a comprehensive enforcement plan.

Technological "smart" solutions

Technological interventions, otherwise known as smart parking systems, can make operations and enforcement more efficient for parking operators and provide insights on how the system is working. Smart system technologies, such as mobile applications and "smart meters,"

enable different stakeholders to engage in data collection and sharing, facilitate cost reduction, and improve transparency and accountability in enforcement.

If enforcement is not monitored or facilitated by a technology-based system, then it is up to the discretion of the enforcement agents to, for example, accept a bribe instead of clamping a vehicle. This type of behavior is not uncommon, particularly where enforcement accountability is low.[44]

A range of smart solutions are available and used for on-street parking management. These solutions vary in terms of cost, ease of implementation, and accuracy. Moreover, each of these solutions can be effective at achieving outcomes in addition to enforcement as outlined in the table on page 58. Cities considering integrating smart solutions must first define these outcomes and understand which solution(s) might contribute to them. For example, if a city is interested in understanding user behavior, sensors or mobile applications would contribute to that goal, while enforcement agents using inspection support devices might not.

Additionally, all smart solutions work most effectively when there is an up-to-date vehicle registration system in place as well as reliable internet connectivity: All smart solutions discussed in this section depend on broadband connectivity to link the device to a back-end office that collects data and cross-references it with license plate and driving license records to carry out effective parking enforcement. Even where this level of connectivity is available, it may not be considered cost-effective to use in the context of parking enforcement.

Inspection Support Devices also referred to as personal digital assistants (PDAs), are one of the most common technologies used in parking enforcement because they maximize the effectiveness of enforcement agent inspections by automating certain processes. Importantly, an inspection support device provides a record of all the details of an inspection, including the starting and closing time, GPS location of the violation, and the agent conducting the inspection. This information is logged in a system that interfaces with a server that can download the data to the billing, accounting, traffic management, and/or law enforcement system of a municipality. Inspection support devices assist agents in determining whether a violation has occurred and the appropriate penalty by automatically:

- Recognizing the license plate number of a parked vehicle;

- Identifying the vehicle type (e.g., motorcycle, passenger car, taxi, bus), which allows for calculation of different fees;

- Determining the penalty amount based on the regulations for the area in effect at the time of inspection;

- Providing an option to identify any nonstandard circumstances that contribute to a higher or lower penalty;

44   New York City Council. 2018. Placard abuse: Data team.

Inspection support devices are used by enforcement agents to log and track parking infractions.
SOURCE: stesilvers/shutterstock

● Prompting agents to take photos to document the violation and providing a time stamp;

● Printing the penalty receipt so that the agent can affix it to the vehicle and creating a copy to be mailed to the vehicle's registered address.

Without an inspection support device, some of these steps may need to be completed manually, which could lead to error or corrupt behavior. The latter is of particular concern when determining the penalty amount. If possible, inspection support devices should be purchased and owned by the city, not the operator, to ensure accuracy and credibility.

Sensors are installed in the ground or rest on the ground and can detect the presence of a parked vehicle using radio signals and laser light reflections. This helps enforcement agents identify occupancy, the duration of parking stays, and whether parking is occurring illegally. Sensors provide the most accurate results within seven meters—approximately four to five parking spaces—however, accuracy can decrease with greater distances and sharper reflection angles. Higher-quality, more costly sensors are able to distinguish between vehicle types, such as cars and motorcycles, and between parked and moving vehicles. When connected to a parking locator application, sensor-generated data can also help drivers better locate available parking

spaces, reducing excess kilometers driven searching for parking. Data produced by sensors over time enables policymakers to better understand patterns and trends of overstayed or mis-parked vehicles as well as monitor and respond to infractions and ensure compliance.

Sensors installed in the street can detect whether a parking space is available or occupied and transmit this information to drivers in real-time, helping to reduce the amount of time spent cruising for a spot.
SOURCE: New York Department of Transportation, Flickr

Scan cars are vehicles with automated license plate recognition (ALPR) cameras mounted to them, typically on the roof (for cars) or the front of a motorbike. These units are flexible and can be mounted onto any type of vehicle. For example, New York City uses ALPRs mounted to public buses on three bus-only routes to issue citations to cars illegally parked along those routes. When applied to parking enforcement, the ALPR cameras capture the license plates of parked vehicles as the scan car drives past. License plate data can then be checked to see if the parked vehicles have paid or hold the required permit. This process relies on the government implementing a vehicle registration database or similar system that allows for automatic connection of a license plate with a permit. Compared to human-powered enforcement, scan cars cover four times more ground and generate data in real time. With greater coverage in a shorter time, scan cars scale up the ability to identify and ticket infractions and therefore promote compliance. Real-time data enables governments to more accurately monitor system operations and understand trends. However, ALPR cameras that are programmed to read standard car-size license plates may have difficulty accurately reading motorcycle plates, which are much smaller, and other nonstandard license plates.

LEFT:
Electric scan cars are used for parking enforcement in Amsterdam, reading license plates and identifying vehicles that do not have a valid permit or correct payment.
SOURCE: harry_nl, Flickr

RIGHT:
Parking enforcement in Washington, DC uses scan cars with ALPR cameras to improve the efficiency of parking validation.
SOURCE: Wayan Vota, Flickr

Mobile applications serve dual purposes: They can enable drivers to pay for parking and let enforcement agents monitor parking payments and infractions. If a driver overstays their time, an app can provide information that pushes the driver towards renewing payment or moving their vehicle. In some cases, mobile applications are connected to smart parking meters, giving drivers more payment options (via the app, or using cash or a credit card at the meter; see Pay-by-phone sidebar, above). Existing digital payment apps can be used with parking meters (e.g., Alipay and WeChat pay in Chinese cities), or independent apps can be developed to facilitate mobile parking payment. The latter, typically when developed by the city, can also provide enforcement staff with up-to-date information on parking occupancy, expired meter locations, and related infractions. A vehicle registration database does not necessarily need to be linked to these mobile applications, but an up-to-date database will enable enforcement staff to more accurately and efficiently link vehicles (and parking citations) to the registered owner.
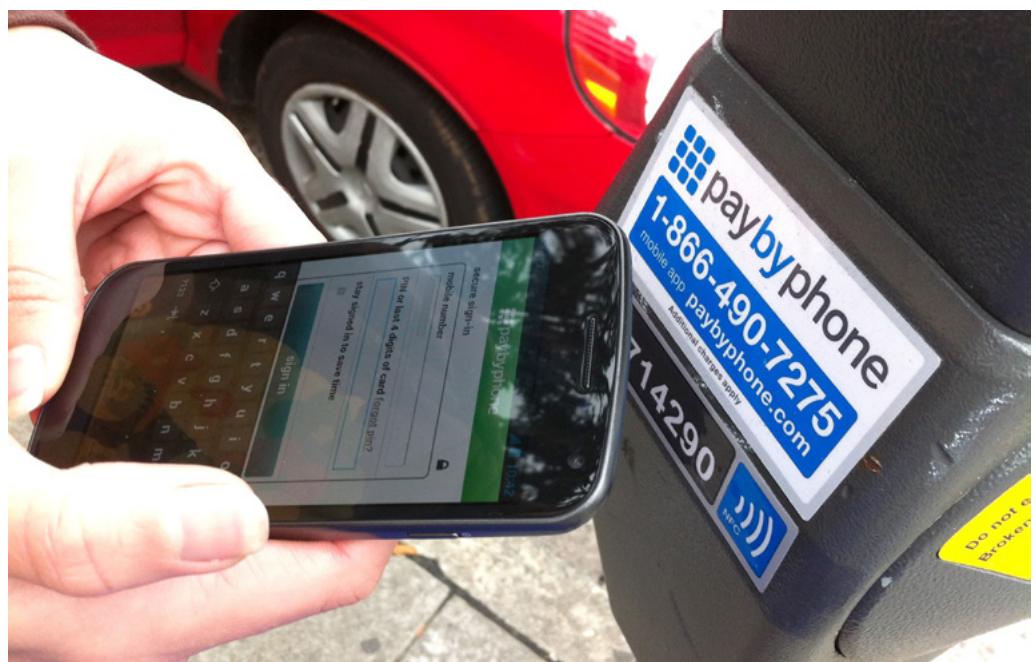
Mobile applications have become increasingly popular means of parking enforcement because they make it easy for drivers to pay for parking and renew payment if it expires. They also help parking enforcement agents work more efficiently, alerting them when payment has expired.
SOURCE: Jason Tester, Flickr

COMPARING SMART PARKING SOLUTIONS

TECHNOLOGY	ACCURACY	COST	PARKING SPACES REVIEWED/HOUR	BENEFITS
Inspection Support Devices	Low– Med	$–$$	300	Flexible in where it can be used Enables enforcement without vehicle registration database (citation placed on vehicle)
Sensors	Med–High	$$–$$$	5	Some real-time data provision (may not detect parking duration) Underground installation reduces street clutter Can link to user-facing apps that provide parking availability information
Scan cars	Med	$–$$	1,500	Optimize monitoring due to accurate real-time data provision Highly efficient, can have fewer enforcement agents, and fewer violations go unnoticed
Mobile app (and "smart" meters)	Low	$	18*	Easy to use, and encourages payment compliance for drivers Provides real-time data for monitoring and enforcement

* On average, a smart meter can track the occupancy of 18 spaces per hour depending on the quality of technology and the range and radius of parking spaces.

Adapted from: The future of smart parking is already here.

CONSIDERATIONS	OUTCOMES

Dependent on human interaction with device

REQUIRES: enforcement agents to conduct inspections using the ISD; if no vehicle registration database exists, no way to follow up with driver about unpaid citation

Difficult to relocate, repair, or replace (especially if underground)

Nearby magnetic fields (e.g., tram, metro) may reduce accuracy

REQUIRES: network connectivity (Low Power Wide Area networks can be useful[45]); control center to collect data; installation and maintenance team

Maintenance, repair, and additional emissions from scan vehicles

Privacy concerns (vehicle registration database)

Environmental conditions may reduce accuracy

Difficulty reading nonstandard-sized plates, such as motorcycles

REQUIRES: vehicle registration database, vehicles to mount cameras on (can be existing, such as buses or taxis, or procured for this purpose)

If mobile app replaces meters, can limit access for those without smartphones

Behavior data limited to those using mobile app (if other payment options available)

REQUIRES: network connectivity, widespread smartphone use; vehicle registration database improves enforcement capability

Reduce traffic ●
Understand user behavior ●
Increase payment compliance ●

A number of cities have implemented smart solutions for parking enforcement in recent years. Amsterdam uses a variety of smart solutions, referred to as "information-based enforcement," including scan cars and a digital back-office system. The digital back-office system processes the ALPR scans in real time and identifies illegal parking violations. The system interfaces with digital parking registers and submits parking penalty charge notes and illegal parking violations to the appropriate authorities.[46] The system reviews 1,500 parked cars scanned per hour (approximately 150,000 parking spaces daily) and quickly validates and assigns a penalty.[47] This maximizes enforcement efficiency and can reduce the labor needed to enforce an on-street parking program.

While smart solutions have been successful in increasing efficiency and parking compliance, they are often expensive to purchase and maintain. For example, Paris spent €15 million (USD $17.7 million) to implement its smart parking system, which included installing complex data-gathering sensor devices and parking meters, as well as developing a mobile app for digital payment.[48] Costs will also depend on whether there is already infrastructure in place that can be built on (e.g., using taxis as scan cars in cities where taxis are widely used) or whether the entire system will be built from scratch.

Physical solutions

While physical materials—like bollards, high curbs, and curb extensions—that block vehicles from driving onto sidewalks are predominantly used to improve pedestrian safety, they can also serve as parking enforcement solutions. Physical solutions should, however, be coupled with other (manual and/or technological) fee-based penalties to ensure a comprehensive enforcement strategy. Physical solutions are commonly used in Nairobi, Kampala, and other East African cities to deter drivers from parking illegally by clearly delineating no-parking zones. Physical solutions can also ensure that cars stay out of cyclist and pedestrian zones. This increases overall street safety, in addition to establishing parking norms. However, these measures may not work as well at preventing two-wheelers, such as motorcycles and scooters, from entering no-parking zones or parking illegally on sidewalks or in cycle lanes. The design and type of physical solutions used should consider whether two-wheelers make up a large share of trips and contribute to illegal parking.

Physical solutions such as concrete curbs can be expensive to build and inflexible to change. In some cities, "salons," small green spaces raised a few steps above ground level, serve as physical solutions to deter illegal parking. The raised nature of these spaces may be enough to ensure they do not turn into parking lots in some cities, while in others more restrictive solutions may be required.

46   Radu, M. 2015. Netherlands using VW scan cars to automatically give parking tickets.
47   ScanAuto. 2017. Scancar products.
48   Lin et al. 2017. A survey of smart parking solutions.

Options with lower upfront costs, such as planters or flex curbs, can also deter illegal parking while offering more flexibility for future curbside needs. These options may, however, accumulate costs over time, as they degrade more quickly and require frequent repair and replacement compared to permanent solutions. Before investing in more expensive and permanent designs, cheaper physical solutions can be piloted and adjusted based on public feedback. Once built, most physical solutions require relatively low maintenance costs. Physical solutions can also reduce the need for human-powered enforcement, which helps to minimize labor costs.

LEFT:
In Paris, bollards line both sides of the street to discourage illegal parking in the pedestrian realm.
SOURCE: Henry de Saussure Copeland, Flickr

RIGHT:
With no physical barriers in place to support no parking zones, cars may encroach onto footpaths or other public space to park.
SOURCE: ITDP

PENALTIES

Penalties serve as both deterrents and punishments to ensure parking enforcement. Fines are commonly used penalties for parking violations, while wheel clamping and towing are used to address repeat and/or severe violations. Wheel clamping and towing may also be the only recourse a city has to reduce illegal parking, especially if the city does not have access to a reliable vehicle registration database. However, using clamps and towing as the primary consequence for parking violators should be a temporary solution, because it is costly to maintain.

Wheel clamps are often used for vehicles with multiple unpaid parking violations or serious offenses, like this vehicle parked in a "no parking" zone in Panaji, India.
SOURCE: Joegoauk Goa, Flickr

Fines

Fines support enforcement because they create norms around parking by deterring drivers from violating parking rules. As discussed in the introduction to this section, parking fines should vary according to the urgency and severity of the violation.

Issuing fines requires that a ticket or citation be delivered on site (typically attached to the vehicle) or mailed to the driver. To issue fines effectively, the city should have access to a database of vehicle registrations that includes vehicle owners' home addresses—otherwise it is difficult to follow up with vehicle owners regarding unpaid fines, so a large share of citations will go unpaid. Recent developments in technology have enabled municipalities to identify violations and issue fines using ALPR cameras or similar digital devices, which can significantly improve enforcement effectiveness. However, these technologies still require an up-to-date vehicle registration database in order for citations to be sent to vehicle owners for payment. If a registration database is not available, wheel clamping (discussed later in this section) can be used on vehicles with unpaid fines, but this requires additional time and resources.

All fines must be set higher than the cost of parking all day in a priced zone to effectively deter violations. Standardizing payments for different types of violations can help to depoliticize fines, and including incentives (e.g., a discount is applied if the fine is paid within 24 hours) and deterrents (e.g., fine increases if not paid within 10 days) can encourage timely payment.

Fines tend to impose a greater economic burden on lower-income groups who may not have the disposable income to afford to pay a parking fine all at once. However, underpricing parking fines and even hourly rates can result in higher-income groups taking advantage of the system and occupying more street space without any financial disincentives. To combat this, more severe penalties should take effect after a driver accumulates a certain number of parking tickets. This type of penalty system disincentivizes receiving multiple parking citations regardless of one's ability to pay the corresponding fines. In Mexico City, parking tickets count as a "point" on a driver's license. If a driver accumulates 12 points in a three-year period, their license is suspended for six months to three years.[49]

49 Muñoz, J. 2018. Licencia suspendida.

A FEW EXAMPLES OF PAYMENT STANDARDIZATION

CITY ⬇	PARKING FEE/HOUR ⬇	PENALTY STANDARDIZATION ⬇
Amsterdam, Netherlands	**€7.50** (USD $8.79)	**€373** (USD $440) base fine to reclaim towed vehicle (within one day) **€30** USD ($35) additional daily fine for an unclaimed vehicle
Cape Town, South Africa	**R 19** (USD $1.15)	Fine must be paid within 15 days After 15 days, the driver must appear in court
Delhi, India	**RS 40** (USD $0.55) 1st hour **RS 70** (USD $0.95) 3 hours **RS 300** (USD $4.10) 5 hours	**RS 500** (USD $6.85) | Fine paid within 60 days After 60 days, registration/licensing services are restricted and driver must appear in court If another infraction occurs after 60 days, fine increases
Kuala Lumpur, Malaysia	**RM 2** (USD $0.48) 1st hour **RM 3** (USD $0.72) subsequent hours	**RM 50** (USD $12) Flat fine if paid within 14 days **RM 100** (USD $24) Fine doubles after 14 days

Offering (or requiring operators to offer) opportunities to pay off parking fines in installments and at a reduced rate accommodates groups that face greater financial burdens. San Francisco's Financial Justice Project, which is tasked with understanding and reforming how fines impact vulnerable residents, launched payment plans and community service alternatives for low-income people faced with the economic burden of paying municipal fines.[50] Payment plans allow residents to pay a ticket in installments over a fixed time. So-called "courtesy tickets" for first-time violators of certain parking rules, which do not carry a monetary fine, may also help to encourage compliance and maintain equity. The ultimate goal is to avoid penalizing honest parking mistakes made by otherwise law-abiding people, thereby easing their resentment of parking enforcement. Additional support mechanisms that facilitate access to payment plans, ticket-contesting information, fee-reduction programs, and other alternative options are needed, especially for people who do not have access to a checking account, the ability to pay in person, etc. E-governance solutions, like a clear and concise website, can help make such information more easily accessible. The city may also consider partnering with local community organizations to work with drivers and discuss the financial alternatives available to them.

Government vehicles

Assessing penalties on government-owned cars can be challenging, especially in cities where civil servants are some of the worst offenders when it comes to parking rules. A mechanism must exist to issue penalties to drivers of government vehicles where the government is not responsible for or able to waive the fines. Reregistering government vehicles could also be contingent upon having no outstanding fines.[51] These efforts can help to incentivize parking compliance by drivers of government vehicles.

Placards for people with disabilities

In many cities, legislation exists to accommodate the needs of people with disabilities and to ensure their ability to access public spaces. In the context of parking, this typically means providing special status placards to people with disabilities that enable them to park in designated spaces (usually close to building entrances) or receive a discount or free parking at on-street spaces.
It is important for parking operators to ensure that placards meant for people with disabilities are not being abused—by placard holders or by drivers without a disability—to avoid paying parking fees. Particularly in low- and middle-income cities, people with disabilities who have access to a vehicle are not necessarily financially burdened. That is to say that their need for accessible parking spaces is typically much higher than their need for free parking. Free parking for disability placard holders is such a strong incentive for placard fraud in many cities that parking management experts recommend avoiding or removing payment exemptions for people with disabilities. Instead, providing rebates to limited-income drivers with disabilities can help reduce the burden for those who are, in fact, financially burdened. If parking is free or heavily reduced for people with disabilities, enforcement should be strict to minimize fraudulent placard use.

Wheel clamping

In addition to fines, wheel clamping (sometimes referred to as "booting") can deter more severe parking violations as well as encourage payment of outstanding fines. While fining is relatively easy for the city or operator to administer as a deterrent to drivers violating parking rules, in some instances it may not be enough. Clamping may be appropriate for violations such as parking in a paid space without paying or exceeding the allotted parking time, especially if the violation is observed repeatedly or beyond a designated time limit (e.g., a vehicle is parked in a paid space without paying for five days). Clamping may also be implemented if a vehicle exceeds a certain threshold of unpaid parking fines.

Usually a driver will need to pay a percentage of their outstanding fine(s) to have the wheel clamp removed. In other cases, drivers need to pay a flat fee before the clamp is removed. "On-site" wheel clamps allow drivers to remove the clamp themselves (usually by submitting payment over the phone and receiving a code to release the clamp); however, most clamps need to be removed by a city official, presenting an additional level of inconvenience. If a driver does not initiate payment to remove the clamp in a designated amount of time (e.g., two business days), the vehicle should be towed.

51   Benedictus, L. 2016. Guardian. A fine mess: How diplomats get away without paying parking tickets.

Clamping as a deterrent strategy for leaving parking fines unpaid rests heavily on the ability to identify violating vehicles. This is easily and efficiently done if scan cars are used for enforcement. Furthermore, the operator (city or private operator) will incur costs for enforcement officers and dispatchers to facilitate wheel clamping. However, fees for clamp removal may be able to cover the cost of the program. This is the case in San Francisco, where wheel clamping carries an estimated operating cost of $1 million: Approximately 2,100 vehicles per year are clamped, and owners eventually pay the $515 fine to have the clamp removed, generating about $1.08 million.[52]

In Prague, flatbed tow trucks equipped with a crane mechanism can extract cars for towing from tight parking spaces.
SOURCE: John Lloyd, Flickr

Towing

Towing should be reserved for the most severe parking violations and the most egregious instances of fine nonpayment. If a vehicle is parked in an illegal zone, such as a loading zone, cycle or bus lane, or traffic lane (double-parked), it serves the rest of the road users to tow the vehicle. Similarly, if a vehicle has been clamped and outstanding fines have not been paid, the vehicle should ultimately be towed.

Towing requires space to park towed cars, known as impound lots. These are typically surface lots, which may include an onsite customer service center where drivers can resolve their parking fines and claim their vehicles. Impound lots may be managed by a municipal public works department or similar. Alternatively, the city may obtain towing equipment and storage services through a contract with one or more private towing companies. Vehicles that are not claimed after a specified number of days should be considered abandoned; in some cases, cities list these vehicles for public auction, otherwise they are scrapped.

ENFORCE

ACTIONS & RECOMMENDATIONS

Develop a parking enforcement plan that considers the role of informal parking attendants in the new parking system and includes an appropriate number of enforcement agents, technological and/or physical support mechanisms, and penalties that encourage parking compliance.

Parking enforcement should remain independent of police operations.

Set parking fines high enough to be a deterrent but no higher, and offer payment plans or other mechanisms that relieve disproportionate economic burden on low-income drivers.

Generate a vehicle registration database, if one does not exist, to enable more effective enforcement and payment of penalties.
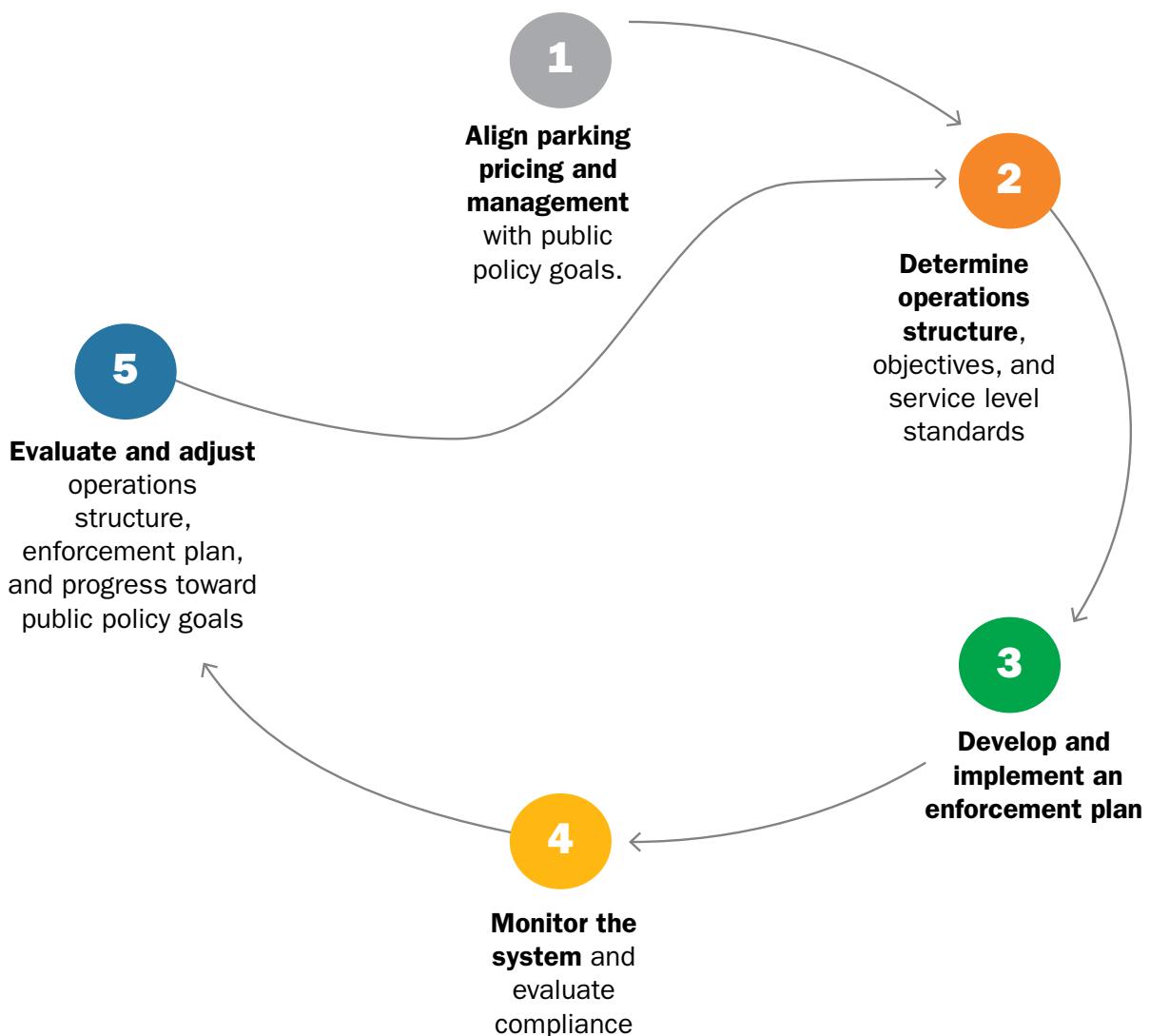
Consider adopting technological solutions that support enforcement, reduce corruption, and allow for easy and transparent data collection on parking infractions, payments, occupancy rates, and related behavior trends.

Understand and anticipate challenges to enforcing parking with special statuses.

3.6 PREPARE FOR SYSTEM EVALUATION

Regardless of whether the system is publicly operated or some or all aspects are provided by a private operator, a process for consistent monitoring, evaluation, and occasional modification should be developed as part of a parking management strategy. This includes setting targets for the parking program before implementation, identifying indicators and data needed to evaluate progress toward those targets, and establishing a method for producing and disseminating reports to share progress and inform policy adjustments. Additionally, the parking management entity should establish minimum service level standards that must be met by the parking operator(s).

ITDP has developed the following framework, which is designed to help cities be more outcome-oriented in their decision-making. It is important to note that this process is iterative—occasional adjustments undertaken as part of step 5 should be reflected in operations objectives and expectations (step 2) and in subsequent steps.

1
Align parking pricing and management with public policy goals.

2
Determine operations structure, objectives, and service level standards

3
Develop and implement an enforcement plan

4
Monitor the system and evaluate compliance

5
Evaluate and adjust operations structure, enforcement plan, and progress toward public policy goals

SETTING OUTCOME-ORIENTED TARGETS

As discussed in **Section 3.1**, cities should link parking reform with more ambitious citywide transport outcomes. Once these outcomes have been identified, indicators can be used to evaluate impacts of the parking program and related progress toward public goals, as shown in the following table.

GOAL	INDICATOR(S)
Improve access by increasing trips made by sustainable transport (public transit, cycling, walking)	Mode share by public transport, cycling, and walking vs. mode share by private vehicle Occupancy and vacancy targets by block and/or zone Average time spent searching for parking (decreasing year over year)
Improve equity by reallocating space on public roads for people	Number of on-street parking spaces converted to other uses (increasing year over year)
Improve safety by reducing traffic crashes that result in injury or death	Instances of double-parking (decreasing year over year) Killed or seriously injured (KSI) rates (decreasing year over year)
Improve health by reducing harmful air pollutants	Vehicle kilometers traveled (decreasing) Concentrations of air pollutants (e.g., NOx, PM) inside priced parking zones vs. citywide (decreasing year over year)
Establish a reliable revenue stream to finance sustainable transport improvements	Revenue per meter or space, per area Number of projects receiving funds from parking revenue Total revenue allocated to sustainable transport projects (maintain or increase year over year)

Establishing these indicators will help city staff think through the types of data needed to establish a baseline before launching the parking scheme so progress can be evaluated year over year. Staff should identify the methods they will use to collect this data, which may include working with a third-party data collection and evaluation company. The city should be clear about which data is expected from operators and which data it will collect itself. For example, mode share data will need to be collected through surveys (these could be distributed by the parking operator(s) and/or the city), while air pollutant concentration levels will need to be gathered using roadside monitoring devices (likely requiring city oversight, and therefore beyond the purview of a private parking operator). It is also important to be clear about the presence of potential confounding variables that may contribute to observed outcomes in addition to the changes made as part of the parking program. Identifying control areas that have similar characteristics to priced parking zones but do not fall within the parking scheme boundaries can help to minimize the effect of confounding variables.

PARKING DATA COLLECTION AND USE

Three main types of parking data contribute to a comprehensive picture of parking needs and effective management: inventory, occupancy, and behavior data. **PARKING DATA MUST BE COLLECTED AND ANALYZED ON A LOCAL SCALE TO BE ACTIONABLE. AGGREGATED PARKING DATA FOR THE WHOLE CITY IS NOT USEFUL AND CAN BE CO-OPTED TO SUPPORT CLAIMS OF PARKING SHORTAGES.**

Inventory

Occupancy

Behavior

Data on parking supply

Data on occupancy levels, including illegal parking rates

Data on parking behavior of individual vehicles and resulting impacts on mode shares, parking-related decision-making by users, etc.

Many resources on parking focus heavily on inventory and occupancy data. Indeed, inventory data are critical to understanding how much on-street parking is available in different parts of the city (supply) which provides the foundation for parking management. Occupancy data provide insights into where parking availability falls on a spectrum of empty (occupancy too low) to saturated (occupancy too high) and can contribute to mapping priced parking zones throughout the city. These data are typically collected by the city prior to launching a managed parking program and should be collected annually (or more often) to guide operational decisions on parking and enforcement.
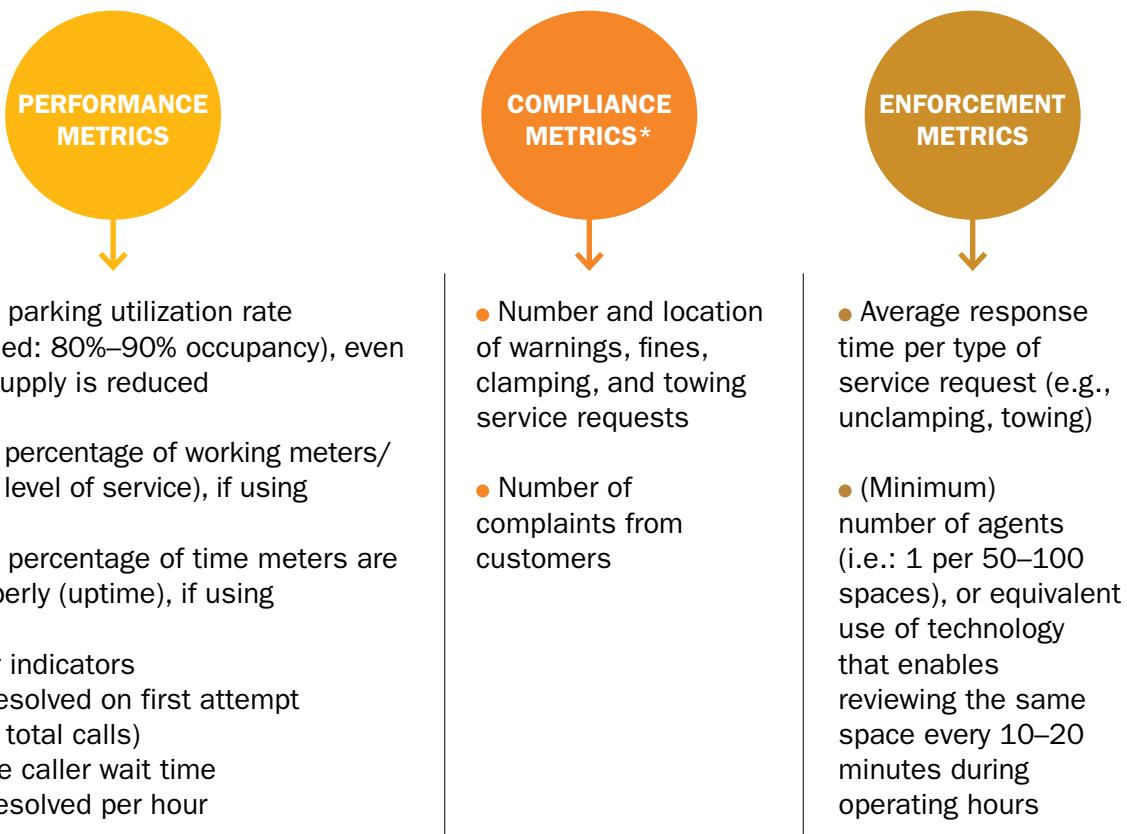
While behavior data does not need to be collected as frequently as occupancy data, it should not be overlooked. These data help inform whether and how the parking program is altering mobility decision-making at the individual level and to what extent the program is contributing to established citywide goals. Collecting this data can help cities make more informed decisions when it comes to parking management, and it can provide evidence for continuing successful measures and adjusting less successful ones. Collecting behavior data typically requires a more sophisticated **technology system** than one for collecting inventory and occupancy data. Thus, collaboration with the parking operator(s) is critical, because some behavior data may need to be collected by the operator and shared with the city. The city may employ more direct behavior data collection, such as through surveys and related qualitative methods, to understand how the parking program is impacting parking and driving behavior at the individual level.

OPERATOR EVALUATION: SERVICE LEVEL STANDARDS

If the operator is a private entity, service level standards should be embedded in the contract and used for periodic evaluation of operational performance. This way, the operator receives a base amount of revenue that covers operating costs and includes a fair and attractive profit. This amount should be tied to the results of the periodic evaluation, increasing if performance meets or exceeds certain standards and decreasing if not. If operations and maintenance are consistently not meeting minimum standards, then the contract should be nullified based on terms not being met.

Minimum service level standards for operators may include:

PERFORMANCE METRICS

COMPLIANCE METRICS*

ENFORCEMENT METRICS

- Maintain a parking utilization rate (recommended: 80%–90% occupancy), even as parking supply is reduced

- (Minimum) percentage of working meters/kiosks (their level of service), if using

- (Minimum) percentage of time meters are working properly (uptime), if using

- Call center indicators
  - Calls resolved on first attempt (out of total calls)
  - Average caller wait time
  - Calls resolved per hour

- Number and location of warnings, fines, clamping, and towing service requests

- Number of complaints from customers

- Average response time per type of service request (e.g., unclamping, towing)

- (Minimum) number of agents (i.e.: 1 per 50–100 spaces), or equivalent use of technology that enables reviewing the same space every 10–20 minutes during operating hours

*High compliance by users and, thus, low rates of fines, clamping, and tow requests is the goal. Many penalties (and customer complaints)—and penalty instances increasing over time—indicate the system is not working properly.

SYSTEM EVALUATION:
ANNUAL REPORT AND PERFORMANCE METRICS

The parking system as a whole should be monitored daily and evaluated as part of a more robust review annually. The results of the review should be available to the public, including community stakeholders and local media, via an annual report. This will help allay any public suspicions about the parking operator and/or city "gouging" residents with the parking payment scheme. The annual report should define and provide progress toward public policy goals (as described previously), which helps to increase public confidence in the system. In particular, the annual report should provide information on the use of revenues from the parking system, including the amount needed to cover operating expenses and the amount allocated to sustainable transport projects. Transparency around these projects may help to maintain public support for continued operation of the parking program. Photographs, interview quotes, and stories that document how people are interacting with and benefiting from transport projects funded by parking revenues can also build public support. Other financial indicators related to expenses, assets, and revenue will demonstrate the financial health of the system, and operations indicators can assure that the program is functioning effectively over time. Examples of operations and financial indicators are included in the table below.

SYSTEM AREA	INDICATOR(S)	ALSO INCLUDE
Operations	Parking events per meter or space (turnover), by day of the week, time of day, month Average occupancy, by time of day Parking search/cruising time and percentage of vehicles cruising Average parking stay Average speed, congestion in the area	Loading and freight management interactions
Payment	Distribution of transactions by payment mode (coin, card, mobile) Parking rate vs. occupancy, by time of day	Valid modes of payment Variable rates (if applicable)
Enforcement	Illegal parking rates Total violations issued, by location	Technology used for enforcement: PDAs, ALPR cameras, mobile applications
Financial	Revenue per meter or space, by area Revenue from enforcement (fines) Capital improvement costs Operating costs	

Cities should decide early on which indicators will be used to determine how well the parking scheme is operating and therefore what data will be reported in the annual report. Data collected using these indicators should not only show which targets are being met but also which are not, and how unmet targets will be improved upon. As part of the annual report development process, the city may consider distributing surveys to the public to assess how they use the system, how their habits may have changed, and how strongly they support different elements of the program.

EVALUATE

ACTIONS & RECOMMENDATIONS

Define indicators that will be used to evaluate impacts of the parking program and related progress toward broader public goals.

Establish a process to collect and analyze data on operator performance to compare against level of service standards.

Publish operations and financial indicators, as well as public support, in an annual report.

4 SUPPORTIVE PARKING ELEMENTS

While not *required* to operate a priced parking program, considering the following supportive parking elements at the outset could help to integrate these more seamlessly into the parking system and yield greater impacts. However, implementing these will likely require additional capacity, technology, and coordination between city agencies.

ROAD SPACE REALLOCATION FROM VEHICLES

Cities with capacity limitations should consider road space reallocation projects, which do not require a lot of capacity to implement, as a first step in de-prioritizing vehicle use and catalyzing a shift to sustainable transport modes. Such projects could include pedestrianization, Complete Streets, transit-priority lanes, and related efforts. Then, parking reform can begin, continuing the momentum toward driving less and generating revenue to expand and improve sustainable transport options. Parking reform supports space reallocation by addressing the narrative of a parking shortage. Both road space reallocation and on-street parking pricing can be implemented incrementally as needed, which may help with political palatability and public acceptance.

CAPACITY REQUIRED

Limited

ROAD SPACE REALLOCATION
More safe, comfortable spaces for people shifts trips to sustainable transport

Fewer trips made by private vehicles

PARKING REFORM
Revenue generated from pricing parking further expands sustainable transport

Even fewer trips made by private vehicles

Robust

CONGESTION PRICING + LOW EMISSION ZONES
A large, high-quality sustainable transport network supports most urban trips

Fewest trips made by private vehicles

INTEGRATION WITH OTHER TRAFFIC REDUCTION STRATEGIES

Cities interested in reducing traffic and vehicle use should consider aligning their on-street parking program with traffic reduction strategies. On its own, a priced on-street parking program may not achieve the air quality, congestion reduction, or mode shift outcomes cities would like to see—especially if parking pricing is only introduced in limited districts or neighborhoods. Integrating priced on-street parking with emissions pricing (low emission zone, zero emission zone) or congestion pricing can underscore a shift to sustainable modes like walking, cycling, and public transport. For example, **Madrid** integrates parking regulations with emissions-based vehicle access restrictions.

In Fortaleza, Brazil, pedestrianization efforts transformed space formerly used by vehicles to safe spaces for walking and cycling.
SOURCE: City of Fortaleza

DEMAND-BASED PRICING

Demand-based pricing enables parking managers to charge a variable, market-based price for parking to manage demand for vehicles and driving. While on-street parking in many cities costs a flat price regardless of location or time of day, demand-based pricing varies based on the location, time of day, and other factors. Because parking is less expensive at certain times (such as off-peak hours on weekday afternoons), drivers are incentivized to make trips during those times. Demand-based pricing makes drivers consider the price of parking, just as they might consider the price of fuel or maintenance when deciding whether and when to drive. This approach not only improves on-street parking performance but can also improve the performance of surrounding streets by reducing incidences of distracted driving while searching for an available space or double-parking.

FLEXIBLE CURB MANAGEMENT

Curb space in cities is becoming increasingly valuable as more and more stakeholders—public transit, ridehail and shared micromobility operators, freight, electric vehicles, and local food-delivery vehicles—vie for access and use. Recognizing this expanding demand for curb space, cities should consider integrating on-street parking rules with a broader set of rules that prioritize curb access for travel—by public transport, personal and shared micromobility, and low emission modes—over vehicle storage. This would include determining which blocks are ideal for designated bus lanes or pick-up and drop-off zones in place of on-street parking, or where charging for curb space based on demand could free up space for the highest-value uses. This can benefit all road users, including drivers, who can be reasonably confident they will find a convenient short-stay parking space when they need it. Active enforcement is a key element of success. Most cities taking action on curb management are working against well-established car cultures and long-held expectations from drivers that on-street parking will be available on nearly every city block. Cities looking to implement a priced parking program for the first time may be able to leapfrog these issues and implement a holistic, flexible curb management strategy from the outset.

On Rua de Galvão Bueno, a main street in Sao Paulo's Liberdade neighborhood, on-street parking has been repurposed as public seating and a wider pedestrian realm.
SOURCE: Alf Rebeiro/ shutterstock

5 CASE STUDIES

5.1 MEXICO CITY

BACKGROUND

In 2007, Mexico City was experiencing an explosive surge in private vehicle use, with car ownership doubling over the previous decade. In addition to increased travel times and congestion, air quality had significantly worsened in conjunction with the rise in car ownership. In 2008, pollution from traffic led to 14,000 deaths, and traffic crashes resulted in 24,000 deaths and nearly 800,000 people injured or disabled.[53] In the decade since, Mexico City has undergone a significant shift in its transportation policy, prioritizing parking policy as a strategy to respond to these road safety challenges and to prevent other issues arising from car-oriented pollution and congestion.

Historically, Mexico City's on-street parking was unregulated. Parking was either free or informally controlled by "*franeleros*"—unregulated valet attendants who often resorted to extortion and were susceptible to bribes and other corrupt activities. Lack of oversight and corruption resulted in widespread public dissatisfaction and low revenues. Addressing parking issues became a major part of Mexico City's transport and mobility reforms: Off-street parking minimums were converted to parking maximums, and an on-street parking management system was piloted. The city government identified areas most impacted by the informal parking culture and most enthusiastic for a formalized parking system. Working with local stakeholders, Mexico City piloted ecoParq in 2011, which integrates on-street parking meters, management, and enforcement into a coordinated neighborhood parking system.

OPERATING STRUCTURE

Mexico City uses **concessions** to authorize private operators to conduct parking operations, including maintenance, customer service, and provision of the hardware and software. The program operates 25,765 on-street spaces across seven neighborhood zones. The city had previously used Temporary Revocable Administrative Permits (PATRs) to establish the priced parking zones and manage the program. Under a PATR, the operator owned the assets for an initial 10-year period. After the first 10 years, the assets transferred ownership to the public sector, at which point PATRs were transitioned to concession agreements. Concession agreements allow private operators to manage daily operations.

Operadora de Estacionamientos Bicentenario (OEB), COPEMSA Metropolitana, Mojo Real estate, and Nueva Generación Estacionamientos won concessions to manage on-street parking in the first three pilot neighborhoods in Polanco. Each of the private operators has a similar contract with the Mexico City government, and they all operate under the umbrella of the ecoParq program. The name "ecoParq" was adopted to differentiate the new priced on-street system from existing parking

Population
(municipal boundary)
8.85 million

Number of priced on-street spaces
25,765

Operating model
Concession agreements

% of trips by private vehicle
23%

53 **ITDP Mexico. 2012.** Transforming urban mobility in Mexico.

operations. It was created to connote a sustainability- and citizen-oriented purpose, in an effort to positively reframe the public's relationship with priced parking. It also simplifies interactions and information exchanges between the public and the program; drivers interact with ecoParq as a whole, not with each individual operator.

Branding all concessioned operators under the ecoParq program also remedied distrust that arose initially from bringing in multiple private operators. When Mexico City launched its parking pricing program, there was backlash when the public learned that several of the operators did not have experience operating parking programs. There was a lack of transparency in how government resources are managed and spent broadly, and community members worried that this de facto privatization would result in operators' prioritizing revenue generation over parking management and neighborhood improvement. To address this, surveys are distributed to assess public opinion and satisfaction with ecoParq.

In Mexico City, some on-street parking spaces were replaced with temporary outdoor seating for restaurants during the COVID-19 pandemic.
SOURCE: ITDP Mexico

FINANCIAL MODEL: REVENUES AND FEES

EcoParq operators receive 70% of total revenues, with the remainder going to the Ministry of Mobility (SEMOVI), which is responsible for the recovery of public space in the neighborhoods.[54] Over the first six years of the program (2012 to 2018), total revenues amounted to nearly MEX $2 billion (USD $94.5 million), from which the city government received nearly MEX $660 million (USD $31.2 million). City-allocated revenues are used for local streetscape improvement projects within the parking districts. Specific projects are determined by the Committee on Transparency and Accountability, which is made up of neighborhood associations, local district leadership, and SEMOVI. In 2019, funds were used to finance sidewalk rehabilitation as well as lighting and planter installation in neighborhoods where ecoParq is operating.[55]

ENFORCEMENT

The enforcement structure in Mexico City is somewhat unique: EcoParq enforcement agents are partnered with a municipal police officer. In some cases, both parties will survey on-street parking together, or the police officer will be "on call" with an ecoParq agent. This structure was designed to limit corruption by establishing an accountability structure between the public and private enforcement representatives. The partnership facilitated stronger parking management, transparency, and compliance. However, the structure has proved expensive to maintain, and the city is renegotiating the revenue structure.

UPDATE ON ECOPARQ

In 2019, the ecoParq program was reevaluated with the intention of scaling up the program and responding to concerns about long-term sustainability. All existing concessions were reviewed as part of this process.[56] The city is also exploring ways to improve data sharing and communication with users.

54 ITDP. 2013. Parking and travel demand management policies in Latin America.
55 Gobierno de la Ciudad de México. 2019. EcoParq public space Projects.
56 Suárez, G. 2019."Gobierno de CDMX revisa concesiones para operación de parquímetros.

5.2 SHENZHEN

Population
12.9 million

Number of priced on-street spaces
800,000

Operating model
Public operation

% of trips by private vehicle
22%

BACKGROUND

From 2009 to 2014, car ownership in Shenzhen rose by 16%, rapidly increasing congestion and slowing traffic to an average of 26 km/h on inner urban streets during peak hours. Insufficient parking regulations further contributed to congestion. An earlier parking management contract had been cancelled, and Shenzhen had free on-street parking with little enforcement for several years, which led to predictable on-street problems. Shenzhen had also set an off-street parking minimum, requiring residential developments to provide 1 to 1.5 car parking spaces per unit (floor area of at least 90 m^2). These requirements generated many parking spaces, particularly in rapidly urbanizing areas of the city where housing developments expanded. Studies link this growth in parking spaces to a significant increase in traffic, congestion, and air pollution issues in Shenzhen.[57] Illegal parking in public spaces such as sidewalks and green belts also remained a challenge.

From 2013 on, major Chinese cities have been implementing significant changes to address traffic issues. These efforts were aimed at reestablishing control and pricing more effectively compared to the earlier contract. While private cars account for only 22% of trips, congestion remains a primary transport issue. Shenzhen's approach to transportation demand management has traditionally been more market-oriented compared to other cities because of the overwhelming number of private parking spaces in the city. Since the majority of parking is offered by property developers, much of the policy attention is focused on private parking development.[58]

OPERATING STRUCTURE

The Shenzhen Road Traffic Management Center and Municipal Commission of Transport collectively manage on-street and off-street parking. The Shenzhen Road Traffic Management Center was established in July 2014 to manage on-street parking and enforcement. On-street parking was divided into zones with varying fees, and in the first two years of the project, the city added and priced 22,000 on-street parking spaces.[59] By the end of 2019, 31,000 on-street parking spaces were in operation. The full plan is estimated to take 330,000 vehicles off the road,[60] and since the pilot project, illegal on-street parking during the weekday evening peak has fallen by 92%. To further curb parking demand and private vehicle use near public transit, off-street parking minimums for residential buildings within 500 meters of rail stations have been replaced with maximums as of 2019. For office and commercial buildings, parking minimums were maintained but maximums are also being adopted.

57   China Association of Automobile Manufacturers. Notice of Shenzhen Municipal People's Government on Implementing Incremental Regulation and Management of Cars.
58   Smart Cities Dive. How China is solving its congestion crisis.
59   Shenzhen Municipal Transportation Committee. 2019. Introduction to the temporary parking project of motor vehicles on the roadside in Shenzhen.
60   Smart Cities Dive. How China is solving its parking crisis: From congestion to sustainable transport.

FINANCIAL MODEL: REVENUES AND FEES

Parking fees are significantly higher than they had been as a result of Shenzhen's reforms. Prices are based on different parking zones and can run as high as 223 RMB (USD $35) for a full workday, which is much higher than Beijing's parking rate of 10 RMB for the first hour and 15 RMB for each additional hour (approximately 115 RMB for a workday). Partly due to public opposition, on-street parking charges have been lowered in the years since the reforms took effect in 2015, particularly in zones Two and Three. In addition, overnight on-street parking became free-of-charge to mitigate parking challenges in some residential areas, especially in older and small neighborhoods.

Parking revenue is collected through a branch of the municipal government. The decision to ensure all revenue is directed to the government was intended to limit any losses that may occur when contracting with a private company, as had been observed in Beijing and Shanghai. Shenzhen's on-street parking program does not use physical parking meters or pay stations at all. Fee payment is managed and issued through the Yitingche ("Easy Parking") mobile app. Yitingche allows drivers to see the location of available parking spaces, provides navigation to a chosen space, and displays the payment amount based on the required parking duration. During its first month of operation, the city provided Yitingche credit to drivers who downloaded the app so that they could get familiar with the new payment system.[61]

WeChat Pay or AliPay, used widely throughout Chinese cities to pay for mobility and other services, can also be used to pay for on-street parking. WeChat Pay is a digital payment system in which customers register their license plates if they choose to use WeChat to pay for parking. Cameras scan cars at parking sites, matching license plate numbers with registered accounts in the WeChat Pay database to settle parking fees. AliPay works similarly, and both systems can work offline without a data connection as well as online. These technologies have reduced the time to process payments from 20 seconds to two seconds, which facilitates faster parking turnover and decreases the number of vehicles and time circling in search of parking. Shenzhen is a young city where access to smartphones is extensive; however, those who do not have a smartphone can pay for parking by calling the parking operator.

ENFORCEMENT

Parking enforcement is conducted using a combination of manual and smart solutions including parking sensors, an on-board tag, and mobile phone applications. Across the four pilot areas—Futian CBD North, Science and Technology Park South, Agricultural Center South, and Hongling—600 enforcement agents, each responsible for 80 to 100 parking spaces, conduct enforcement using PDAs to record parking infringements.[62] Each enforcement agent is provided with an electric bicycle (costing 2,000 yuan) to monitor more ground faster and a camera to document infractions. In the first month of the pilot, enforcement agents registered 26,523 violations. To reduce conflict between drivers and enforcement agents, agents only document evidence of violations or illegal parking and do not clamp or tow vehicles.

61   Ximin, H. 2014. Roadside parking app simple to use.
62   Mobility Transition in China. 2015. Policy evaluation: The impact of parking management in Shenzhen.

5.3 CHENNAI

Population
(municipal boundary)
11.23 million

Number of priced on-street spaces
12,000 (2018 plan)

Operating model
Management contract

% of trips by private vehicle
30%

BACKGROUND

From 1995 to 2015, Chennai's population grew by 70%, and vehicular traffic has risen by 300% in the past 15 years.[63] A 2011 analysis ranked Chennai as the second-highest car-owning city in India, with 127 cars per 1,000 residents.[64] This trend, coupled with virtually free parking, has led to high demand for parking and, consequently, greater congestion. Recognizing the need to curb vehicle use, Chennai began planning for a citywide parking management system covering around 12,000 on-street parking spaces that were previously free-of-charge or unmarked. Chennai's 2018 plan is the first citywide parking management system in India and is ongoing.

The Chennai smart parking system aims to optimize the use of available parking spaces and encourage a shift away from private vehicles and toward sustainable transport modes. Reducing corruption and revenue leakage are also important goals, as corruption has been observed under the previous parking system: The municipal corporation would lease a street to a parking vendor for a lump sum. The vendor then collected cash payments directly from drivers, which made it easy for vendors to misrepresent actual demand and underreport revenue. To reduce this, the new parking system introduced a cashless mobile payment option that produces a record of transactions that can be verified by the city.

OPERATING STRUCTURE

Under the new parking system, management and day-to-day operations are carried out by a private operator. The operator who bid the lowest service charge per hour per parking space was awarded the contract. The city pays the operator a fixed rate per parking space per hour for their services. The operator deploys on-the-ground attendants to collect parking fees, which are deposited in an escrow account. The ownership of the parking spaces remains with the road-owning agencies.

FINANCIAL MODEL: REVENUES AND FEES

In the 2018 parking reform plan, Chennai increased on-street parking tariffs from Rs 5/hour to Rs 20/hour and limited parking to a maximum of eight hours. For each hour paid, the Greater Chennai Corporation (GCC) receives Rs 9.45 and the operator receives Rs 10.55. If the GCC increases parking fees above Rs 20, the service charge for the operator will remain at Rs 10.55 and the rest of the fee will go to the city.

In locations where demand is higher, the rate is Rs 40/hour to encourage parking turnover and discourage long-term parking. The system was changed from post-paid (paying for parking at the end of stay) to pre-paid (paying for the expected amount of time) to ensure a base payment. Vehicles that overstay the allotted time are ticketed.

Chennai does not have on-street parking meters or pay stations. The parking operator uses two applications: one for users to pay for parking,

63   Sreevatsan, A. 2010. 300 percent rise in vehicle population in 15 years.
64   Ghate & Sundar. 2014. Proliferation of cars in Indian cities: Let us not ape the West.

and one for parking attenders (enforcement agents) to conduct enforcement and collect parking fees. The back end of these applications is integrated with a Smart Parking Control Center, and revenue collection details are available in real time and accessible to local authorities. If a user does not have access to a smartphone or does not have the mobile app, enforcement agents can collect cash from them and enter the transaction into the parking attender app. Each parking attender has an e-wallet point of sale device through which parking fees can be paid. There are approximately 58 attendants currently responsible for fee collection.

ENFORCEMENT

In Chennai, the parking operator handles enforcement, from recruiting agents to managing ticketing. Additionally, a camera-based technology system monitors whether on-street parking spaces are occupied or vacant. These cameras monitor approximately 20 to 25 parking spaces each. Parking attenders (enforcement agents) are responsible for educating users not to park in no-parking areas and alerting the local police authorities when wheel clamping or issuing a chalan (parking penalty ticket) to a violating user is necessary. Currently, the Greater Chennai Corporation is in talks with city police to improve parking enforcement and establish revenue sharing. The GCC is creating a parking policy that will address these points.

Chennai's smart parking system is being designed to encourage a shift away from private vehicles and reduce corruption experienced under the city's previous parking system.
SOURCE: ITDP India

5.4 MADRID

BACKGROUND

Following the European Union's 2009 Action Plan on Urban Mobility, Madrid developed a regional Sustainable Mobility Strategic Plan.[65][66] As part of this initiative, Madrid reformed its parking policies and put additional parking measures in place with a goal of cutting carbon dioxide emissions by 20%. While 40% of trips in Madrid are made using a private vehicle, the city has high shares of walking and cycling (35% of trips) as well as public transportation (25% of trips) use. Given that the majority of trips are made by car, many of Madrid's transportation policy reforms focus on promoting vehicle electrification. To encourage electrification of privately owned vehicles, Madrid is taking a demand-management approach— limiting vehicle access to downtown depending on emissions levels (an area known as Madrid Central, shown in gray on the map below). In 2014, the city also added variable pricing based on vehicle emission levels to its existing priced parking program, known as the Regulated Parking Service (SER), to further disincentivize vehicle use in the city center. Importantly, Madrid has pledged to simultaneously expand walking and cycling networks and to improve the availability of public transportation.[67]

Population
(municipal boundary)
3.23 million

Number of priced on-street spaces
83,000

Operating model
Concession agreement

% of trips by private vehicle
40%
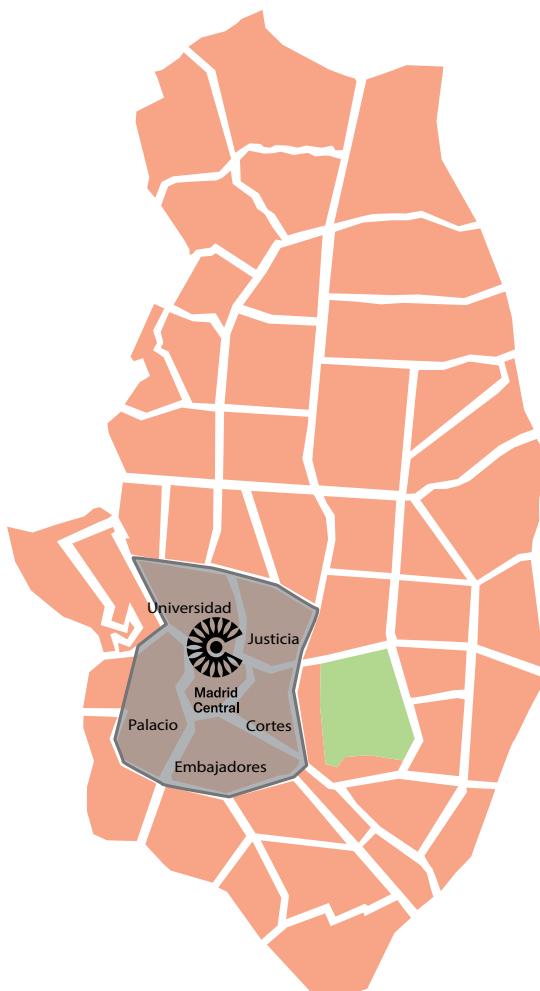
Madrid Central, marked in grey, is a small area of the city where parking and circulation of certain types of vehicles is restricted depending on fuel type.

65 European Commission. 2009. Action Plan on Urban Mobility.
66 EMTA. 2016. The Sustainable Mobility Strategic Plan of the Madrid Region continues to developing measures and proposals.
67 Rodríguez-Pina, G. 2018. Madrid City Hall bans older, more polluting cars from center.

Trends since SER was implemented through 2014 (last available data) show shorter parking stays and fewer vehicles circulating within the priced parking zone, while traffic volumes increased outside the zone.[68] At the same time, instances of double-parked commercial and other vehicles decreased, and space for commercial loading and unloading within the SER zone was more readily available.

OPERATING STRUCTURE

Madrid has a 30-year concession contract with a private operator, Indigo, to manage its parking system. The city is responsible for monitoring system performance, while Indigo is in charge of all daily operations.[69]

FINANCIAL MODEL: REVENUES AND FEES

Residents, people with disabilities, and zero-emission, emergency, and public transit vehicles are permitted to enter Madrid Central without restriction. All other vehicles are subject to entering and parking restrictions within the zone depending on their emissions level, and they are assessed a €90 fine for violating these rules. Vehicles with an ECO sticker (hybrid vehicles) can enter and park within the zone up to a maximum of two hours. Vehicles with a C or B sticker (petrol cars and light-duty vans manufactured after 2000, and diesel cars and light-duty vans manufactured after 2014) are permitted to park in a public lot or garage but cannot park on the street. Older vehicles may not enter the zone. Under the Regulated Parking Service (SER), 4,000 of Madrid's parking spaces have a flat fee, and vehicles are subject to a 10% to 20% discount or surcharge depending on their emissions rating and the occupancy level of the parking area. In other words, a low-emitting vehicle parked in a low-occupancy area will receive a discount on the flat fee while a high-emitting vehicle parked in a high-occupancy area will pay a surcharge. Flat parking rates are slightly higher within Madrid Central compared to the larger SER area.[70]

ENFORCEMENT

Using a single digital platform, cameras monitor all 83,000 parking spaces, reading vehicle license plate numbers and providing real-time data to the city that can be used to monitor performance of the operator and system overall. These cameras also determine the parking rate, which changes based on the occupancy level of the area and the vehicle emissions level. The system has its own mobile application through which drivers can pay for parking and renew their stay if time expires.[71] Drivers can also pay for tickets through the app or at the parking meter, reducing barriers to payment and helping to make it efficient.

68   Ciudad de Madrid. 2014. Informe del estado de la movilidad de la ciudad de Madrid.
69   Indigo Group. Controlled on-street parking in Madrid.
70   Friesen & Mingardo. 2020. Is parking in Europe ready for dynamic pricing? A reality check for the private sector.
71   Indigo Group. Controlled on-street parking in Madrid.

5.5 MOSCOW

Population
(municipal boundary)
12.5 million[72]

Number of priced on-street spaces
89,000

Operating model
Parking authority

% of trips by private vehicle
19%[73]

BACKGROUND

Moscow faced high demand for parking in the early 2000s due to completely free-of-charge parking and a lack of enforcement. This was combined with a shortage of parking spaces (about 1.9 million spaces in a city with about 5 million cars), which resulted in drastic congestion and illegal parking: Drivers regularly obstructed sidewalks, crosswalks, green spaces, and bus stops to park their vehicles.

The city of Moscow sought to address this by establishing a priced on-street parking program in 2012. The city also cracked down on illegal parking, raising fines from 300 rubles (USD $9.20) to 3,000 rubles (USD $92). The parking program covered 558 regulated spaces across 20 downtown streets in the Boulevard Ring during its first year, and it had grown to cover 78,000 regulated spaces as of 2018. The initial regulated zone was expanded to the city's Garden Ring, which surrounds central Moscow, in 2013, and to the Third Ring Road in 2015.[74] By 2015, demand-based pricing was introduced, with different prices set for different parking zones and prices adjusted based on occupancy.

As a result of introducing paid on-street parking in highly congested areas, traffic flows improved by up to 12% and illegal parking fell by 64%.[75] Average vehicle speeds increased from 5km/h to 15km/h.[76]

Since the implementation of the paid on-street parking program, Moscow has also worked to launch a peer-to-peer carsharing program to be fully implemented in 2021 and to add electric vehicle charging at 80,000 parking spots.[77] On-street parking remains free for electric and carshare vehicles as well as for motorcycles.

OPERATING STRUCTURE

Moscow's parking program is managed by Moscow Parking Space Administrator, a state-owned private entity also known as a parking authority. The Moscow Parking Space Administrator is responsible for overseeing all parking infrastructure (including operation of off-street parking lots), managing parking revenues, enforcing parking policies, and administering fines for violations across all eight parking zones.[78]

72   United Nations. 2019. World Population Prospects.
73   Deloitte. 2019. Moscow Mobility Index.
74   Moscow City Government. 2017. Everything you need to know about paid parking in Moscow.
75   McCaslin, H. 2013. Moscow's parking chaos reined in by pricing plan.
76   Now Innovations. 2012. Case study: Moscow.
77   Moscow Parking. Moscow Parking: About a project.
78   Ibid.

Moscow implemented its on-street parking program in 2012, and has since added electric vehicle charging to many on-street spaces.
SOURCE: Alexey Broslavets/ shutterstock

The initial parking pilot that was launched in 2012 aimed to achieve several objectives, which the Moscow Parking Space Administrator continues to pursue, including:

● Improving travel speeds and reducing congestion in parking zones;

● Increasing on-street parking turnover;

● Reducing parking violations; and

● Reducing private vehicle use and promoting public transport use.

The Parking Space Administrator contracts out parking payment to two private firms: Gorparkovki and Now Innovations. Now Innovations has provided parking meter payment solutions as well as mobile-app-based

79   Now Innovations. 2013. Moscow.
80   Gorodskiye Parkovki. 2019. Gorparkovki.

payment and data collection since the start of the pilot in 2012.[79] In 2018, Gorparkovki won a contract to provide a mobile-app-based payment option for off-street surface parking lots.[80]

FINANCIAL MODEL: REVENUES AND FEES

Parking fees are highest in Moscow's central business district (inside the Boulevard ring) at 100 rubles (USD $1.35) or 200 rubles (USD $2.70) per hour. On streets between this area and the Garden Ring road that surrounds central Moscow, parking fees are a minimum of 80 rubles per hour. On more congested streets inside the Garden Ring, the fee is 50 rubles for the first 30 minutes and 150 rubles per hour thereafter to incentivize short parking stays and ensure more turnover.[81]

Pricing previously free on-street parking spaces substantially increased city revenues. In 2013, the first year of nonpilot operation, the program generated 293 million rubles (USD $3.9 million). In 2019, the program generated 4.45 billion rubles (USD $60.1 million). In total, the parking program has yielded 35.6 billion rubles (USD $482 million) from the pilot launch in 2012 through 2020.[82]

Operating costs are financed from the Moscow city budget, and all parking revenue is directed back to the city budget. Revenue totals from each parking district are reported and then multiplied by a population coefficient for each district, resulting in the amount of revenue allocated back to each district. Each district has an executive body, or "*uprava*," which uses the revenues for improvements within the district. Decisions about which projects receive funding from parking revenues are made cooperatively by the *uprava*, referencing local plans, and elected district representatives. Parking revenues have been used to improve and maintain parks, squares, boulevards, and other public spaces; improve access for people with limited mobility; and improve and maintain streetscapes, among other uses.

ENFORCEMENT

Moscow utilizes 350 enforcement officers, 370 vehicles, and 115 CCTV cameras to conduct parking enforcement. The city also uses multiple smart solutions to amplify its parking enforcement.

Moscow has installed more than 12,000 on-street sensors. These sensors are attached to a mobile parking application that allows drivers to locate available parking spaces. The government also uses the sensors to gain insights into parking behavior and to identify parking infringements more easily.[84]

The city is also piloting the use of an autonomous scan car for enforcement, which operates along the Garden Ring and scans approximately 1,000 cars per day. The government announced the autonomous scan car project soon after declaring plans to launch a peer-to-peer carsharing program. These programs are part of Moscow's strategy to reduce both single-occupancy vehicle trips and car ownership.
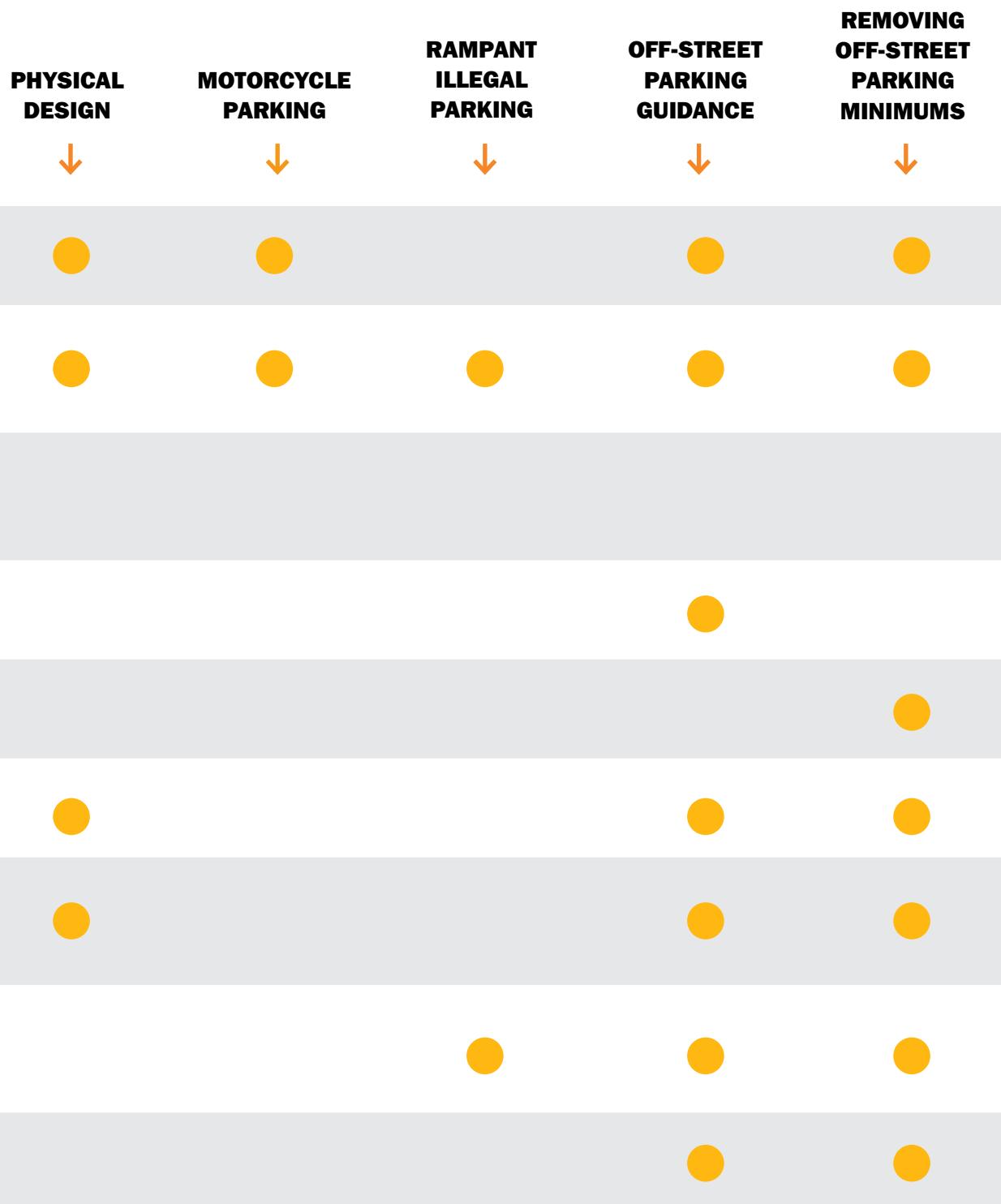
81   Moscow Parking. Rates and rules for paying for parking in Moscow.
82   Moscow Parking. Moscow parking: Where does the money go?

6 APPENDIX

6.1 PARKING RESOURCES MATRIX

	GOAL-SETTING ↓	SETTING FEES ↓	ZONING REFORM ↓
Parking Policy in Asian Cities by Paul Barter (ADB)		●	
On-Street Parking Management: An International Toolkit by Paul Barter (GIZ)	●	●	
Demand-Based Parking Case Studies by Paul Barter		●	
Parking Pricing Implementation By Todd Litman		●	●
High Cost of Free Parking by Donald Shoup	●	●	
Parking and the City by Donald Shoup	●	●	
Parking Management Best Practices by Todd Litman	●	●	
Parking: An International Perspective by multiple authors		●	
Parking Reform Made Easy by Richard Willson	●	●	●

	PHYSICAL DESIGN	MOTORCYCLE PARKING	RAMPANT ILLEGAL PARKING	OFF-STREET PARKING GUIDANCE	REMOVING OFF-STREET PARKING MINIMUMS
	●	●		●	●
	●	●	●	●	●
				●	
					●
	●			●	●
	●			●	●
			●	●	●
				●	●

6.2 ITDP PARKING RESOURCES

Ideas to Accelerate Parking Reform in the United States
Martha Roskowski and ITDP US, 2021

Parking Basics
ITDP India, 2015

Parking Guidebook for Beijing
ITDP China, 2015

Less Parking, More City
ITDP Mexico, 2014

Parking Guidebook for Chinese Cities
ITDP, 2014

Impacts of the ecoParq Program on Polanco
ITDP Mexico, 2013

Implementation of Parking Meters in Hipodromo: Baseline Study
ITDP Mexico, 2013

Parking and TDM Policies in Latin America
IDB and ITDP, 2013

Europe's Parking U-Turn
ITDP, 2011

CONTACT

ITDP

**Institute for Transportation
& Development Policy**

9 E. 19th St, 7th Floor
New York, NY 10003

P: +1 212-629-8001

M: mobility@itdp.org

W: www.itdp.org