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A Community of Transportation Professionals



CURBSIDE MANAGEMENT PRACTITIONERS GUIDE

ACKNOWLEDGMENTS

The development of this resource was undertaken by the Institute of Transportation Engineers (ITE) Complete Streets Council in response to widespread interest in the designation and optimization of curb space to accommodate the needs of all users. The purpose is to outline a decision-making framework that can be applied across a broad spectrum of locations and contexts.

New curbside management concepts are continually being brought forward in a variety of forums. We encourage readers to consider innovative treatments while also evaluating tested strategies implemented by other cities.

Given the rapid evolution of curbside management practices, readers should follow new developments and ITE's ongoing efforts to keep its members "in the know" in this field. This resource will be regularly updated to incorporate newly accepted strategies as well as provide additional case studies investigating implemented and tested treatments.

The Institute of Transportation Engineers would like to thank the following four individuals for serving as the primary authors of this document:

Meghan F. Mitman, Fehr & Peers, Walnut Creek, CA

Steve Davis, Fehr & Peers, San José, CA

Ingrid Ballús Armet, Fehr & Peers, San Francisco, CA

Evan Knopf, Fehr & Peers, Walnut Creek, CA

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Primary input on the goals and direction of the resource was provided by a steering committee consisting of the above authors as well as the following collaborators:

Larry Marcus, Wallace Montgomery, Tysons, VA

Matthew Roe, NACTO, New York, NY

Moira Dhaliwal, The Bernstein Companies, Washington, DC

Behnaz Razavi, Sabra & Associates, Vienna, VA

Jeff Lindley, ITE, Washington, DC

A number of contributors provided oversight and technical review during the development of this document, including the following:

Josie Ahrens Walk SF	Fabian Gallardo San Francisco Municipal Transportation Agency (SFMTA)	Taylor McAdam Fehr & Peers	Catherine Prince City of Fort Lauderdale	Mary Catherine Snyder SDOT
Adam Cohen University of California (UC) Berkeley	Martin Guttenplan CDM Smith	Peter Martin CDM Smith	Alex Rixey Fehr & Peers	Aaron Villere NACTO
Mike Dannemiller RBA Group	Alex Jonlin SFMTA	Jodie Medeiros Walk SF	Debs Schrimmer Lyft	Shivam Vohra SFMTA
Peter Day Lyft	Andy Kosinski Fehr & Peers	Dan Nabors Arlington County, VA	Susan Shaheen UC Berkeley	Jerry Walters Fehr & Peers
Stephanie Dock District Department of Transportation (DDOT)	Steve Lavrenz ITE	Jamie Parks SFMTA	Meghan Shepard Seattle Department of Transportation (SDOT)	Ryan Westrom Greenfield Labs, Ford Smart Mobility
		Benito O. Pérez DDOT	Amy Smith Uber	Allison Wylie Uber



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(Source: Adam Coppola Photography)

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INTRODUCTION

Curb space is where movement meets access. However, this valuable and flexible public space is not always optimized for its highest and best use. Curb space can be used not only as car parking and loading, but also as the front stoop, sidewalk café, transit hub, freight delivery zone, taxi stand, rain garden, or trash collection area. It serves many purposes throughout the day and makes possible the exchanges and interactions that occur on great streets. Curb space has historically been a reliable revenue source for municipalities through parking fees, and a key indicator for real estate and retail value. The curb space is usually contested; reassigning curb space for new purposes is often politically fraught, in part because use of the curb is competitive and viewed as zero-sum.

The conversation about who controls the curb is quickly shifting in cities and towns. For several decades, curb space uses and regulations have been assembled piecemeal in response to property and business

owners, and overwhelmingly allocated to private vehicle storage. The proliferation of shared mobility options like bike share, for-hire vehicles companies, micro-mobility modes, and e-commerce package deliveries has intensified demand for curb access, and thrown into sharp relief the urgency of managing curb space as a public asset. Shared active transportation has illustrated the need to build safe and comfortable bicycling and walking infrastructure, while for-hire vehicle companies have created both new transportation options and a new set of challenges pertaining to curb access and congestion management.

These rapidly expanding markets have exposed significant new challenges that must be addressed through planning, design, and policy. Public agencies must take proactive steps to design, measure, price, and manage their curb space, and they must do so in collaboration with transit agencies, private mobility operators, tech sector innovators, and key local and governmental stakeholders. Engineers and planners



PLANNING CONSIDERATIONS

Overview of Competing Needs and Synergies Between Modes

Curbside management is fundamentally about creating an organization scheme that improves mobility and safety for all via prioritized and optimized curbside space use.

Curbside management exists at the nexus of transportation, land use, and economic development. Its complexity arises from interlocking demands that are both political and logistical, weaving together a dense set of challenges including multimodal safety, ADA compliance, parking policy, congestion and trip generation, urban freight movement and delivery, and emerging mobility options. Managing curbside space effectively requires matching regulations and operations to clear policy goals: universal access; sustainable ecosystems; resilient economies; and a safe, reliable, and equitable transportation system.

Curbside space is flexible—while physically moving the curb usually requires expensive capital construction, curbside use can be changed quickly, temporally, and iteratively. Planners and engineers have a diverse toolbox available to address the dynamic challenges of curbside management. “Paint-and-plastic” treatments can establish safer places to bike and more efficient routes for transit quickly and at relatively low cost. Low-tech signage and high-tech apps are in widespread use to establish priority access by time-of-day, such as off-peak freight delivery and peak-hour transit. Accurate pricing for curbside use is critical to managing demand and congestion, and designation of loading and parking zones can help to organize emerging mobility options like dockless bike share and e-scooters, as well as for-hire vehicle pick-ups and drop-offs.

Essential Right-of-Way Functions

As a step in that process, the most critical uses for the right-of-way at the project locations should be determined. As part of its curbside management efforts, the [City of Seattle](#) has defined the following six essential functions of the public right-of-way:

Mobility – The movement of people and goods, including sidewalks, bicycle lanes and protected bikeways, dedicated bus or light rail/streetcar lanes, and general purpose vehicular travel lanes.

Access for People – People arriving at their destination or transferring between different modes of transportation. This includes transit stops, passenger loading/unloading zones, taxi zones, short-term parking, bicycle parking, and curb extensions.

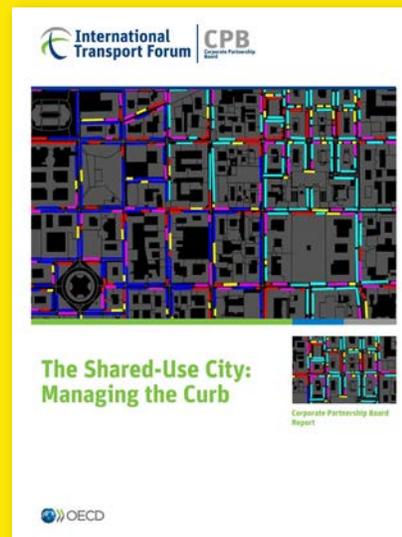
Access for Commerce – Goods and services reaching their customers and markets primarily through commercial vehicle or truck loading zones.

Activation – Provision of vibrant social spaces that encourage people to interact and congregate. Uses that drive activation include food trucks, restaurant patios or sidewalk cafes, parklets, public art installations, seating, and street festivals (including farmers markets).

Greening – Enhancements to aesthetics as well as environmental health via such accoutrements as planted boulevard strips, streets trees, planter boxes, rain gardens, and bio-swales.

Storage – Provision of storage for vehicles and equipment, including bus layover spaces, reserved spaces for specific uses such as police or government vehicles, short-term vehicle and bicycle parking, longer-term on-street parking, and construction vehicles.

Understanding the potential uses of the right-



The Shared-Use City: Managing the Curb

[This paper](#) from the International Transport Forum provides an overview of curbside management challenges with which cities around the world are increasingly faced as new shared mobility services and urban goods deliveries increase. Through quantitative modeling and experts' input, ITF analyzed the relative efficiency, contribution to city policy objectives, and implications on city revenues of shifting curb space use away from parking towards passenger and commercial loading. The report suggests that curb space should be flexible and dynamic to adapt to different uses and users, including new mobility services such as for-hire vehicles, over the course of the day. Finally, the model showed that, when for-hire vehicles have better access to the curb, pressure on traffic could decrease as the percentage of shared rides increases.

Essential Right-of-Way Functions

Function	Definition	Uses
Mobility	Moves people and goods	Sidewalks Bus or streetcar lanes Bike lanes General purpose travel lanes - includes freight Right-or left-turn only lanes
Access for People	People arrive at their destination, or transfer between different ways of getting around	Bus or rail stops Bike parking Curb bulbs Passenger load zones Short-term parking Taxi zones
Access for Commerce	Goods and services reach their customers and markets	Commercial vehicle load zone Truck load zone
Activation	Offers vibrant social spaces	Food trucks Parklets and streateries Public art Seating Street festivals
Greening	Enhances aesthetics and environmental health	Plantings <ul style="list-style-type: none"> • Boulevards • Street trees • Planter boxes Rain gardens and bio-swales
Storage	Provides storage for vehicles or equipment	Bus layover Long-term parking Reserved spaces (e.g. for Police or other government use) Construction

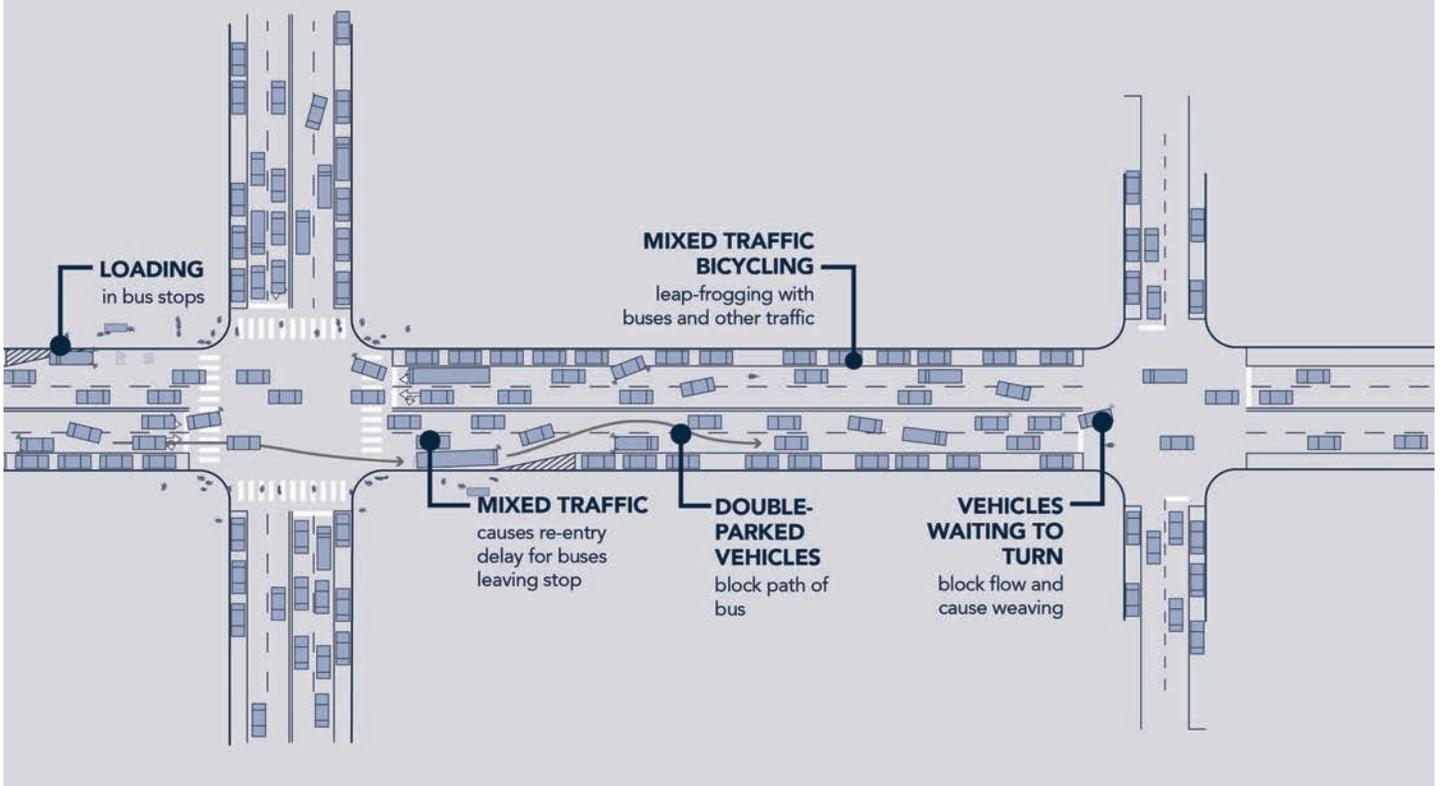
Primary right-of-way functions identified by Seattle Department of Transportation.

of-way allows agencies to evaluate the relative merits of potential improvements as well as to understand which users stand to benefit from their implementation. While the City of Seattle provides

a comprehensive framework, each agency must identify its own needs, priorities, and goals in identifying its primary right-of-way functions.

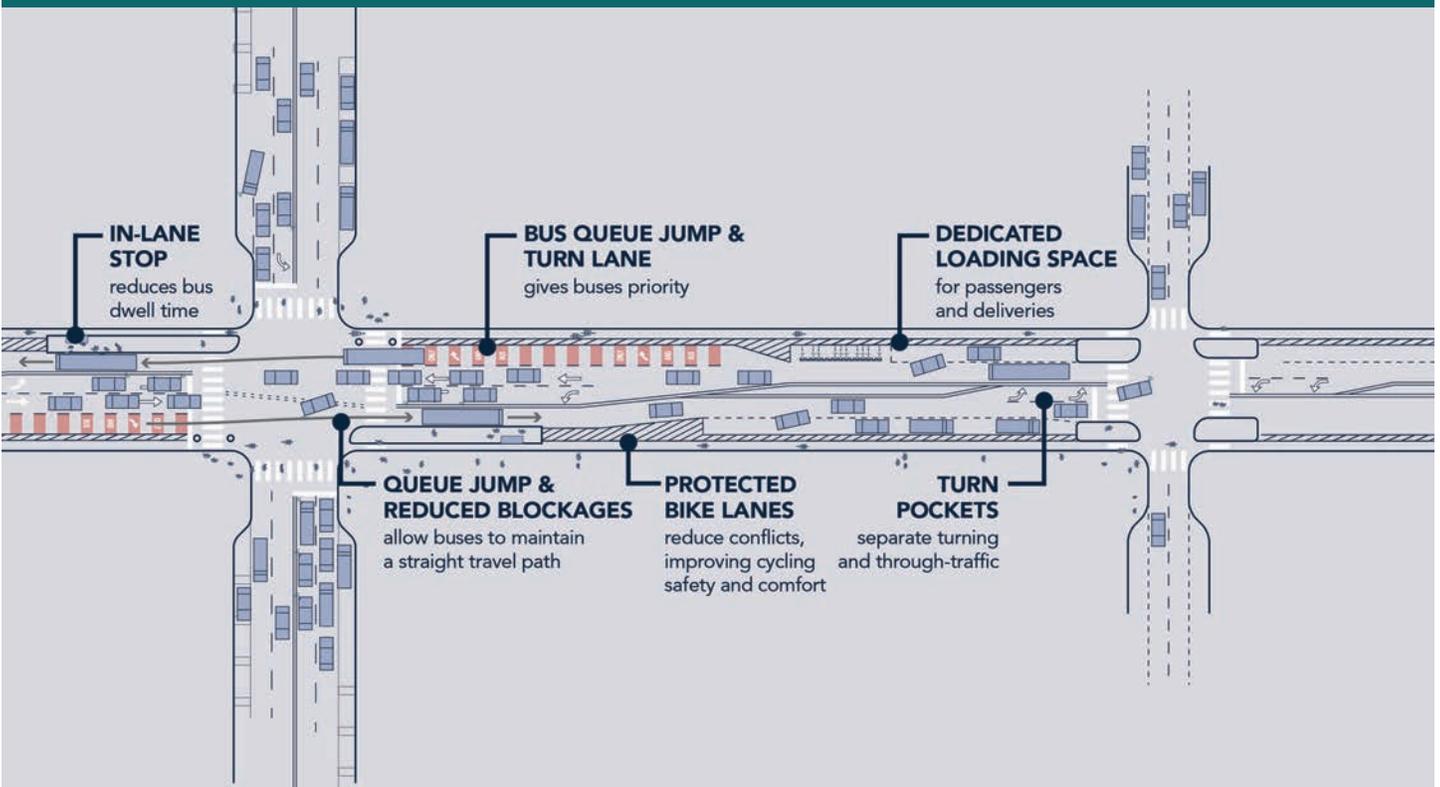
BEFORE

Unorganized streets cause friction between vehicles and reduce transit reliability due to blockages.



AFTER

Organizing a street and curb space allows more efficient flow & operations for both transit and general traffic.



(Source: NACTO Curb Appeal)

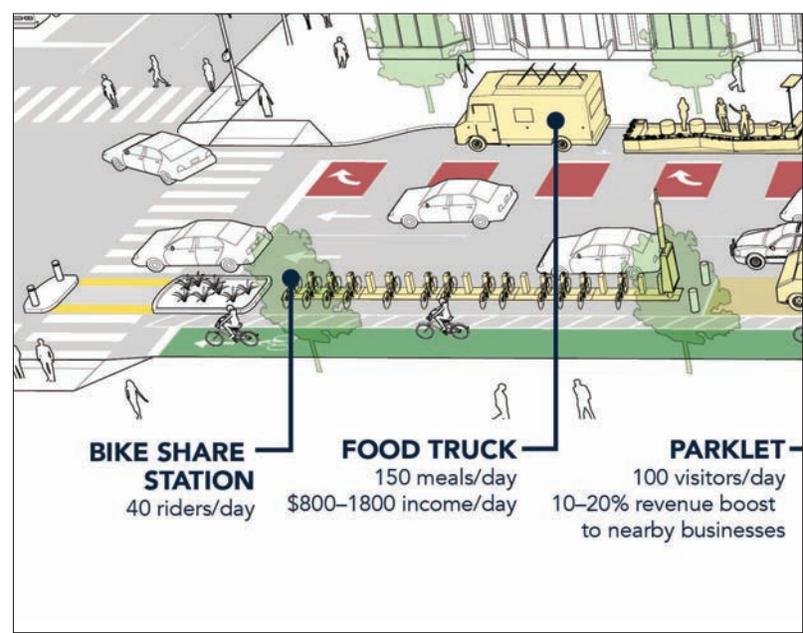
AVAILABLE TOOLS AND TREATMENTS

A vast array of tools and treatments are available to reallocate precious real estate within the public right-of-way. These create a toolkit of treatment options which agencies can use — and expand upon — as they undertake the planning and implementation of curbside management strategies. These tools generally address the following considerations and right-of-way uses:

- Planning and Implementation
- Access to Loading/Unloading Zones
- Parking
- Transit
- Bicycle
- Pedestrian and Activation

Productivity of right-of-way for different uses.
(Source: NACTO Curb Appeal)

The toolkit described here is intended to serve as a reference during the treatment selection process, but no single treatment is likely to result in significant change in use of the right-of-way on its own. These treatments are intended to be used in coordination and/or combination with one another to serve the land uses, activity demands, and modal priorities identified within a curbside management plan.



Planning and Implementation

Tools to facilitate planning and implementation, though not necessarily directly visible as part of the final project, can be crucial to the successful execution of a curbside management strategy. The approaches described below can serve to streamline the process of evaluating and communicating potential curbside management treatments.

Flex Zones

Rather than designating fixed uses for all portions of the roadway, agencies can designate flexible areas – called “flex zones” – to accommodate different right-of-way functions along segments of the roadway. Flex zones can be used to serve different purposes through the following types of implementation:

- Multiple functions served simultaneously in the same space, such as in combined commercial and passenger loading zones
- Different functions served at different times in the same space through time-of-day restrictions, such as a peak-period travel lane which is used for off-peak loading or parking
- Multiple functions served simultaneously in different spaces along the road, such as the conversion of some on-street parking to provide designated loading zones, parklets, and curb extensions along the curb on the same block face

The implementation of flex zones allows efficient use of the curb space and entire roadway based upon the varying demands at different times and

locations. This is especially beneficial for highly peaked curbside demands.

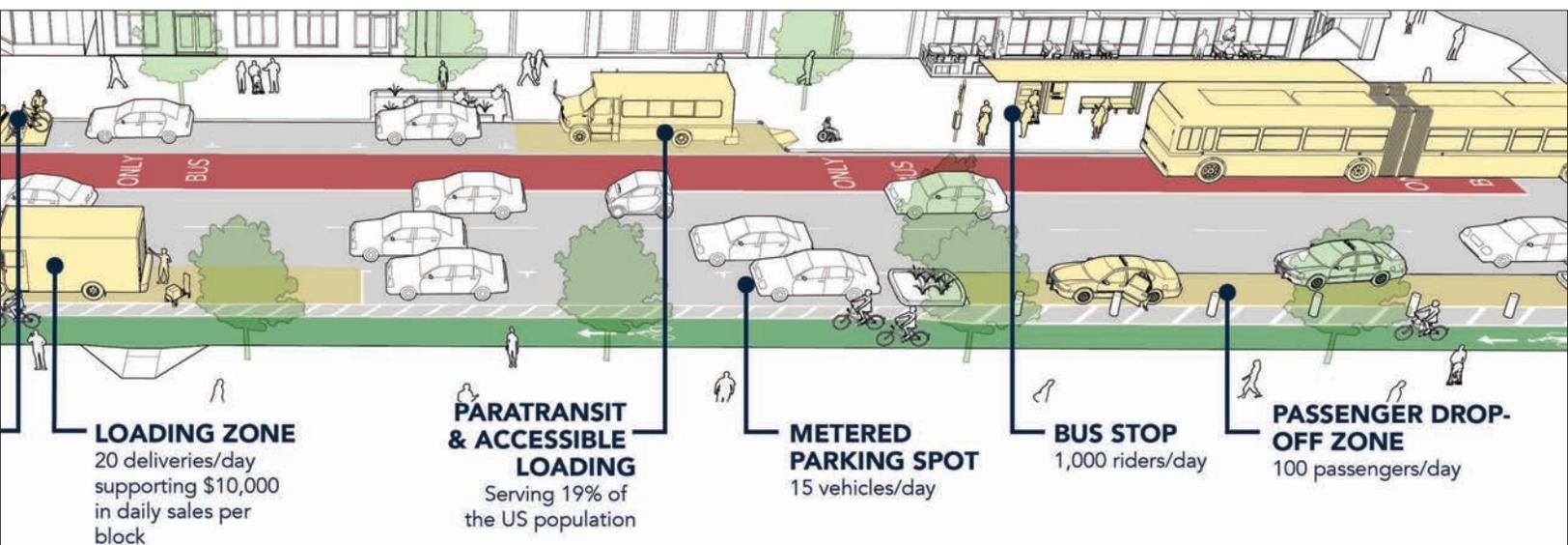
Layered Network Approach to Modal Prioritization

A common issue that results in congestion and crashes in dense urban cores is the interplay of different modes and uses attempting to utilize the same space on the same roadway. A layered network approach promotes the designation of different priorities along different segments in close proximity to one another with the goal of allowing the overall network to serve all users effectively even though any given individual roadway segment may not. An example of this approach would be the designation of a roadway corridor to prioritize transit and transit-supportive modes while identifying separate parallel corridors to prioritize vehicular throughput and access needs, respectively.

Living Previews

“Living previews” are the temporary installation of some or all of a proposed improvement project. Also known as pop-ups, living previews allow residents to observe, interact, and comment on the project in a manner that typically yields greater participation and better represents the proposed treatments. Staff can be present on-site to collect real-time feedback from participants in the living preview during anticipated times of high participation.

Treatments which make ideal candidates for living previews include protected bicycle facilities, curb extensions, parklets, roundabouts, and road ‘right-





Living preview of protected bikeway and parklet on Taylor Street, San Francisco, California.

sizing' projects. In San Francisco, a series of curbside management treatments such as commercial and passenger loading spaces, separated bikeways, and parklets were tested through a living preview along a segment of Taylor Street as a key component of the [SF Vision Zero Plan](#) (Vision Zero SF).

Living previews have a great deal of benefit for technical stakeholders, including agency engineering staff, as on-the-fly design modifications can be made to ensure the proposal operates as well as possible. They can allow for coordination and testing of actual design vehicles with emergency service providers. Project evaluation can also be done during the living preview event to collect data on how the facility is used, including speed data, volumes, and community preference and perception.

Access to Loading/Unloading Zones

One of the most fundamental goals of a curbside management plan is to maximize efficiency of the roadway by streamlining access to the curbside for

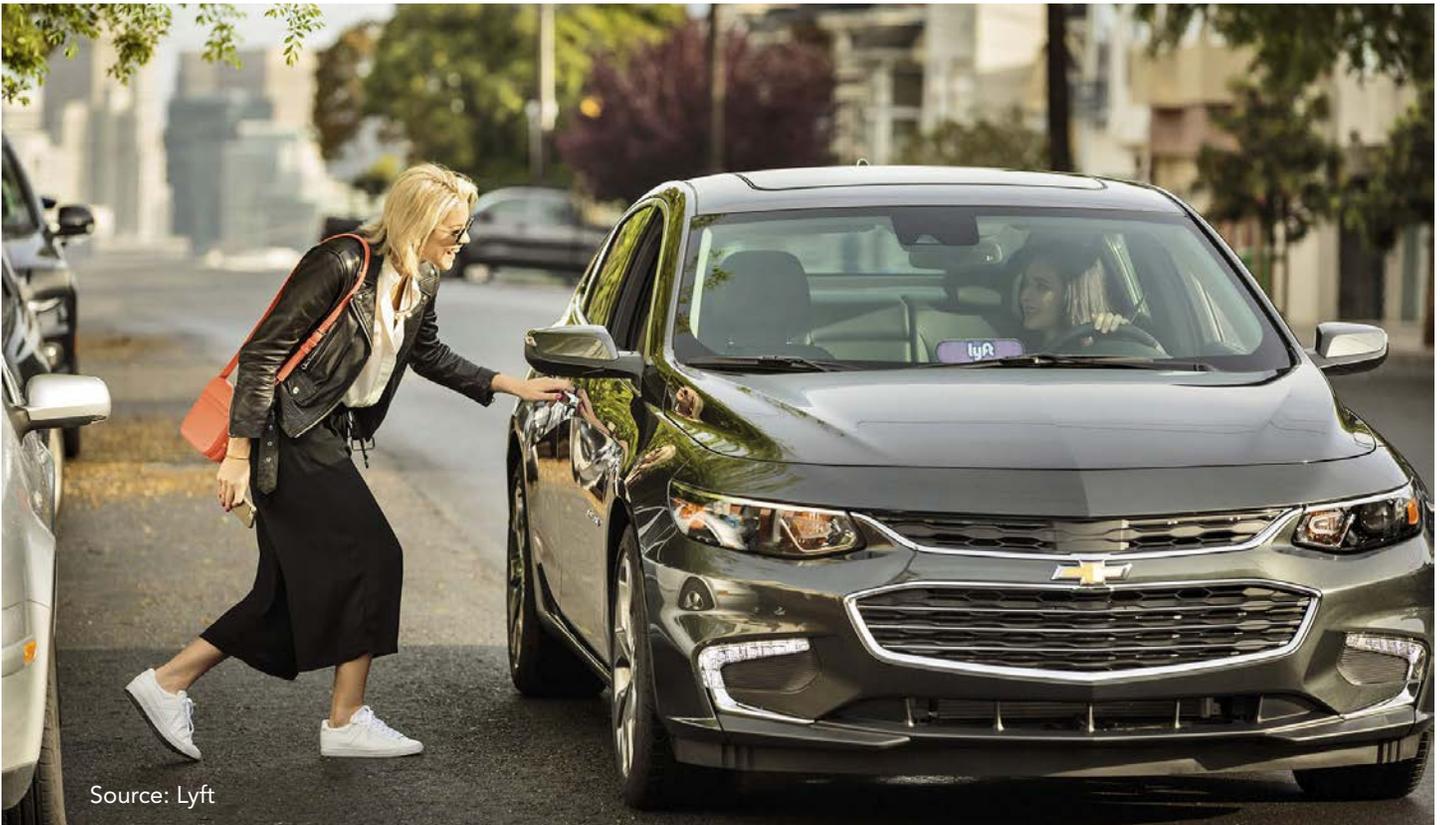
loading and unloading activities. Some strategies for de-cluttering loading/unloading zones are unique to passenger access or freight access, but many are simultaneously applicable to both in most contexts.

Passenger Access

Access to the curbside for passenger pick-up and drop-off activities has long been an important consideration in the built-up areas. Once primarily an issue for taxis, the growth of for-hire vehicle activity and forthcoming automated vehicle demands make the provision of adequate passenger loading and unloading zones critical to a curbside management plan.

Identifying Demand for Passenger Loading/Unloading Space

A growing problem in many cities is the need to determine the demand for curb space associated with passenger loading and unloading activities, particularly in central business districts and other popular locations. Observations of pick-up and drop-off activity, specifically focused on driver and



Source: Lyft

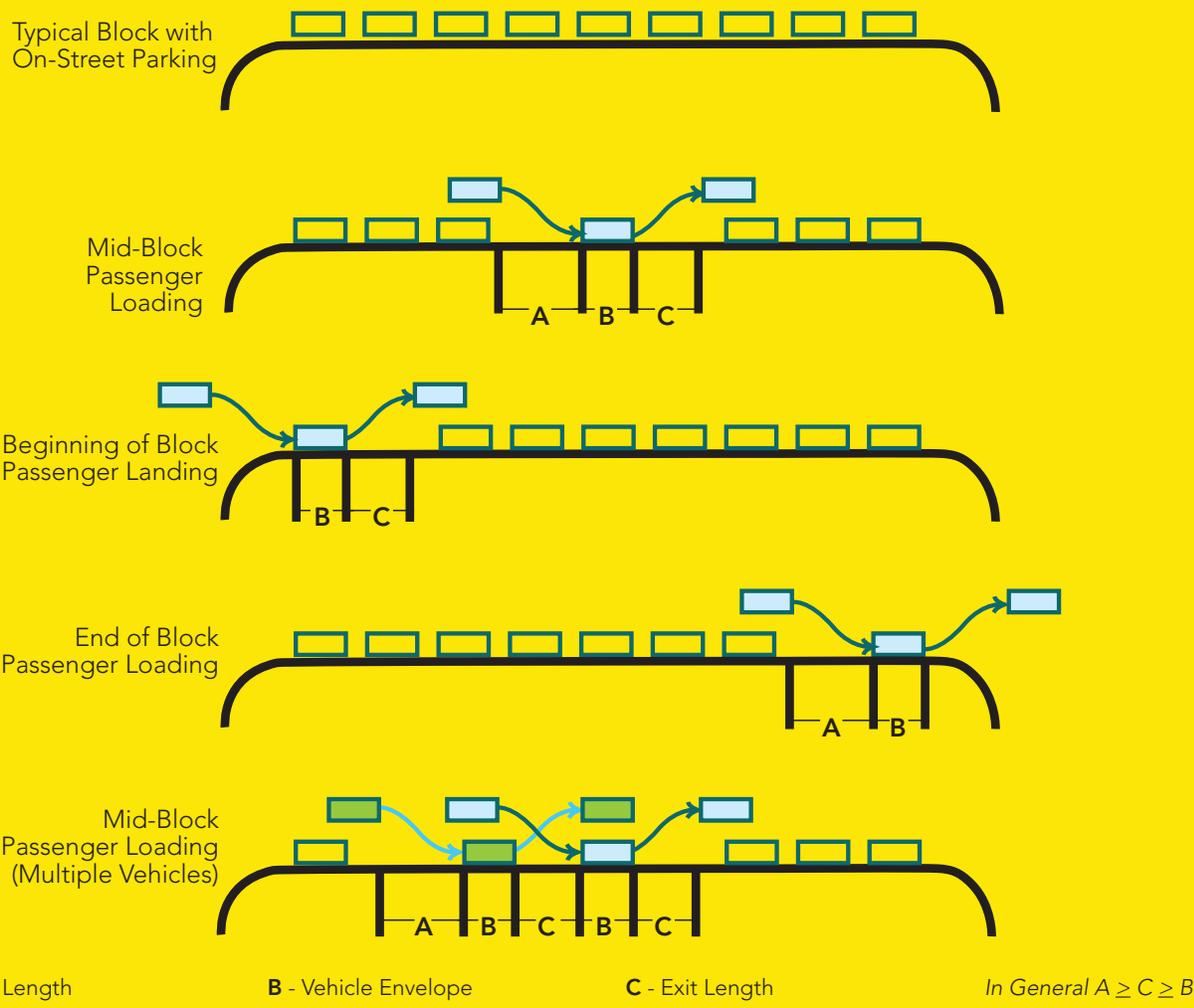
passenger behavior, can be critical to understanding on-street interactions near high-demand generators such as transit centers and major event venues. Automated (video) data collection over an extended period of time can allow agencies to establish a record of activity and, where feasible, coordination with taxi and for-hire vehicle companies can yield critical data on demand and ridership. Ultimately, understanding the level of demand at a given location can assist agencies with the designation of curb space based on evolving need and curb space value, and could potentially lead to the establishment of geofencing in coordination with for-hire vehicle companies. It is anticipated that new tools for understanding local demand will continue to develop as transportation planners increasingly rely on data from cell phones or local sensors.

Geofencing for For-Hire Vehicles

To facilitate pick-up and drop-off zones in areas of high activity or constrained curbside access, for-hire vehicle companies have used geofencing — the creation of a virtual geographic boundary — to make it easier for drivers and riders to locate one another



Sign at Chicago's O'hare Airport directing passengers to for-hire vehicle pick-up location.



Curb space required for passenger loading in different configurations.

during the pickup process. This is particularly useful in high-demand destinations such as performing arts venues, stadiums, and others. Geofencing can be used to direct for-hire vehicle drivers and riders to pick-up and drop-off zones, call attention to restricted areas for drivers and customers, and reduce impact on surrounding neighborhoods and arterials.

Digital infrastructure such as geofencing is frequently utilized at airports, transit centers, and major event venues to enable riders and drivers to more easily locate one another and guide interactions between for-hire vehicles and other transportation modes. For example, in the San Francisco Bay Area, geofencing is regularly used at commercial service airports as well as 4th and King Caltrain Station, and was also implemented temporarily at event site for the Super Bowl in 2017 (Moon, 2017).

Freight Access

Reliable access to freight loading and unloading is important to facilitate commerce and avoid blockages to travel lanes due to undesirable truck stopping. This is especially true with the growth of internet retail spurring increases in package shipments which is creating significantly greater demand for delivery access. As a result, it is becoming increasingly important to designate loading zones not only in commercial or industrial areas, but also in residential areas where the frequency of package deliveries may result in blockages for other curbside uses. The strategies included here seek to take advantage of alternate delivery strategies and schedule flexibility to ensure availability of curbside space for freight activity when it is needed.



Source: Seattle Department of Transportation

Freight Zone Pricing

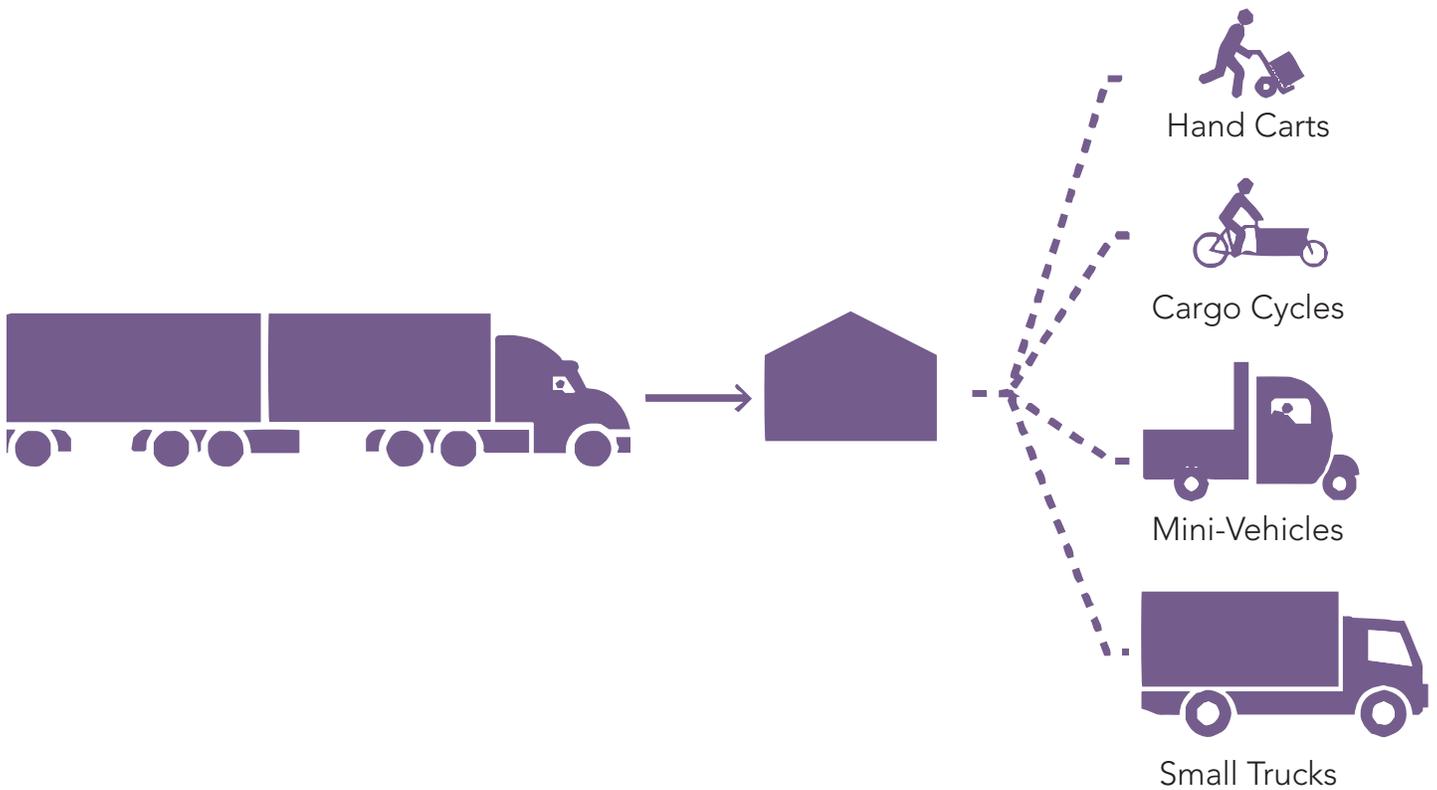
Implementation of paid access to freight loading and unloading zones can be a means to both reduce the duration of occupancy and ensure that these zones are more frequently unoccupied when needed. The District of Columbia now utilizes paid permit control allowing commercial vehicles to park in loading zones during designated time periods while still allowing vehicles to pay for loading space upon parking via mobile service or smartphone application (GoDCgo, 2018). Although the proposal to charge commercial vehicles for use of loading zones was initially met with pushback, the District has found that delivery companies are willing to pay for the reliability that the real-time app provides, given the time savings and reduction in parking violations.

Off-peak Delivery and Congestion Pricing

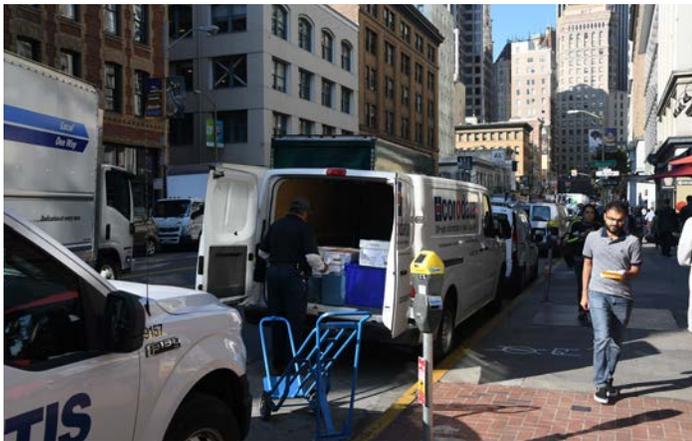
As a means of mitigating demand at peak periods, some cities have attempted to encourage off-peak delivery for businesses in central districts. To achieve increases in off-peak delivery, cities such as New York worked with delivery companies and businesses to address the economic and logistical factors that lead

to increased delivery during peak periods. New York City implemented programs to encourage off-peak delivery that included charging delivery vehicles up to \$20 at both critical points of entry into Manhattan — such as the Holland Tunnel and Tappan Zee Bridge — as well as working with individual receivers to switch delivery to off-peak periods in Manhattan in a [pilot study by NYC DOT](#) (NYC DOT, 2010). The program worked on the theory that this congestion price would encourage delivery companies to work at off-peak periods and thus reduce congestion.

Shifting delivery hours tended to be most viable for large, chain businesses as well as businesses with extended opening hours. Delivery carriers specifically noted beneficial effects from off-peak delivery, including better availability of parking, lower congestion, less stress from driving, faster travel times, and less time required to complete delivery routes. Receivers notably experienced higher capacity to work with customers during peak periods. This is due to staff being available to work with customers as opposed to coordinating delivery during peak periods (NYC DOT, 2010).



Function of urban consolidation centers (Source: [NACTO Urban Street Design Guide](#))



Delivery Vehicle Staging Zones

Dedicating time-limited on-street space to next-in-queue transport trucks waiting to access single access off-street loading/unloading points in high demand building locations can reduce incidents of large vehicles illegally stopping and blocking lanes or, alternatively, circling around the block unnecessarily awaiting the next-in-queue opportunity. Toronto is currently evaluating the implementation of delivery vehicle staging as part of its [Curbside Management Strategy](#) (2017).

Urban Consolidation Centers for Last Mile Delivery

Within many urban areas, issues related to “last mile” deliveries (or the trips from distribution centers to final locations) are well-documented as sources of conflict over road space. The expansion of use of e-commerce technology coupled with higher residential and job densities exacerbates this problem. Cities around the world have dealt with this issue through innovative approaches incorporating multimodal connections and new approaches to urban distribution hubs. Urban Consolidation Centers (UCCs) are Public Private Partnerships (PPPs) that operate to address the issue of urban distribution hubs and last-mile deliveries through addressing redundancy in delivery services within specific neighborhoods, high numbers of low-volume deliveries made to the same location via different delivery services, and dwelling times at loading zones. These are primarily partnerships between municipal governments and delivery companies. UCCs typically do this by consolidating packages from multiple delivery firms and distributing them for last mile deliveries via smaller, low-emission vehicles.



Delivery vehicles and buses compete for curb space in Berkeley, California.

Passenger and Freight Access

In many cases, greater duration and/or reliability of passenger and freight access may be an acceptable tradeoff for slightly reduced proximity to the ultimate destination. The strategies below take advantage of this flexibility to reduce the utilization of right-of-way on more active corridors for loading activity.

Moving Loading and Access around the Corner

Transit vehicles and bicycles typically utilize the curb space for very short durations relative to other modes, but due to greater per-user efficiency and lesser impact on the transportation network, are often prioritized on major corridors in curbside management strategies. Uses such as freight and passenger loading and short-term parking are also important, but can sometimes be accommodated on adjacent blocks or streets from their destination depending on identified modal and access priorities.

As such, rather than attempting to serve all curbside uses directly in front of each adjacent land

use, cities can identify a reasonable proximity for loading and unloading access to each individual destination. This can allow curb space on main streets to be designated for high-turnover parking uses as well as the most efficient uses in terms of person throughput, such as transit, or community activation needs, such as parklets. There may be special considerations for people with disabilities and others who require direct access to the curbside in front of a specific location.

The growth of package deliveries has created a notable increase in demand for freight loading zones. In dense residential areas, it may be desirable to locate these loading zones away from key transit or bicycle corridors in favor of locations where longer-duration access to the curbside can be provided without resulting in blockages. Many delivery drivers will prefer reliable, legal access to a slightly more distant dedicated loading space over the option of parking illegally closer to their destinations.



MOVING LOADING AND ACCESS AROUND THE CORNER

“Surveys of nearby businesses and institutions are a way to identify freight and private-passenger loading needs, potentially finding patterns that curbside space allocation based solely on land use might not identify. Forming partnerships with local business, delivery services, and other street users can be important to collecting data that allows planners to determine how to best accommodate loading and deliveries without blocking other street users.”

(NACTO, 2017)



Parking

To reduce blockages of bus lanes, bicycle facilities, and crosswalks by double-parked vehicles, curb space regulations can put a price or a time limit on convenience. Studies have indicated that nearly half of local vehicle traffic volume may be made up of drivers cruising for parking in some downtown areas (Shoup, 2006). Reliable availability of parking can be pursued by assigning curb space dynamically according to time, price, and demand. These strategies allow cities to provide parking spaces where they are most needed while reducing congestion caused by cruising and potentially decreasing overall parking supply.

“The mismatch between supply and demand for both business-oriented and residential parking is at the root of lane-blocking spillover, and is also a cause of the sometimes intractable politics around parking.”

(NACTO, 2017)

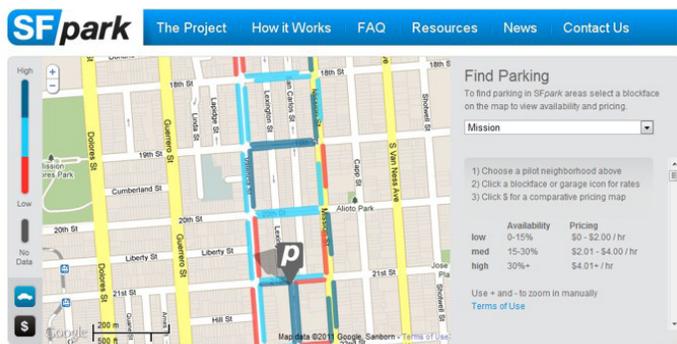


Smart parking meters allow adjustments to rates by time of day.

Demand-Based Pricing

Adjusting paid parking rates for peak times, special events, or real-time demand can reduce cruising by making it easier for drivers to find parking at peak times while potentially allowing drivers to pay less for parking during off-peak periods. For example, the ParkSmart program

SFpark Dynamic Parking



A demand-responsive parking pricing program in San Francisco, SFpark began in 2011 as a pilot aimed at opening up parking spaces on each block to reduce circling and double-parking. The pilot was implemented in some of the most congested areas of the city, including the Financial District, and required the installation of new meters and parking occupancy sensors. In the program, rates may vary by block, time-of-day, and/or day-of-week. Based on the results of the pilot, demand-responsive parking has been implanted citywide in San Francisco.

(SFMTA, "DEMAND-RESPONSIVE PARKING." 2018).

In New York City increased peak period parking rates on a highly-trafficked neighborhood street while maintaining lower rates during portions of the day with less demand. Post-implementation evaluations indicated that the changes yielded small decreases in the occurrence of cruising and double-parking (NYCDOT, "PARK Smart," 2018).

In downtown areas, where metered parking is often much less expensive than garage parking, time-of-day pricing is an easy way for cities to provide low-cost parking at off-peak times while keeping prices more in line with the market at peak times. Cities can also assign higher prices to areas close to demand generators with lower pricing farther away, encouraging faster turnover where it is most useful. One method for implementing this strategy is to utilize higher pricing directly on major commercial streets while providing lower pricing are the corner on minor streets.

Some cities are also using data to dynamically adjust metered rates to respond to changes in occupancy levels over time. Parking occupancy is continually measured by sensors, rather than just by multi-space meter payments that do not detect whether vehicles leave before their time is up. Using the collected data, parking pricing is adjusted every month or two, by block and time of day, to meet target occupancy. Real-time information, including parking rates and availability by block, can be checked online or by smartphone app, helping drivers make decisions about where to park.





Time Limits

Parking time limits can be implemented to require more frequent turnover of parking spaces where desirable. Double-parking, bicycle lane blockages, and parking at loading/unloading zones are often caused by poor availability of proximate on-street parking for short-duration activities. Because of this, providing short-term parking spaces — typically allowing 15 minutes of occupancy or less — can increase availability and access for short-duration needs. This strategy can be implemented alongside less restrictive parking zones to serve the needs of multiple users.

Should total demand still surpass available supply on a street, short-term parking can be metered or progressive parking fees — charging an increase parking rate as time progresses to incentivizes shorter occupancy — can be implemented (NACTO, 2017).

Time-of-day Restrictions

In areas with significant peaking in demand for parking, travel lanes, or loading zones, time-of-day parking restrictions can be effective at balancing the needs of uses while using the right-of-way in an efficient and flexible manner. In the District of Columbia, [a pilot aimed at improving safety and](#)

[reducing congestion during nightlife economy hours near Dupont Circle](#) was spearheaded by the Golden Triangle Business Improvement District (BID) (Golden Triangle BID, 2018). After multiple rounds of data collection and community engagement, the District —including DDOT, the Office of Planning, Public Works Parking Enforcement, Metro Police, and many others — and the Golden Triangle BID devised a pilot to prohibit on-street parking between the hours of 10PM and 7AM from Thursday night to Sunday morning.

These time-of-day restrictions were limited to a three-block area with the highest concentration of nightlife venues. These blocks were identified through collaboration with for-hire vehicle companies, which agreed to share anonymized data of pick-ups and drop-offs in the area. New parking signs were designed to communicate both the normal daytime restrictions and the new nighttime parking restrictions. This pilot freed the curbside for pick-up and drop-off activity so that instances of walking into the street to meet their vehicle could be reduced. This pilot began in late 2017 and will be evaluated at both six and 12 months to determine next steps.



Reduced Occupancy Targets

In addition to parking pricing, identifying a desired parking occupancy rate is critical to any strategy for managing curbside parking. Given that demand—and therefore occupancy—is generally inversely related to price, these two variables must be carefully weighed against one another. Targeting an occupancy rate of 80 percent, for example, results in one in five spaces available on average and can reduce cruising by ensuring unoccupied parking is more readily available. Short-term parking and loading zones may require even lower targets, though this may be difficult to achieve during periods of peak demand. Long-term parking zones should target an appropriate maximum occupancy rate and, within a sensible range, be priced accordingly. In general, the goal of reduced occupancy targets is to improve the efficiency of travel lanes rather than to maximize the use of on-street parking itself.

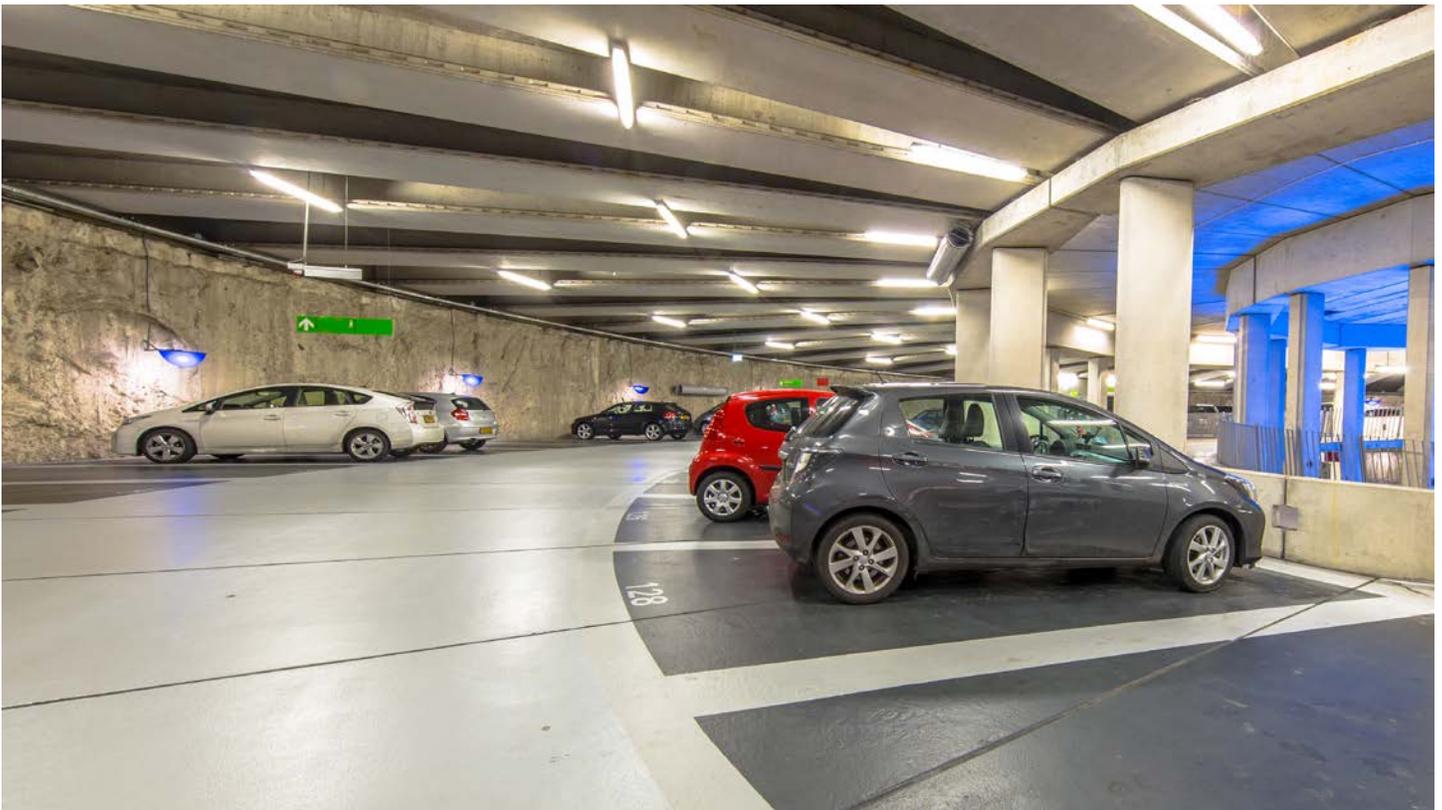
Setting metered parking prices high enough to free up parking spaces is not a stand-alone method of curbside management. In some locations, demand for curb space is so high that the market-clearing price would be difficult to defend; if a parking space is valued at astronomical sums by potential users, it may have more value in a public space use rather than as parking.

(NACTO, 2017)

Evaluation of Area-wide Availability

“Parking reductions can be flashpoints in transit projects but can be mitigated by addressing and discussing parking on an area-wide level. For example, contextualize parking options by explaining it as the total number of spaces within a short walk of the street in question—a few blocks, 1000 feet, or a 5-minute walk. If paid or shared off-street spaces are available to the public or business patrons, include them in the analysis. This ‘walkshed’ approach to parking is fair—transit riders are also expected to walk 1/4 to 1/3 of a mile in most cases—and increases the likelihood that drivers will walk between stores rather than driving to multiple sites along the corridor, and key spaces can be reserved for those who need nearby parking or loading zones, like people with disabilities.”

(NACTO, 2017)



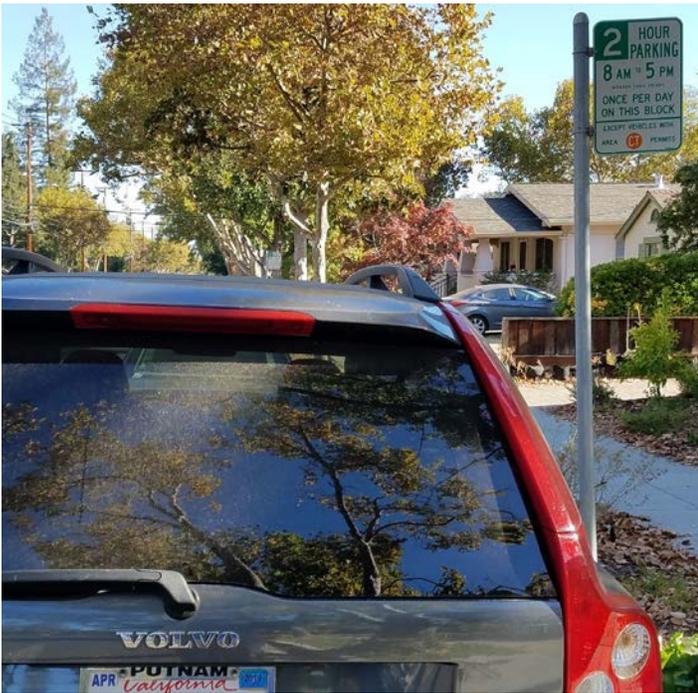
Inclusion of Off-street Options

In densely developed areas, a majority of the parking supply is provided off-street in private facilities which are not operated in accordance with city strategies or goals. A [parking study](#) conducted in Austin found that over 90 percent of parking spaces in the downtown area are located off-street, and the occupancy for those spaces is typically below 80 percent (Downtown Austin Alliance).

Unused off-street parking supply provides cities with an opportunity to alleviate on-street parking demand. Some cities operate their own off-street parking facilities and price parking in them according to the broader pricing demand strategies of the areas where they are located. In other cases, cities have taken advantage of privately owned facilities by developing agreements to make shared accessory parking available to businesses and residents (NACTO, 2017).

“Reducing a destination area’s parking supply supports growth of other modes. Over time, reducing the number of non-resident parking spaces in a neighborhood with good transit and cycling access will support a shift to transit riding. Cities have instituted parking maximums and eliminated parking minimums in new development or charge for some forms of off-street parking in dense or transit-rich areas. These changes reduce the expectation of private motor vehicle use in a growing city.”

(NACTO, 2017)



A residential parking permit zone in Palo Alto, California.

Priority Parking Programs

Residential parking permit (RPP) and other similar parking restriction programs are generally implemented to reduce the incidence and/or duration of non-resident parking in a given neighborhood or zone. RPPs are often implemented where commuter, commercial, visitor, or tourist parking demand can result in limited on-street parking availability for residents at key times. By discouraging specific areas as a parking destination, these programs can reduce traffic into neighborhoods where they are implemented. RPPs can be particularly desirable in residential neighborhoods which have limited off-street parking supply and are in close enough proximity to more densely developed areas or employment centers to result in increased parking demand.

Many RPP programs require that all permits be paid in order to incentivize use of off-street parking options — including residential driveways — while disincentivizing on-street parking of a greater number of vehicles than are needed by any given owner.

Parkmerced

Parkmerced is a community development with high-rise apartments and townhomes. Their [Car-Free Living Program](#) is a first-of-its-kind partnership that encourages residents to use public transportation and ride share, providing a more affordable alternative to car ownership (Parkmerced, 2018). New residents who participate in the Car-Free Living Program receive a \$100 monthly transportation credit per apartment to use with Getaround, Clipper (a transit fare card in the San Francisco Bay Area), and Uber. Any resident can also catch a ride in an UberPool from Parkmerced to nearby public transit stations for a flat rate of \$5.

Transit

Curbside management strategies are often designed to provide modal priority to transit on key corridors as an effective means to discourage single-occupancy vehicle travel and increased transit ridership. The selection of high-quality transit treatments such as those below can combine with increased service levels and amenities to best achieve these goals.



Bus-only lane on United Nations Plaza in New York, New York.

Transit Lanes

Transit lanes are a portion of the roadway dedicated explicitly to the operation of transit vehicles without serving other through traffic. Use of transit lanes by other vehicles may be permitted in locations such as intersection approaches where turning traffic crosses or mixes with transit vehicles. Transit lanes do not have physical protection or barricades separating them from other traffic, but are often delineated by special pavement markings, including continuous red paint.

Bus Queue Jumps

Queue jump lanes are essentially short transit lanes at the approach to a signalized intersection which, when combined with improved traffic signal operations, can allow buses to bypass vehicle congestion. Traffic signals where bus queue jumps are implemented typically provide either a leading bus interval or active transit priority. Separate signal indications are provided to control transit vehicle movements. The provisions of queue jump lanes typically require restriction of other curb space uses near the intersection uses in urban areas, but can result in significant reductions in delay and increases in travel time reliability for transit service.



Bus boarding island in Los Angeles, California.

Bus Bulbs and Bus Boarding Islands

Bus bulbs are unique curb extensions that allow buses to stop without leaving the travel lane and are typically implemented where existing parking or bicycle lanes provide a de facto curbside bus pull-out. Provision of bus bulbs can result in reductions in delay and bus-vehicle conflicts that result from buses entering and existing the travel lane.

Where dedicated bicycle facilities are provided, bus boarding islands can be implemented to route the bikeway between the bus stop and sidewalk rather than between the travel lane and bus stop. Bus



Curb Appeal: Curbside Management Strategies for Improving Transit Reliability

The National Association of City Transportation Officials (NACTO) released [this white paper](#) focused on strategies for changing curb use to better support transit. The paper provides examples of policies and projects which have been implemented in cities across North America to improve transit reliability through management of the competing demands along the urban curb. In addition to transit, the paper addresses considerations for other important curb uses such as bicycling, deliveries, passenger pick-up/drop-off, streetscape improvements, and public space activation.

boarding islands reduce the number and control the location of conflicts between transit patrons and cyclists. The City of Chicago has implemented many bus boarding islands as part of its Loop Link project to improve transit reliability and reduce conflicts between travel modes (City of Chicago, 2018).

Commuter Shuttle and Private Transit Management

San Francisco Municipal Transportation Agency (SFMTA) implemented a voluntary pilot program to regulate commuter shuttles from 2014 to 2016. The [Commuter Shuttle Pilot program](#) allowed commuter shuttle operators to have access to certain restricted public transit curbside space (i.e., bus stops) for passenger loading in exchange for paying a fee, providing data, and complying with a set of permit conditions (SFMTA, "Commuter Shuttle." 2018). The program aimed to reduce vehicle miles traveled (VMT) by reducing single-occupancy vehicle use, improve safety related to curbside loading activities, and improve relationships between the City and private shuttle operators.

Similarly, SFMTA approved a [permit program](#) to formalize private transit operators as a response to the increase in providers within San Francisco such as Chariot (SFMTA, "Private Transit Vehicle Permitting." 2018). These operators use high-capacity vehicles that are open to the public as a jitney or form of microtransit. SFMTA regulated these services to reduce unsafe passenger loading, minimize travel on restricted streets, collect data, and address lack of vehicle accessibility.

Automated Enforcement of Transit Spaces

Transit lanes, queue jumps, and bus stops can only operate efficiently when they are free and clear of blockages caused by other encroaching uses. Because of this, enforcement of regulations which discourage blockages is key to the operation of any transit facility. Manual enforcement is generally too time-intensive, costly, and ineffective to serve as a solution, leading agencies to pursue automated enforcement strategies. Automated enforcement,



Protected bikeway (cycle track) in Cambridge, Massachusetts. (Source: Adam Coppola Photography)

though sometime requiring a greater up-front investment in equipment and infrastructure, can provide continuous, reliable enforcement across a broader footprint.

Automated enforcement typically relies on the use of either bus-mounted or pole-mounted cameras to read license plates and record video evidence of infractions. When pole-mounted cameras are used, algorithms can be employed in some areas to identify vehicles which travel in a transit lane for multiple consecutive blocks. As is consistent with automated traffic enforcement in many jurisdictions, citations are often issued to vehicle registrants rather than drivers and are treated as civil violations similar to parking infractions. Privacy and civil liberties considerations must be taken into account as part of the implementation of an automated enforcement system (NACTO, 2017).

Bicycle

As many cities were developed largely in the era of automobile dominance, bicycles were often overlooked as a design vehicle for urban travel. Curbside management strategies typically seek to reestablish cycling as a primary mode which operates in concert with transit to reduce the vehicular demand on many corridors. This does, however, often require updated design of the curbside to accommodate these bicycle facilities. At times, the presence of bicycle facilities may preclude the use of the curbside for some of the aforementioned uses.

Protected Bikeways (Cycle Tracks)

A protected bikeway, or cycle track, is a dedicated bicycle facility that is located within or next to the roadway, but is distinct from both the sidewalk and roadway while being separated from the latter by vertical barriers or elevation differences. Protected bikeways can be one-way or two-way, with special consideration needed at intersections for two-way facilities. The general goal of protected bikeways is to increase user comfort for cyclists of all ages and abilities.



Bikeshare docking station in Houston, Texas. (Source: Creative Commons CC0)

Protected bikeways are typically located on the curb side of parked vehicles, with adequate clearance to allow for vehicles doors to be opened, where on-street parking is allowed. In addition to on-street parking, separation between travel lanes and a street-level protected bikeway may be provided through the use of raised medians, bollards, planters, or other physical delineation. Pavement treatments such as colored or textured markings are typically used to separate the bikeway from the pedestrian space when provided at sidewalk level.

Bicycle and Shared Mobility Device Storage

Bicycle parking may be provided in the public right-of-way in the form of sidewalk bicycle racks or on-street bicycle corrals. In addition, bike share stations also increasingly occupy space either within the flex zone or directly behind the curb on the sidewalk. Dockless bikeshare and other emerging personal mobility devices (e.g. e-scooters) also need storage space in the public right-of-way, ideally located adjacent to the curbside to reduce interaction with pedestrians. Regulations typically establish that these should be parked in the landscape/furniture zone of the sidewalk (i.e., between the main pedestrian path



Dedicated parking for dockless mobility devices in Austin, Texas. (Source: Austin Transportation Department)

and the curb) but some cities, like Seattle and Austin, have started painting parking areas on the sidewalk for these personal mobility devices to provide more clarity and reduce sidewalk clutter (Cox, 2018).

Pedestrian and Activation

Reduced prioritization of vehicle travel lanes within the right-of-way typically yields an ability to enhance pedestrian space. Additionally, flexible utilization of the curbside increases opportunity to provide activation that benefits the community.



Pop-up parklet in Austin, Texas. (Source: Austin Transportation Department)



Curb extensions can reduce crosswalk length and provide space for directional pedestrian ramps, greenery, and adjacent mobility device storage.

Curb Extensions

Curb extensions, or bulb-outs, extend the sidewalk into the parking lane at intersections, making pedestrians more visible, shortening crossing distances, and slowing vehicle turn movements. They can also provide space for landscaping and other amenities. Bulb-outs should be designed to maximize pedestrian space within curb radius guidelines appropriate to the local context. Curb extensions are utilized by a growing number of cities across the country to improve conditions for pedestrians.

Close attention should be paid to how bulb-outs interact with other curbside uses; for instance, bus stops and loading zones must be longer when

adjacent to bulb-outs than they would be adjacent to the intersection to provide additional room for maneuvering to the curbside and out of the travel lane.

Wider Sidewalks

A common element of many complete street and curbside management plans, wider sidewalks are a popular treatment for encouraging pedestrian activity. Wide sidewalks can comfortably accommodate larger numbers of pedestrians of all ages and abilities while generally feeling less exposed than narrow sidewalks located immediately at the back of curb. Policies in Washington, DC call for a minimum sidewalk width of 6 feet in residential areas, 8 feet in light commercial or dense residential zones, and 10 feet in heavier commercial or downtown areas (Government of Washington DC, 2011).

Parklets

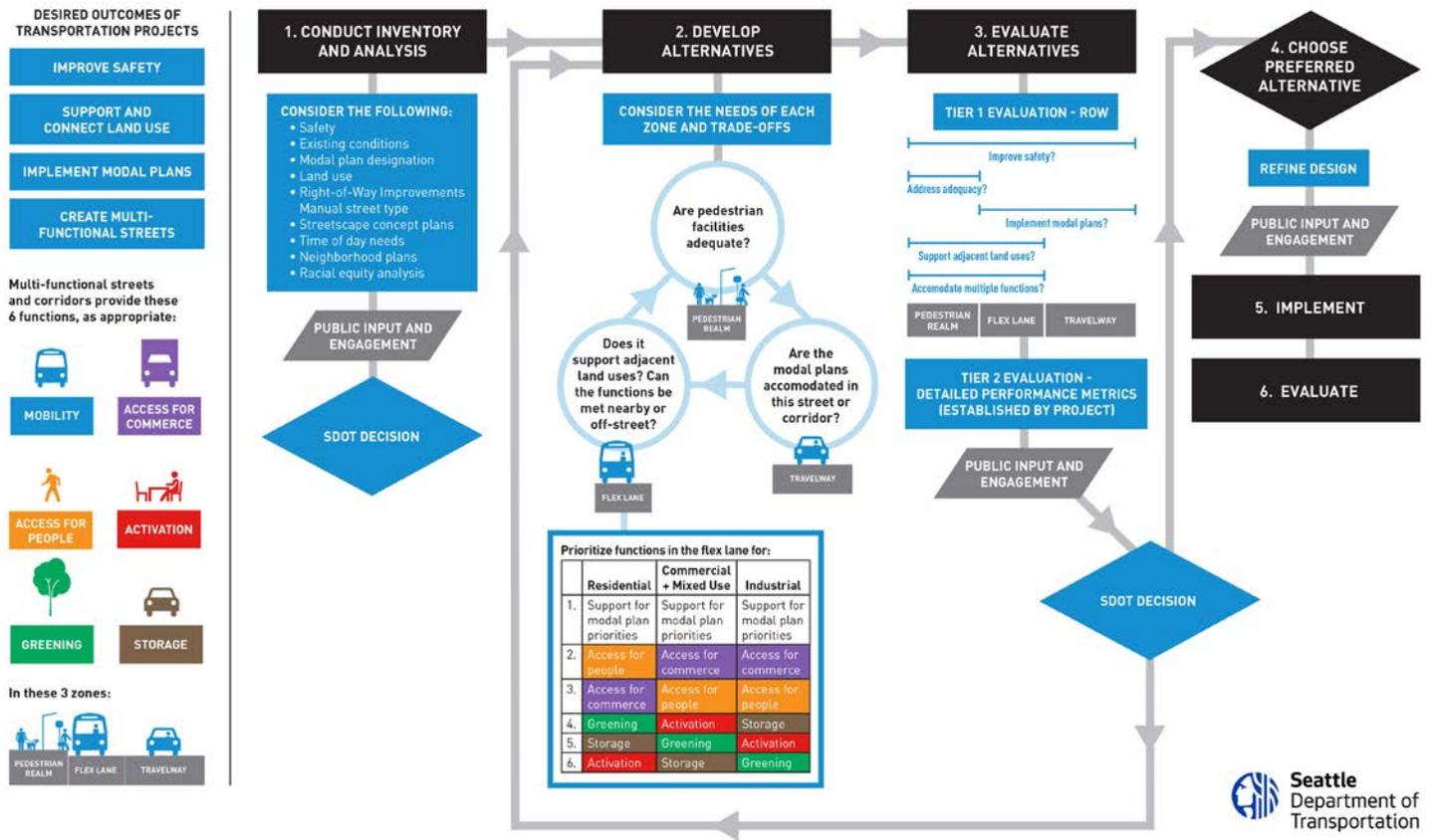
Parklets are designed to expand the pedestrian realm beyond the existing curb line in order to activate additional public space. Many cities have utilized parklets to convert on-street parking to a person-oriented environment that includes urban park features such as landscaping, benches, and public art. Similarly, “streeteries” and other adjacent land uses sometimes make use of similar extensions past the curb line to provide seating, patios, or other amenities without disrupting the sidewalk for mobility.

An aerial photograph of a city street scene, overlaid with a semi-transparent teal color. The image shows a wide street with multiple lanes, a central green median with trees, and various vehicles including cars, a bus, and a truck. Buildings line the streets, and a large, ornate building is visible at the top center. The overall scene is captured from a high-angle perspective.

TREATMENT SELECTION PROCESS

The overall curb space demand and management process can be triggered by a street improvement, development project, or broader planning effort. As a result, curbside management changes may be evaluated and implemented for an area as small as the frontage of a single property or as large as an entire city. Because some treatments can be effectively deployed at discrete locations while others may require a broader corridor or area-wide implementation to achieve desired results, both short- and long-term planning strategies should be considered during the selection of treatments to be implemented.

SEATTLE RIGHT-OF-WAY (ROW) ALLOCATION DECISION FRAMEWORK



An example framework for decision-making processes pertaining to right-of-way allocation utilized by Seattle Department of Transportation.

In general, the curbside management treatment selection consists of the following steps:

1. Inventory existing conditions
2. Identify land use and activity considerations to develop modal prioritization
3. Identify appropriate treatment alternatives
4. Assess and present alternatives for public feedback
5. Refine and implement treatments

As processes for project approval and agency adoption of projects vary between jurisdictions, this basic selection framework should be adapted to the unique local context. Note that community and stakeholder engagement may be valuable at multiple stages throughout the treatment selection process to ensure that strategies and projects pursued are consistent with the needs of residents, businesses, and agencies.

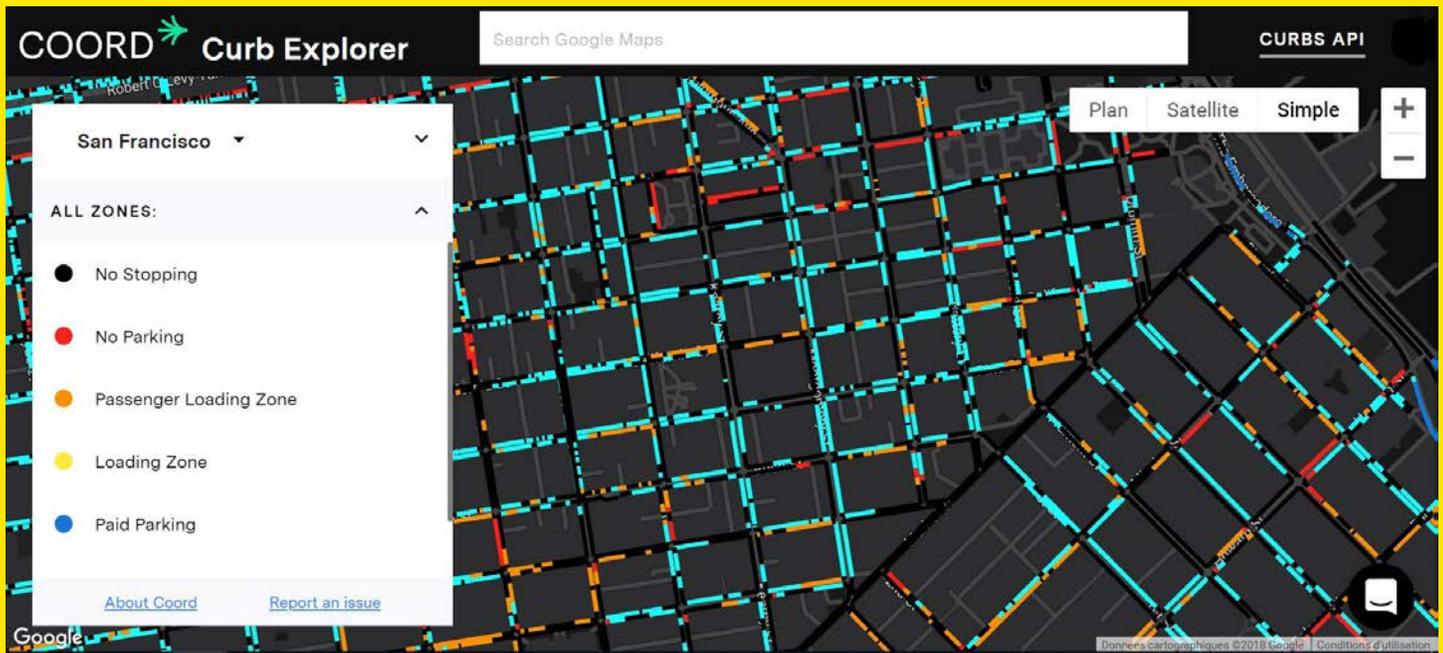


1. Inventory Existing Conditions

The initial step in beginning to develop a curbside management strategy is to complete an inventory of existing conditions, including a detailed assessment of how curb space is currently utilized and managed. An accurate context for the curbside should be identified to ensure that selected treatments are appropriate for the observed conditions.

At a minimum, the inventory of existing conditions should include the following:

- A review of existing policies, by-laws, or codes which may impact curb space utilization
- Field observations to identify key existing curbside users, the characteristics of their use (i.e., supply, demand, and utilization), lane or parking designations, and use restrictions
- Determination of any obvious needs or opportunities



Coord web interface

Big data is changing the way data about curbside uses can be collected and evaluated. Mapillary, for example, is a collaborative platform that uses crowdsourced or privately-provided street-level imagery to identify and map the locations of features such as signs, sidewalks, and traffic signals. This technology can enable the large-scale collection of asset information which could be useful in completing curbside space inventories. Meanwhile, private third-party data vendors such as Coord have undertaken pilot projects to document curbside uses and parking restrictions throughout major cities such as San Francisco and Toronto, creating datasets which could serve as a starting point for curbside management evaluations.

In addition to concerted data collection and observation efforts, data pertaining to existing curbside access and users may be available through other channels such as:

- GIS databases maintained by transit, parking management, and/or other municipal agencies
- Approved or constructed development plans for parcels abutting the public right-of-way

- Coordination with mobility providers and delivery services including ride hailing services, car share, bike/scooter share, package and freight handlers, etc.

Third party data vendors specializing in city planning and transportation data may become an increasingly viable option to consolidate and refine data pertaining to the use of the public right-of-way, including the curbside.



2. Identify Land Use and Activity Considerations to Develop Modal Prioritization

Taking into account the local context of land uses and activity, a relative prioritization of travel modes and right-of-way functions can be developed on a corridor-by-corridor or even block-by-block basis. Designating specific modal priorities assists with evaluating trade-offs and ensuring that allocation of the curbside and right-of-way in discrete locations serves the overall goals of a larger project. Note that modal prioritization may also vary by time of day for certain corridors and contexts. Typical modal priorities include the following:

Transit Priority

Streets which prioritize transit are those where surface transit routes with high ridership require curbside and/or flex zone access to load/unload passengers. Transit vehicles may operate in mixed traffic or along dedicated bus/light rail alignments. Transit priority corridors give the highest priority to mobility and access for people while typically deemphasizing storage, and may include features such as dedicated transit lanes, bus queue jumps, and enhanced transit stops.



Cincinnati Bell Connector on-street light rail in Cincinnati, Ohio.

Bicycle Priority

Locations which provide key connections in the cycling network may be appropriate to designate for bicycle priority. These corridors typically see a high-cycling mode share and place the greatest priority on mobility and access for people. While storage is typically deemphasized, on-street parking can provide opportunities to provide protection for bikeways. Where surface transit is present along bicycle priority corridors, transit stops must be carefully designed taking into consideration interactions between transit vehicles and bicycles (also known as bike/bus interface). The provisions of boarding islands to eliminate direct conflict between boarding/alighting transit riders and cyclists may be appropriate in locations with high-volume transit service.



Two-way cycle track in Berkeley, California.

Pedestrian Priority

Pedestrian priority corridors are those where person-based mobility, access for people, activation, and greening are considered most desirable and there is a lesser need for vehicular mobility. This designation may be appropriate in neighborhood settings where through vehicular traffic can be minimized or eliminated in favor of providing space for enhanced sidewalks, seating, parklets, and other activation features. Roadway space may be utilized for storage rather than mobility where appropriate, especially as parked vehicles can enhance protection for pedestrians.

Major Thoroughfares

Major thoroughfares, including walkable and bikeable urban streets, are those which have an emphasis on facilitating the movement of vehicular traffic. Particularly in developed environments, a roadway should be designated as a major thoroughfare only after deliberate evaluation and consideration of area-wide mobility needs and priorities. In many cases, maintaining high quality transit, bicycle, and pedestrian facilities on major thoroughfares can be valuable at maximizing the efficiency of the overall transportation network. Arterial roadways are often barriers for active transportation modes and are where severe injury and fatality collisions are concentrated in many cities; care should be taken in the design of major thoroughfares to ensure they do not hinder safety, accessibility, and connectivity for all users.



Major thoroughfare with high quality bicycle and pedestrian facilities. (Source: [NYCDOT](#))

Mixed-Use Main Street

Streets that provide direct access to adjacent ground-level commercial and retail land uses are ideally suited to serve as a mixed-use main street. These are typically corridors which have a “main street” typology with a mix of uses which may have little or no off-street parking, therefore relying

on the public right-of-way for a majority of their access needs. As a result, mixed-use main streets emphasize access for people and activation while also sometimes accommodating storage. Most access for commerce is accommodated on adjacent corridors and mobility is seen as a lower priority on these corridors.



Mixed-Use Access

Streets that provide access to nearby commercial, retail, or residential properties which front other roadways may be appropriate to focus on mixed-use access. These are typically minor roadways which emphasize access for commerce and people as well as parking, in keeping with the concept of moving parking, access, and loading zones “around the corner.” Activation and greening are generally not priorities in these locations given that their primary purpose is to provide access to other nearby areas with greater activation such as mixed-use main streets.

Unique land uses or activity centers may dictate the need for specialized modal prioritization methods beyond those described above both on and off the public right-of-way. For example, land uses which generate high levels of peak demand such as convention centers, arenas/stadiums, and major transit centers may necessitate connections to all types of mobility while simultaneously requiring increased access to passenger loading/unloading space for taxis and ride-hailing services. Each situation should be evaluated on a case-by-case basis to identify the ideal treatments.

Curbside Use Priorities by Context			
Priority	Residential	Commercial & Mixed Use	Industrial
1	Support for Modal Plan Priorities		
2	Access for People	Access for Commerce	
3	Access for Commerce	Access for People	
4	Greening	Activation	Storage
5	Storage	Greening	Activation
6	Activation	Storage	Greening

[City of Seattle](#) has adopted new policies defining the curbside lane as a “flex zone,” and allocates curbside use priorities by context. All of these functions need to be evaluated for the corridor or area under review. Accommodating key infrastructure outlined in citywide modal plans is the highest priority, followed by accommodations and allocation for space for access for people and goods. Public space activation, greening, and parking uses are addressed, according to land-use context.



3. Identify Appropriate Treatment Alternatives

Once local land uses, activities, and modal priorities have been established, appropriate treatment alternatives for curbside management can be developed. Available tools and treatments identified in Chapter 2 serve as a starting point for the identification of alternatives which can be selected to emphasize different right-of-way functions.

Some treatments, such as parklets or bus queue jumps, can be effectively deployed at discrete locations while others, like protected bikeways and dedicated transit lanes, typically require a broader corridor implementation in order to achieve the desired results. As a result, both short- and long-term planning strategies should be considered during the selection of treatments to be implemented.



4. Assess and Present Alternatives for Public Feedback

Once treatments have been selected, the project alternatives should be evaluated to determine both their anticipated efficacy as well as impact on each right-of-way function and user relative to existing conditions. Evaluations can be made qualitatively or quantitative metrics such as VMT, levels of traffic stress), walk/bike score, and anticipated economic impacts, may be used.

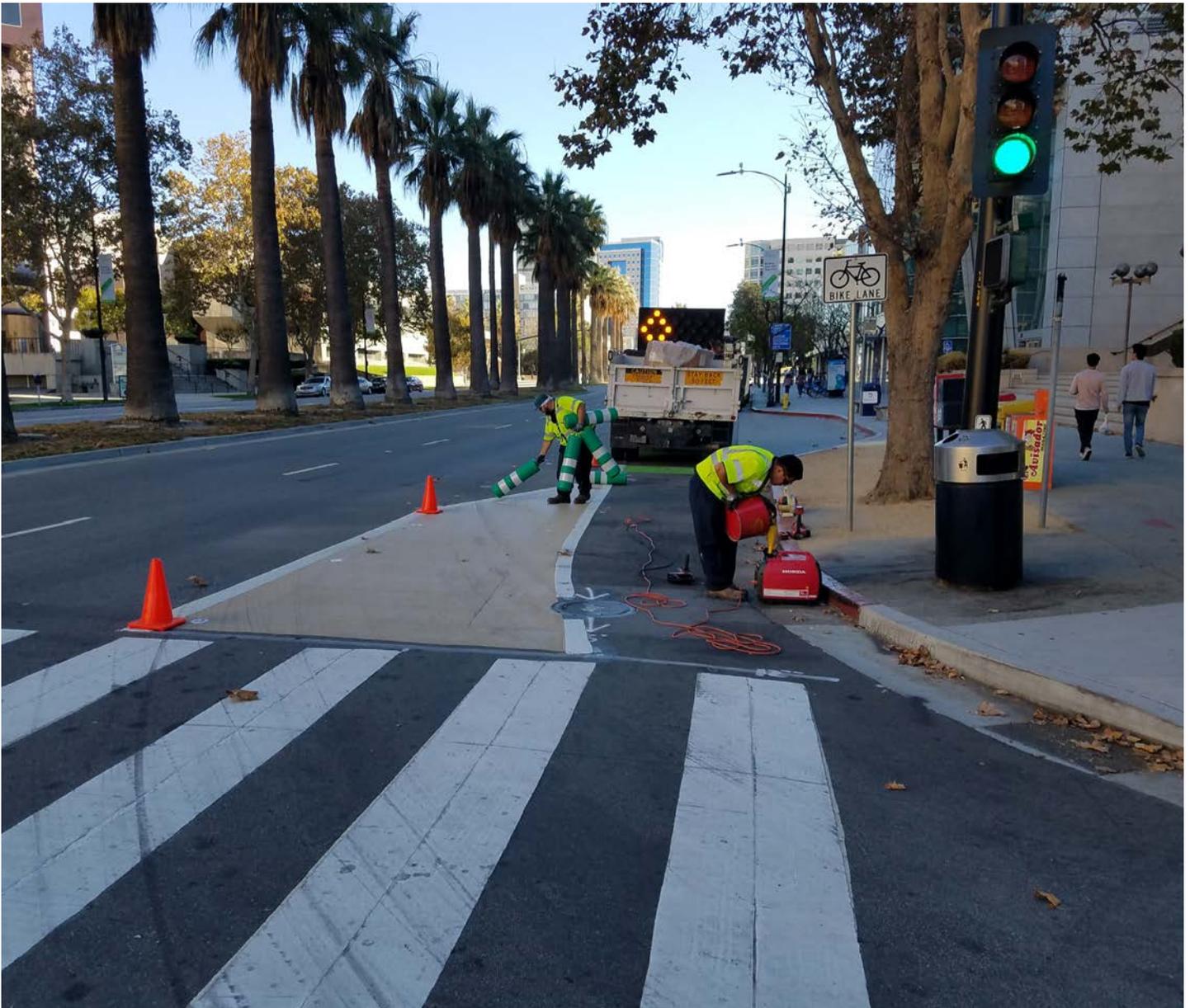
Given public sensitivity to roadway and parking changes in many cities, the presence of a high-functioning, collaborative public-private stakeholder advisory body can be crucial to allow an open and productive dialogue. Ideally, stakeholder advisory groups comprised of both public and private representatives can provide feedback and guidance on potential treatments throughout the selection process described above.



A thorough outreach process taking advantage of social media, internet presence, surveys, mailers, local community meetings and events, and/or living previews should be utilized to increase project awareness and solicit feedback. Living previews and pop-up events are particularly effective at reaching the community where and how they utilize impacted project areas as well as increasing understanding of the proposed improvements by allowing stakeholders to directly interact with the proposed environment on an interim basis.



Projects which proceed without community buy-in obtained through a rigorous outreach process often face greater scrutiny and, as a result, greater challenges to achieving success. Public outreach may ultimately be an iterative process that entails dialogue with stakeholders at multiple stages throughout the treatment selection process.



5. Refine and Implement Treatments

After receiving input from both public and private stakeholders, the selected treatments are refined to establish a final preferred alternative. Depending on the magnitude of changes and stakeholder concern, repeating the assessment and public feedback process after identification of the preferred alternative may be appropriate. For larger projects, the development of a specific implementation plan documenting project phasing, construction requirements, ongoing outreach protocols, and other key parameters may also be helpful.

Once agreement has been reached to proceed, plans for the project are typically developed using either an accelerated “quick build” method or standard design development process at the agency’s discretion. Interim quick build implementations can provide an opportunity for real-world interaction with the implemented project over an extended period of time while adjustments can be made that would otherwise be difficult with final implementation. This can be especially attractive for early projects in an area which has not been subject to similar curbside management treatments.



PERFORMANCE MEASUREMENT

Once implemented, curbside management strategies should be monitored for their efficacy in meeting stated project goals, which will often encompass the following: mobility, livability, accessibility, safety, efficiency, and economic vitality. Monitoring may include near-term proxy data analysis as well as longer term statistical trend assessment.

Potential measures of effectiveness and data sets are shown in the following tables:

MOBILITY

Measure Of Effectiveness (MOE)	Dataset(s)
Fewer blocked bike facilities	In-field observations (anecdotal)
Fewer blocked transit lanes	Video data collection Citations (medium term)
Target loading zone utilization and turnover levels achieved	In-field observations (anecdotal) Video data collection Parking/ curb space sensors (if present)
Improved transit reliability	Transit schedule adherence data
Improved transit ridership	Transit ridership (APC data)
Improved average transit speed	Transit schedule adherence data Average travel speeds from GPS/AVL data
Higher occupancy in TNCs (i.e., increased use of shared TNC rides)	In-field observations (anecdotal) Video data collection TNC-provided data (if required/leveraged)
Reduced cruising behavior	In-field observations (anecdotal) Video data collection
Reduced congestion and pollution levels	Traffic Counts Cell phone data (big data) Sensors or detection (if available)
Improved vehicle LOS	Analysis of count data
Improved emergency vehicle response time	Reported response times Modelled response times
Improved wayfinding and user experience	User feedback via surveys, focus groups, etc.
Reduced private vehicle ownership	Census data
Reduced parking demand	Anecdotal reduction in parking requests Parking utilization rates from sensors or observations
Improved vehicle travel time on designated "THRU" streets	Sensors Field observations (anecdotal, video, or tubes) Cell phone data (big data)

LIVABILITY

Measure Of Effectiveness (MOE)	Dataset(s)
Additional park/green space provided	Amount of green/park space available citywide, by neighborhood – data inventory
Additional bicycle parking provided	Amount of short-term and long-term bicycle parking – data inventory
Additional seating/ community gathering space provided	Amount of seating/ community gathering space available citywide, by neighborhood – data inventory
Enhanced public space activation	Calendar of community events Permit requests

ACCESSIBILITY

Measure Of Effectiveness (MOE)	Dataset(s)
Reduced use of disabled loading and parking zones	Citations data
Feedback from the disabled community that access is safer and more convenient	Survey or focus group
More disabled loading and parking zones provided on street	Asset management system database
Disabled loading and parking policy and prioritized implementation plan in place and routinely followed	Routing policy, programs, and practices benchmarking
Fewer ADA lawsuits against the jurisdiction	Public lawsuit records, medium- to longer-term

SAFETY

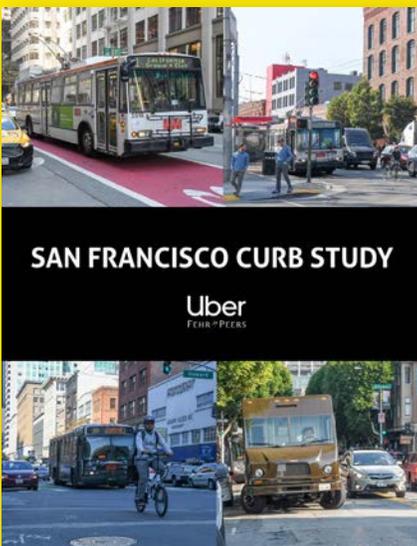
Measure Of Effectiveness (MOE)	Dataset(s)
Fewer consequences of curb access events (i.e., vehicles swerving, bicycles swerving mid-block U-turns, and mid-block crossings)	In-person observations (anecdotal) Video data collection
Less risky consequences of curb access events(i.e., less likely to affect vulnerable users or their infrastructure, less likely to be high-speed)	
Fewer near-miss incidents	Video detection (i.e., Bellevue/ Microsoft) On-board vehicle data on driver behavior (i.e., ZenDrive technology)
Fewer curb-access-related collisions	Local or statewide collision datasets (medium to long term)
Reduced ped/bike conflicts with heavy trucks	In-person observations Video data collection
Reduced moving vehicle violations	Police data on citations for stop sign, red light, crosswalk intrusion, and speeding violations

EFFICIENCY

Measure Of Effectiveness (MOE)	Dataset(s)
Streamlined data collection and analysis procedures in place across city departments	GIS data library compiled, maintained, and frequently used
Innovative technology in place for real-time efficacy monitoring	Inventory of citywide assets
High functioning, public-private stakeholder body assembled and meeting regularly	Meeting minutes of group

ECONOMIC VITALITY

Measure Of Effectiveness (MOE)	Dataset(s)
Additional café/ restaurant seating provided	Permits
Staff time coordinating deliveries reduced	Feedback from business owners via survey or focus groups
More disabled loading and parking zones provided on street	Asset management system database
Improved sales receipts	Tax/ sales data
Enhanced availability and convenience of loading zones	Feedback from business owners via survey or focus groups
Additional funding available for streetscape and façade enhancements	Creation and funding of new BIDs or TMAs with revenue from curb access fees or higher parking fees
Improved turnover and availability of parking near business	Feedback from business owners via survey or focus groups Parking utilization data from sensors or field/video observations



San Francisco Curb Study

In [this study](#), by Uber Technologies and Fehr & Peers, curb activity was observed at several locations with moderate to high passenger-loading activity and a mixture of adjacent land use/neighborhoods and roadway characteristics, each broadly comparable to other similar urban environments across the country. For each location, the study identified several strategies to consider and quantifiable metrics to illustrate the potential effectiveness of providing space based upon relative modal demands. A new metric, the 'curb productivity index', was developed to determine the value of the curb in terms of passenger throughput for each curb use (i.e. number of passengers served per hour per 20 feet of curb). The study also defined three broad strategies to increase curb productivity by allocating curb access more efficiently based on the number of users served, ultimately reducing the frequency of double parking and friction between modes and increasing safety in the travel lane.



FUTURE CONSIDERATIONS

This resource illustrates best practices for the planning and implementation of curbside management strategies based upon known transportation technologies and previously tested treatments. Curb space needs will continue to evolve as mobility options change over time, yet agencies will continue to play a critical role in identifying the most efficient uses for their rights-of-way.

The growth of for-hire vehicle activity and the fast-approaching introduction of automated vehicles may continue to accentuate the importance of efficient curbside loading and unloading zones while gradually reducing demand for on-street parking. Without changes to the design of the right-of-way to address shifting transportation demand, curb space in many cities may be utilized inefficiently.

Tools to manage the sharing necessary at the curbside in all the areas highlighted above are increasingly

available as new technology that supports the real-time and dynamic nature of demand for this space emerges. Matching this demand with curb space supply involves several potential elements including the following:

- Real-time information on space location and availability
- Dynamic pricing on a per-minute basis
- Communication mediums to the potential curbside user

Continued development of tools that provide these capabilities is anticipated. But already some cities have developed elements of these. DC, for instance, as part of their [ParkDC pilot](#) established real-time information on parking space availability as well as dynamic pricing, all communicated back to the consumer via an app (District Department of Transportation, 2018). It is likely that cities will experiment with charging for pick-up and drop-off activity on a per-minute, or even per-second, basis. This activity will be tracked via a management system that

may be available citywide wherever the curbside is regulated. Such universal systems will increase the safety, availability, and efficiency of curb space.

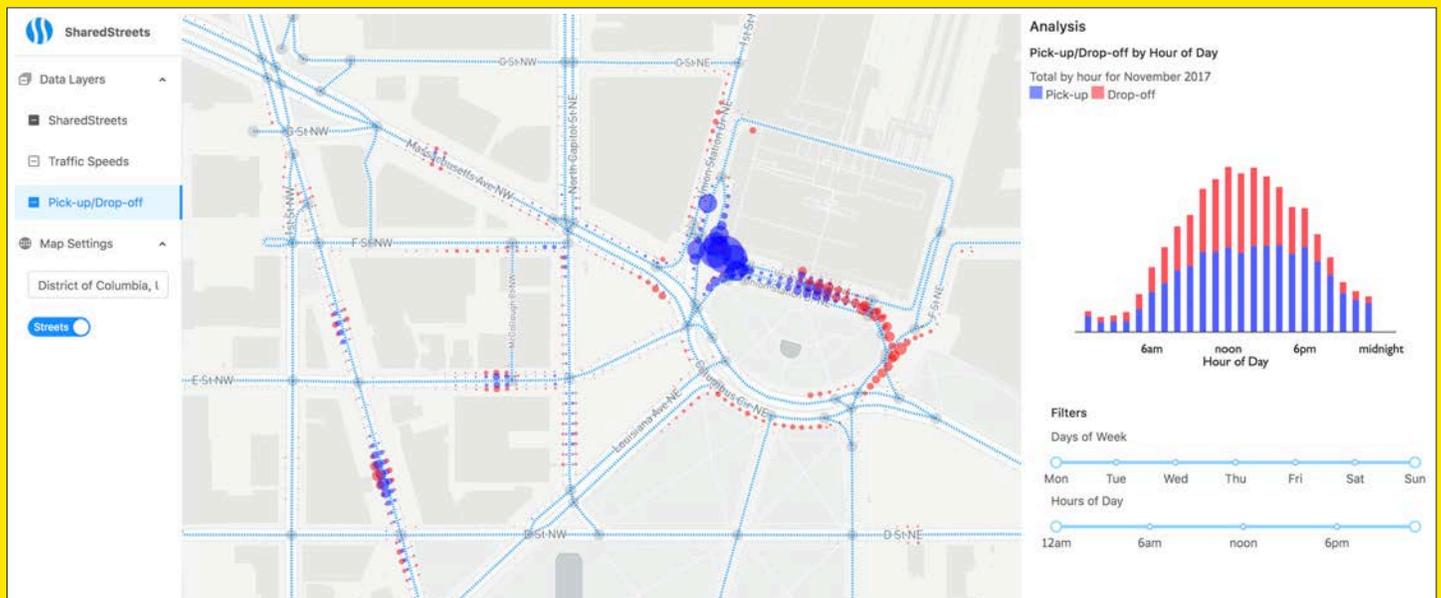
Data management is also a crucial element to the future of managing and integrating systems of all kinds, with the curbside being no exception. As agency staff, mobility providers, and third party vendors all move to establish data protocols to best serve their needs, it is increasingly critical that uniform standards of practice be developed to ensure this data remains useful to policy makers and operators.

For-hire vehicle companies and other emerging mobility providers continue to show the importance of efficient curb space use to accommodate all of users. To that end, regulation of the curbside is an increasingly critical consideration in a successful



An autonomous delivery robot navigates a crosswalk.

transportation management strategy, particularly in the urban environment. Cities that begin developing and implementing sensible strategies today will be better positioned to manage their curbside resources in a manner that incentivizes safe and efficient travel for all users.



SharedStreets

SharedStreets is a digital commons for the street (2018). It provides data standards, map matching, and a platform that serves as a launching pad for public-private collaboration and common infrastructure for data exchange. Among other uses, the SharedStreets data standards allow cities to share a standardized map of their curb space regulations, as well leverage new kinds of data to better understand curbside use.

With an open platform and tools like SharedStreets, cities can inventory existing conditions and evaluate options for reducing idling and circling vehicles, redesigning streets to best match current demand, and laying the foundation for new dynamic pricing to better manage city streets. SharedStreets is partnering with cities and private companies to create new methods for public-private collaboration and data sharing that respect the need for rider and driver privacy as well as the competitive landscape of the industry.

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