BOSTON REGION METROPOLITAN PLANNING ORGANIZATION

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# *TECHNICAL MEMORANDUM*

**DATE:** **December 5, 2019**
**TO:** **Boston Region Metropolitan Planning Organization**
**FROM:** **Andrew Clark**
**RE:** **The Future of the Curb**

The curb lane in urban areas has traditionally been used for parking. However, planners and municipal officials across the country are considering the many different ways curb lanes can be used in response to increasing and changing multimodal demands on the space. Recent trends that are affecting demand for the curb include the growth in online commerce and deliveries, and the increasing popularity of ride-hail services. At the same time, municipalities are focusing on improving multimodal access for people taking transit, walking, and biking.

The Boston Region Metropolitan Planning Organization (MPO) undertook this study to examine the ways in which cities in other regions are addressing these changing and competing demands for the curb lane. Staff identified examples of cities repurposing their curb lanes in response to a particular conflict. This memorandum documents some of the challenges cities in other regions are facing and the innovative solutions they have used to solve them. These solutions typically involved one of the following types of actions:

- Developing policy to guide the redesign or reallocation of curb space
- Providing more passenger pickup and drop-off space
- Providing more commercial vehicle loading space
- Reallocating curb space for multimodal access, including for people riding transit, walking, and biking
- Actively managing existing on-street parking

This memorandum is intended to serve as a resource for municipal officials in the Boston region to address curb management issues in their own communities. Staff considered the lessons learned from other regions and the relevance of those lessons to the Boston region. In many ways, the experiences from other regions are relevant here. There are already local projects underway to address increasing and changing demands for congested curb lanes using some of the

actions listed above. There may be opportunities to pursue additional types of projects that are similar to those seen in other cities.

# 1 ADDRESSING CURB LANE USAGE THROUGH POLICY

Cities are rethinking the way curb lane activity is prioritized, measured, and managed. By thinking about their goals and priorities for a particular segment of street or curb lane, cities are developing strategies for evaluating the performance of curb lanes and managing their usage.

## 1.1 Examples from Other Major Cities

### *Establishing curb lane policy*

Some cities have established policies to help guide future decision making about how to use curb space. Seattle has been a national leader in framing the discussion around the different purposes curb lanes serve and the ways they can be used.[1] In 2016 the Seattle Department of Transportation (SDOT) outlined the six primary functions of the curb and examples of their use:

- **Mobility** prioritizes moving people and goods; for example, general travel lanes or turning lanes, but also dedicated transit and bike lanes, or sidewalks.
- **Access for people** prioritizes space for people arriving at their destination or transferring between different ways of getting around; for example, transit stops, bike parking, passenger pickup and drop-off areas, or short-term parking.
- **Access for commerce** prioritizes space for commercial goods and services to reach customers and markets; for example, commercial vehicle loading zones.
- **Activation** prioritizes spaces for social and community activity; for example, food trucks, street festivals, or public art.
- **Greening** prioritizes space for environmental benefit and green space; for example, rain gardens to help with stormwater management or for street trees, community gardens, and planters.
- **Storage** provides space for vehicle storage, including bus layovers, long-term parking or construction staging areas.

[1] Seattle Department of Transportation, Flex Zone/Curb Use Priorities in Seattle, seattle.gov/transportation/projects-and-programs/programs/parking-program/parking-regulations/flex-zone/curb-use-priorities-in-seattle, retrieved August 2019.

According to SDOT, thinking about the different functions of the curb lane in this way helps Seattle's streets "safely and efficiently connect and move people and goods to their final destinations while creating inviting spaces within the right-of-way."

Toronto's Curbside Management Strategy, adopted in 2017, is comprised of guiding principles, policies, and tactics:[2]

- **Guiding principles** provide a high-level vision for curb lanes that prioritize mobility and access and are safe and reliable. They also stress a need for clear communication about curb-lane policy and decision making.
- **Policies** direct future operational strategies, for example by ensuring that accessibility needs are met, that time limits and pricing strategies be used when appropriate, or that off-street parking, loading, or pickups and drop-offs be encouraged where possible.
- **Tactics** are specific strategies that officials have identified for implementation or further study, organized as "quick wins" (immediate implementation), "short term" (implemented within two years), and "medium term" (implemented within five years).

In some cases, developing a stand-alone curbside management strategy is not the specific goal, but is ancillary to the success of other transportation initiatives. Portland, Oregon's Central City in Motion is that city's plan to maximize the capacity of its existing street infrastructure in anticipation of future growth.[3] The plan details 18 specific projects that improve safety and access for people using transit, walking, and biking, and includes a number of general design strategies that planners and officials should consider when reconfiguring street and curb space. The strategies draw on the experiences of other fast growing cities facing similar transportation challenges, including accommodating emergency response through congested corridors, minimizing conflicts between bikes and buses or turning vehicles, and providing sufficient access for commercial loading.

Most of the projects included in Central City in Motion will require the removal of some parking. Officials published a companion document with strategies that can

[2] Institute of Transportation Engineers, *Curbside Management Practitioners Guide Case Study: Toronto, Ontario, Canada*, November 2018, ite.org/pub/?id=C2CD7DBC-A9DF-D8B8-A907-13E51A880E25; City of Toronto, *Curbside Management Strategy: Improving How Curbside Space Is Used*, November 2017, toronto.ca/legdocs/mmis/2017/pw/bgrd/backgroundfile-109153.pdf.

[3] Portland Bureau of Transportation, *Transportation for Everyone: Central City in Motion Implementation Plan*, 2019, portlandoregon.gov/transportation/article/702575.

help mitigate the loss of parking in exchange for multimodal improvements.[4] These strategies include an enhanced transportation demand management program, shared off-street parking pilots, operational improvements to existing on-street parking, and incentives for new mobility options.

### *Measuring curb lane activity*

As curb designations become more complex, cities should maintain an inventory of their curb lanes. The International Transport Forum notes that cities' knowledge of the curb is generally poor, and that most data collection efforts are undertaken by the private sector.[5] Public-private partnerships can be an effective way to bridge this gap. This study details one ongoing example below: In Washington DC, the District Department of Transportation and curbFlow, a consulting firm that specializes in curbside data collection and management, have partnered to better understand commercial loading space in the city.

To better understand whether a segment of curb lane is being used effectively, and whether a curb lane's designation is serving a community's goals, many organizations are developing methodologies to measure the activity that occurs in the curb lane. The National Association of City Transportation Officials (NACTO) released a white paper highlighting the importance of cities rethinking the way they use their curb lanes.[6] NACTO urges cities to "choose measurement over myths," and provides a few examples: a bike share station can support 40 riders per day; a food truck can serve 100 meals and generate $800–$1,800 per day; a passenger pickup and drop-off zone can serve 100 passengers per day; a parklet can see 100 visitors per day and generate a 10 percent to 20 percent revenue boost to local businesses. NACTO's paper underscores how the cities and curbs of the future will need to balance the needs of many different users within a limited amount of space.

A clear policy goal can help clarify a strategy for measuring the value of curb lanes. In the case of Portland's Central City in Motion, curb lanes are viewed through the lens of overall traveler throughput, because the primary focus of that plan is maximizing the number of people moving through the system. They note, for example, that where a general traffic lane moves 850 people per hour, a dedicated bus lane can move 2,000 people per hour, and a protected bike lane

[4] Portland Bureau of Transportation, *Parking Supply and Demand Management Strategies*, October 2018, portlandoregon.gov/transportation/article/702692.

[5] International Transport Forum. *The Shared-Use City: Managing the Curb*, May 2018, itf-oecd.org/sites/default/files/docs/shared-use-city-managing-curb_5.pdf.

[6] National Association of City Transportation Officials, *Curb Appeal: Curbside Management Strategies for Improving Transit Reliability*, November 2017, nacto.org/wp-content/uploads/2017/11/NACTO-Curb-Appeal-Curbside-Management.pdf.

can move 2,500 people per hour. In this framework, on-street parking is not a particularly high-value use of the curb lane.

Other cities are evaluating their curb lanes in terms of the access they can provide to people using different transportation modes. One such city is San Francisco. The City of San Francisco and ride-hail company Uber retained consulting firm Fehr & Peers to perform a study of the curb lane.[7] A key focus of the analysis was to quantify the productivity of the curb, and how that productivity changes based on the curb space designation. For this, Fehr & Peers devised the "curb productivity index," which is calculated by dividing the number of passengers or vehicles that arrive via a particular travel mode by the amount of time the curb was in use and the length of curb required for that use. This value is then multiplied by 20 feet, which is approximately the size of a typical on-street parking space, giving a final measurement of people served per hour per 20 feet of curb. For example, if over two hours 30 buses pick up and drop off a total of 100 passengers, each bus dwells for 25 seconds (total bus dwell time is 12.5 minutes), and the bus stop is 60 feet long, the curb productivity would be:

$$\frac{100 \text{ passengers}}{12.5 \text{ minutes} \times 60 \text{ feet}} \times 20 \text{ feet} = 160 \text{ people served per hour per 20 feet of curb}$$

On the other hand, if a car carrying two people is parked in a 20-foot parking spot for two hours, the curb productivity would be 1 person served per hour per 20 feet of curb. In these examples, using the space for a bus stop is much more productive.

We note that this index calculates a theoretical curb productivity, because the time element of the calculation does not account for the time that a curb lane is not in use at all. The curb productivity of a bus stop as calculated above considers only when a bus is dwelling at the stop. But when a bus is not present, the space may in practice still be designated as a bus stop, unavailable to use by other modes. However, one could calculate the curb productivity for a curb lane designated as a bus stop over a full hour, regardless of the actual bus dwell time, and compare it to the productivity of other designations. The curb productivity index helped the researchers understand the curb productivity in the different case study locations, and how that productivity varies for different modes.

[7] Fehr & Peers, Uber Technologies, and the City of San Francisco, *San Francisco Curb Study*, September 2018, https://www.fehrandpeers.com/wp-content/uploads/2019/01/SF_Curb_Study_2018-10-19_web-download.pdf.

## 1.2 Opportunities in the Boston Region

High-level street, sidewalk, and curb lane design is loosely guided in the Boston region by a number of policies, including Complete Streets and Vision Zero policies, which are typically adopted at the municipal level. Implementing a regional curbside management policy would require significant coordination, but could be a significant opportunity to streamline management of curb lanes in the Boston region. This could be of particular regional benefit because the region's transportation network transcends municipal boundaries. Consistency in design would be beneficial to bicyclists and transit riders and providers. Consistency in policy would be beneficial to ride-hail drivers and enforcement efforts. In addition, many municipalities in the region may not have the resources to craft and adopt their own curbside management policies, so a regional policy would help those municipalities address curb lane demands more easily.

# 2 MANAGING PASSENGER PICKUPS AND DROP-OFFS

A growing challenge for curbside management is assuring sufficient space for passenger pickup and drop-off activity, both from ride-hail services and private shuttles. This is particularly important as ride-hail usage increases. According to a 2018 analysis by the Pew Research Center, 36 percent of US adults said they had ever used a ride-hail service, up from 15 percent in 2015.[8] In urban areas, that percentage climbs to 45 percent. Nineteen percent of urban users report using a ride-hailing app at least weekly. The US Department of Transportation suggests that there were more than 4.2 billion ride-hail trips in the United States in 2018.[9]

All of these ride-hail drivers need access to an already crowded curb to pick up and drop off passengers, but space is rarely allocated specifically for this use. When curb access is not readily available, pickup and drop-off activity often occurs in travel lanes, causing congestion and unsafe conditions. City officials across the country have begun resolving this conflict in two ways. One strategy is to install new or additional designated passenger pickup and drop-off space, which is often undersupplied near destinations like major performance or sporting venues, or along busy commercial corridors with lots of attractions and high customer turnover. The space can be permanently dedicated for this purpose, or it can be regulated based on time of day to reflect demand. A second strategy is to work with ride-hail services directly to restrict passenger pickup and drop-off in

[8] Jingjing Jiang, "More Americans are Using Ride-hailing Apps," Pew Research Center, January 2019, pewresearch.org/fact-tank/2019/01/04/more-americans-are-using-ride-hailing-apps/.

[9] US Department of Transportation, Bureau of Transportation Statistics, *Transportation Statistics Annual Report 2018*, February 2019, rosap.ntl.bts.gov/view/dot/37861.

an area to specific locations, a technique known as geofencing. The following section provides examples of both of these techniques.

## 2.1 Examples from Other Major Cities

### *Managing pickups and drop-offs from ride-hail services*

One way that city officials are addressing congestion from ride-hail pickup and drop-off activity is by creating designated space for pickup and drop-off activity. In Washington, DC, officials piloted passenger pickup and drop-off space along Connecticut Avenue near Dupont Circle in response to increasing congestion caused by ride-hailing activity during nightlife hours.[10] The pickup and drop-off zones were originally from 10:00 PM to 7:00 AM on Thursday through Sunday. The District Department of Transportation (DDOT) collected data on crash rates, traffic flow, ride-hail and taxi dwell time, transit and bike-share ridership, transit travel speeds, parking citation trends, and economic impacts. After a nine-month evaluation period, the zones were converted to permanent, all-day pickup and drop-off zones, and the program was expanded to an additional five locations across the city.

In San Francisco, ride-hail company Uber hired consulting firm Fehr & Peers to conduct a study of the curb lane.[11] Fehr & Peers collected traffic data, Uber activity data, and observations from videos, photographs, and site visits in the field to understand the causes of curb lane congestion in five locations and to provide some suggestions that could lead to improvements. Fehr & Peers selected five case study locations, ranging from downtown commuting corridors to neighborhood commercial centers. In the case study locations, Fehr & Peers found insufficient passenger pickup and drop-off space causing ride-hail drivers to stop in travel lanes. This behavior blocked transit service, was hazardous to people biking, and raised safety and accessibility concerns. In each location, Fehr & Peers found that designated passenger pickup and drop-off space, typically not provided even though many people arrived via a ride-hail service, would help alleviate congestion. Fehr & Peers proposed providing this space by reallocating space used for on-street parking, which it measured as serving the fewest visitors to the study areas but typically took up most of the curb lane space. Another strategy was to employ flexibility, by allowing multiple uses to share the same space (for example, passenger pickup and drop-off with commercial loading) or by having designations change throughout the day (for example, by using the space for passenger pickup and drop-off when the demand for that use is highest).

[10] Institute of Transportation Engineers, *Curbside Management Practitioners Guide Case Study: Washington, DC*, November 2018, ite.org/pub/?id=C29F4D5E-FE34-2037-3B96-DE312E1DBBFF.

[11] See note 7.

Fehr & Peers completed a similar study in Cincinnati, again in partnership with Uber.[12] In three case study locations, Fehr & Peers collected traffic data, Uber activity data, and observations from videos, photographs, and site visits in the field. Two of these locations were adjacent to major event centers—a performing arts center and a baseball stadium—that generate significant ride-hail activity, especially in the time leading up to the start of an event. Fehr & Peers found that providing passenger pickup and drop-off space during peak demand would help alleviate congestion, reduce delay to transit services, and improve accessibility. The third location was a popular entertainment and nightlife area near the ballpark. Fehr & Peers recommended reallocating most of the on-street parking for passenger pickup and drop-off. The City is reviewing the recommendations.

Another strategy for alleviating ride-hail congestion is to consolidate pickups and drop-offs to specific locations in congested areas through geofencing. Geofencing creates a virtual barrier within a mobile app that prevents pickups and drop-offs from happening in certain locations, instead consolidating the activity to a nearby location, usually one that is less congested. San Francisco has worked with ride-hail company Lyft to trial geofencing in some locations, including Valencia Street in the Mission District, a high-activity mixed-use corridor.[13] In response to safety concerns from cyclists, city officials worked with Lyft to create four venues—or designated pickup and drop-off locations—that would restrict pickup and drop-off activity to side streets to help reduce congestion and conflicts with people on bikes. San Francisco has also trialed geofencing near the 4th Street Caltrain Station to alleviate congestion and confusion as passengers and drivers search for one another.[14] Early reports suggest these pilots are working, but more research and evaluation are necessary.

Toronto is piloting a unique strategy to increase space for passenger pickups and drop-offs. The city's Curbside Management Strategy identified an opportunity to trial taxi waiting and loading in front of fire hydrants. A proposal for a pilot project was approved by the city council in 2018. The City designated 18 hydrants as locations where taxis are permitted to wait for, pick up, and drop-off passengers.

[12] Fehr & Peers, Uber Technologies, and the City of Cincinnati, *Cincinnati Curb Study*, January 2019, fehrandpeers.com/wp-content/uploads/2019/01/CincinnatiCurbStudy_2019-01.pdf.

[13] Debs Schrimmer, Transportation Policy Director for Lyft, *Creating a Safer Valencia Street*, August 2018, medium.com/sharing-the-ride-with-lyft/creating-a-safer-valencia-street-54c25a75b753.

[14] Livable City and Lyft, *Curbing the Caltrain Cluster*, December 2015, livablecity.org/curbthecluster/.

### *Managing pickups and drop-offs from private shuttles*

Addressing the curb lane needs of private shuttles and other transit services has proven essential, as regulation of these services is not as fully developed as it is for public transit service. In response to safety concerns with private employee shuttle services loading passengers at unauthorized locations, the San Francisco Municipal Transportation Agency (SFMTA) implemented a program in 2014 to regulate private commuter shuttles.[15] The program allowed access to some Muni bus stops and other shuttle-only areas in exchange for paying a permit fee and sharing ridership data with the city. There was also an increased enforcement effort to reduce shuttles from loading in unauthorized locations. The program successfully reduced conflicts with public transit service by shifting shuttle loading to less frequently used Muni shuttle stops, improved safety during passenger loading and unloading, and reduced shuttle traffic impacts on neighborhood streets.[16]

Also in San Francisco, the vehicles from an emerging private microtransit provider, Chariot, needed locations to load and unload passengers, causing increased activity at the curb. Operators often loaded at Muni bus stops, creating conflict with existing transit service. In response, officials created a permit program in October 2017 to regulate microtransit services.[17] The goal of the program was to reduce unsafe passenger loading, to minimize loading occurring in unauthorized locations, to address vehicle accessibility (or inaccessibility), and to collect data. As part of the program, operators must pay a permit fee to the City, provide real-time location and ridership data, and ensure full accessibility of their vehicles. In developing the program, SFMTA worked with Chariot to relocate dozens of stops from unauthorized locations. The regulations now require that microtransit services stop only in “white curb zones,” where passenger pickup and drop-off is permitted, or “yellow curb zones,” where commercial loading is permitted. Chariot ceased operations in February 2019, but the City’s regulations for microtransit services remain to provide a regulatory framework for the evolving industry.

## 2.2 Opportunities in the Boston Region

Travelers have experienced the surging popularity of ride-hail services and the associated increase in traffic and congestion in the Boston region. According to

[15] Institute of Transportation Engineers, *Curbside Management Practitioners Guide Case Study: San Francisco, USA*, November 2018, ite.org/pub/?id=C2D66E96-FF01-0BA8-68C3-65CC9116A5AE.

[16] San Francisco Municipal Transportation Agency, *Commuter Shuttle Pilot Program: Evaluation Report*, October 2015, https://www.sfmta.com/sites/default/files/projects/2015/Evaluation%20Report%20-%20Oct%205%202015.pdf.

[17] See note 15.

the Massachusetts Department of Public Utilities, there were 81.3 million ride-hail rides across the Commonwealth in 2018, a 25 percent increase over 2017 totals.[18] More than 80 percent of these rides originated in the Boston region's inner core cities and towns. Of the 15 municipalities statewide with the most rides started, 13 are in the Boston region: Boston, Brookline, Cambridge, Chelsea, Everett, Lynn, Malden, Medford, Newton, Quincy, Revere, Somerville, and Waltham. Where ride-hail usage is highest, ride-hail traffic moves the slowest: Boston, Brookline, Cambridge, Chelsea, Everett, and Somerville all had average ride speeds of less than 17 miles per hour—the slowest in the Commonwealth.

A recent report by the Metropolitan Area Planning Council found that ride-hailing services have added more cars to the region's roads.[19] After conducting a survey of ride-hail passengers and drivers, they estimated that 59 percent of ride-hail trips would have been made by transit, by bike, on foot, or not at all if ride-hailing were not available. New research suggests this increase in traffic is highly inefficient. An analysis by Fehr & Peers found that the estimated share of vehicle-miles travelled in the Boston area by ride-hail services was 8 percent.[20] For 45 percent of those miles, there was no passenger in the vehicle (that is, the driver was either waiting for a ride request or was en route to a pickup location).

A pilot testing designated passenger pickup and drop-off space is underway in Boston. In response to congestion on Boylston Street near Fenway Park, the Boston Transportation Department has converted four parking spaces near the intersection with Kilmarnock Street to passenger pickup and drop-off space from 5:00 PM to 8:00 AM.[21] City of Boston staff are currently collecting data from that pilot, including vehicle turnover rates and incidents of travel lane blockages from pickup and drop-off activity, for a formal evaluation. There may be other locations in Boston and throughout the region where similar treatment could prove effective at reducing congestion, improving safety, and increasing the ability of ride-hail drivers to access the curb.

[18] Massachusetts Department of Public Utilities, TNC Division, *Rideshare in Massachusetts: 2018 Data Report*, May 2019, tnc.sites.digital.mass.gov/.

[19] Metropolitan Area Planning Council, *Fare Choices: A Survey of Ride-Hailing Passengers in Metro Boston*, February 2018, mapc.org/wp-content/uploads/2018/02/Fare-Choices-MAPC.pdf.

[20] Melissa Balding, Teresa Whinery, Eleanor Leshner, and Eric Womeldorff, Fehr & Peers, *Estimated TNC Share of VMT in Six US Metropolitan Regions*, August 2019, issuu.com/fehrandpeers/docs/tnc_vmt_findings_memo_08.06.2019.

[21] City of Boston, *Pick-Up and Drop-Off Zone Pilot Launched in the Fenway*, March 2019, boston.gov/news/pick-and-drop-zone-pilot-launched-fenway.

# 3 MANAGING COMMERCIAL VEHICLE LOADING

Commercial vehicles are another source of congestion on city streets and at the curb. According to CityLab, commercial vehicles now account for 7 percent of urban traffic.[22] The growing preference for online shopping has caused a dramatic uptick in freight delivery: in 2010 the U.S. Postal Service delivered 3.1 billion packages; by 2016 that number had climbed to 5.1 billion. Overall, there are more deliveries to residences, and they are increasingly more frequent and on demand, with some companies trialing same-day or even one-hour deliveries.

In business districts, the increase in commercial activity is putting a strain on existing commercial vehicle loading zones, forcing some delivery drivers to double-park in travel lanes, block bike or transit lanes, or encroach on pedestrian space. City officials are working to solve this conflict by monitoring existing loading space, identifying opportunities to create more loading space, and rethinking urban goods delivery from a systems perspective.

## 3.1 Examples from Other Major Cities

To address the increasing congestion from commercial vehicles making ever more deliveries, some city officials have become more active in their management of the space allocated to commercial vehicle loading. The first step in managing commercial vehicles' use of curb lanes is to understand existing infrastructure and usage. A study in Seattle found 40 percent of commercial vehicles parked in bus lanes, passenger pickup and drop-off zones, tow-away zones, or other no-parking zones.[23] The authors identified the cause of this as insufficient commercial vehicle loading space, and noted the need to develop curb management strategies based on existing site conditions.

A study by the California Department of Transportation examined curbside parking along designated blocks in Los Angeles, Santa Monica, Irvine, Oakland, and Berkeley, in contexts ranging from downtown cores, commercial corridors, and suburban areas.[24] Researchers found commercial vehicles were frequently parked in front of fire hydrants, in accessible parking spaces, or in other "red zones" where standing, stopping, or parking are not permitted. Only 40 percent of commercial delivery vehicles used the appropriate loading zones. The study recommended continued collection of curb usage data and the design of parking management strategies for delivery vehicles.

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[22] Andrew Zaleski, CityLab, *Cities Seek Deliverance from the E-Commerce Boom*, April 2017, citylab.com/transportation/2017/04/cities-seek-deliverance-from-the-e-commerce-boom/523671/.

[23] Schaller Consulting, *Making the Most of the Curb*, June 2019, schallerconsult.com/rideservices/makingmostofcurb.pdf.

[24] See note 23.

Some cities have developed and implemented curbside management strategies to address increasing commercial vehicle congestion at the curb. In 2015, officials in Washington, DC, implemented a citywide program to improve the availability of the city's commercial vehicle loading space and reduce commercial vehicles double-parking.[25] The city began requiring commercial vehicle operators to obtain a daily or annual permit to park in commercial loading zones. Operators who did not obtain a permit in advance could pay over the phone once parked; signage posted at each space provided instructions. Drivers could monitor an online map hosted by the DDOT to find available loading space. The program was initially met with some resistance, but District officials have found that delivery companies appreciate the time savings and reduction in parking tickets, and are willing to pay for the reliability that the program provides. More than 70 businesses purchased annual permits in the first six months of the program, and double-parking violations and non-commercial vehicles parking in loading zones have been reduced by 50 percent.

DDOT provided the following recommendations to other jurisdictions interested in a program to improve management of commercial vehicle loading zones:

- Inventory existing loading zones and collect data on their use.
- Coordinate with police on enforcement of new policies.
- Offer multiple and convenient methods to pay for parking and investigate new forms of payment as they become available.
- Engage with those who deliver and receive goods in the affected area, and with local business and economic development organizations.

DDOT has also partnered with curbFlow, a mobility company that specializes in monitoring curb lane use data in real time to manage commercial delivery vehicle loading activity.[26] Beginning in August 2019, DDOT removed parking from nine blocks along various commercial corridors throughout the city. These curbs were instead used for commercial vehicle loading and unloading, including private vehicles engaged in small-scale commercial operations, like meal pickup and delivery or courier services. curbFlow monitored the usage of the loading zones and found the following results after three months of evaluation:

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[25] Federal Highway Administration, *Commercial Loading Zone Management Program: Washington, D.C.*, March 2017, ops.fhwa.dot.gov/publications/fhwahop17022/fhwahop17022.pdf; See also note 10.

[26] District Department of Transportation, Press Release: DDOT, curbFlow Research Project Finds High Demand for Pickup, Drop-off Zones, https://ddot.dc.gov/release/ddot-curbflow-research-project-finds-high-demand-pickup-dropoff-zones, November 2019.

- Double-parking and illegal U-turns by commercial vehicles decreased by an estimated 64 percent near the trial loading zones.
- Commercial vehicles, including large freight and parcel delivery vehicles and small-scale on-demand delivery vehicles, used a loading zone for an average of 7 to 11 minutes.
- Small-scale on demand deliveries were the most frequent users of the loading zones.

Officials in Toronto have identified a number of policies to help ease commercial vehicle congestion at the curb.[27] One is to formalize existing “advisory” commercial vehicle loading zones, which are signed for use by commercial vehicles but not enforced in practice, by designating them exclusively to commercial vehicles and increasing enforcement to ensure they are used for their intended purpose. This change is expected to speed up delivery operations and reduce the time spent by commercial vehicles cruising for parking.

Researchers in Seattle are tackling commercial vehicle congestion by looking at deliveries from a systems engineering perspective. The Urban Freight Lab—a partnership between the University of Washington, Seattle Department of Transportation, and private stakeholders—has identified a particular point of inefficiency, which they call "the final 50 feet."[28] This refers to the distance goods must travel between being unloaded from a delivery vehicle and being accepted by the final customer. Researchers found that out of every 20 minutes a commercial vehicle spends at the curb, 12 of those minutes are spent negotiating sidewalks, curb cuts, building security, and moving floor-to-floor and door-to-door to access multiple tenants. And if a tenant is not available, this "failed first delivery" eventually necessitates a second trip, either by a second delivery vehicle or by the intended recipient to a delivery company's suburban warehouse. To solve this problem, the Urban Freight Lab worked with its partners UPS and the USPS to install a locker system in the Seattle Municipal Tower that would be available to drivers of both services. The lockers, known as “common carrier” lockers, could be quickly loaded by drivers, reducing dwell times by 78 percent. Moreover, by definition there were no failed first delivery attempts. Items are held in a locker that can be unlocked by the final recipient.

[27] See note 2.

[28] Urban Freight Lab, "The Final 50 Feet Urban Goods Delivery System: Common Carrier Locker Pilot Test at the Seattle Municipal Tower," October 2018, depts.washington.edu/sctlctr/sites/default/files/SCTL_Muni_Tower_Test_Report_V4.pdf.

## 3.2 Opportunities in the Boston Region

Commercial vehicle traffic is ever present in the Boston region, and there may be opportunities to alleviate the curbside congestion experienced and caused by these vehicles. The Massachusetts Freight Plan notes that Massachusetts consumes more goods than it produces.[29] In 2015, the state's freight network moved nearly $500 billion worth of goods—a figure that is expected to double in the next 30 years. One recent study examined urban freight conditions within Boston city limits.[30] It found rates of significant double-parking by commercial vehicles due to unauthorized vehicles parking in commercial loading zones, and recommended implementing a pilot project similar to the commercial loading zone management and permitting program undertaken in Washington, DC, described in Section 3.1 of this memorandum. Further study may help planners identify additional opportunities to address commercial vehicle congestion.

# 4 IMPROVING MULTIMODAL ACCESS AND SAFETY

Municipal officials face an increasing need to balance the needs of many transportation modes. As demand for transit, bicycle, and pedestrian infrastructure increases, municipalities are developing new strategies to provide convenient and safe access to curb space. Municipalities across the country are reconfiguring street space to improve access and safety for people using alternative modes of transportation, like transit, walking, or biking. There is a growing movement towards designing streets as complete streets, where the street is designed for all users of the space. This considers the different modes that people use to access the street, including driving, bicycling, taking transit, and walking, and the different abilities people have, from the youngest to the oldest visitors to a street.

The National Complete Streets Coalition has documented the benefits of complete streets and the need for infrastructure for various modes and users.[31] They note that 28 percent of metropolitan trips are one mile or less, but 65 percent of trips shorter than one mile are made by car. They cite a recent national survey that found

- 47 percent of Americans older than 50 said they could not cross main roads near their home safely;

[29] Massachusetts Department of Transportation, "Massachusetts Freight Plan," April 2018, mass.gov/files/documents/2018/09/04/Freight%20Plan508.pdf.
[30] Office of New Urban Mechanics, *Recommendations to Improve Urban Freight*, August 2019.
[31] National Complete Streets Coalition, *Complete Streets Change Travel Patterns;* National Complete Streets Coalition, *Complete Streets Ease Traffic Woes,* smartgrowthamerica.org/resources/.

- approximately 40 percent said their neighborhoods do not have adequate sidewalks;
- 55 percent reported no bike lanes or paths;
- 48 percent reported no comfortable place to wait for the bus.

More than 1,400 Complete Streets policies have been adopted across the United States by city and state governments.

An important element of a complete street is transit service. NACTO's 2017 white paper provided guidance on reconfiguring curb space to "clear the way for transit."[32] NACTO highlighted two organizing principles. The first is to prioritize transit at critical locations, for example by providing dedicated bus lanes or queue jumps at intersections, or equipping vehicles and signals with transit signal priority (although transit signal priority could be a solution regardless of changes to the curb). The second is to make room for transit at peak periods, for example by use of temporary dedicated lanes during peak commuting times.

## 4.1 Examples from Other Major Cities

### *Improving multimodal access*

In response to growing multimodal demands on streets and curb lanes, cities have been working to improve access and safety for transit users, people biking, and people walking. Several corridors in San Francisco have been reconfigured to improve safety and curb lane access for different modes. To support the city's Vision Zero initiative, an effort to eliminate traffic fatalities in the city, officials identified the High-Injury Network, which is the 13 percent of city streets that account for 75 percent of the city's severe or fatal traffic injuries. In 2018 SFMTA reconfigured the existing curb lane on Polk Street, which is on the city's High-Injury Network, to include improved bike facilities; pedestrian safety improvements like curb extensions, daylighting, crosswalk upgrades, and signal timing changes; curb extensions at transit stops to improve safety; and improved commercial vehicle loading space in more convenient locations and with time restrictions developed through merchant feedback.[33] Officials note that 90 percent of parking within a one-block radius was retained, including 70 percent of parking on Polk Street. The city will evaluate the project with a one-year post-project evaluation—looking at transit efficiency, bicycle counts, traffic counts, commercial loading, and illegal parking—and a two- to five-year evaluation that will also consider traffic collisions and economic impacts.

[32] See note 6.

[33] San Francisco Municipal Transportation Agency, "Polk Street Project," sfmta.com/projects/polk-streetscape-project, retrieved August 2019.

Another corridor on San Francisco's High-Injury Network that has significant safety concerns is 5th Street, a four-lane road with parking on both sides and turn lanes at major intersections.[34] SFMTA is working to improve safety and incorporate improvements for people walking, biking, and riding transit on this corridor. Through the removal of some on-street parking, the project calls for new bike lanes, improved transit stops, and pedestrian safety treatments to improve visibility and safety when crossing the street. The project will also result in improved commercial vehicle loading zones and on-street parking for businesses and residents. Construction is expected to begin on these improvements in fall 2019.

In 2015, Toronto undertook a significant reconfiguration of Queens Quay West in response to multimodal demands on the corridor.[35] The corridor had two lanes of mixed traffic in either direction, parking on both sides, and center-running streetcars. There was no dedicated bicycle space, so people riding bikes had to ride in the travel lanes with fast-moving mixed traffic. From the existing right-of-way, officials created a large pedestrian promenade, a two-way off-street cycle track, and a dedicated right-of-way for transit. Additional signage and pavement markings were installed to improve safety at certain locations, and public feedback received by officials indicates that most people are pleased with the new design.

A similar project was completed in Fort Lauderdale, Florida.[36] Officials implemented safety improvements in 2018 along the congested Las Olas Boulevard in accordance with the City's Vision Zero program. Originally, the road had no bicycle facilities, narrow sidewalks, and faded crosswalks, and was a high-crash location. The city reduced the road from four travel lanes to two, shifted the parking lanes out from the curb, and installed protected bike lanes along the curb. Officials also reserved space for passenger pickup and drop-off along the corridor during peak hours (during weekday morning hours and all day on weekends) and commercial vehicle loading on side streets during off-peak hours. An evaluation of the results found the following:

- The traffic calming measures reduce traffic crashes by 21 percent.

[34] San Francisco Municipal Transportation Agency, "5th Street Improvement Project," sfmta.com/projects/5th-street-improvement-project, retrieved August 2019.

[35] Waterfront Toronto, "Queens Quay Revitalization," October 2015, waterfrontoronto.ca/nbe/wcm/connect/waterfront/26638b5f-1e73-470c-8156-485621dde660/2015_queens_quay_report_final_1.pdf?MOD=AJPERES.

[36] City of Fort Lauderdale, "Las Olas Boulevard Six-Month Safety Improvements Demonstration Project: Evaluation Report," July 2018, fortlauderdale.gov/home/showdocument?id=31059.

- The bike lanes see an average of 30 people riding in peak weekday hours and an average of 56 riding in peak weekend hours.
- An average of 19 passengers per hour use the passenger pickup and drop-off space.

A project specifically aimed at improving the experience for people biking was completed in San Francisco. SFMTA identified Market Street, a popular biking corridor with existing dedicated bike lanes, to test four raised bikeway configurations.[37] Raised bikeways can be a solution along corridors where vehicle, pedestrian, and bicycle zones are difficult to distinguish, where vehicles tend to park in the bike lane, or where people tend to ride their bicycles on the sidewalk. The configurations differed in curb height, visibility, and accessibility. They also differed in the slope of the curb, so officials could test whether people riding bikes would be able to easily enter and exit the bikeway (and, in some cases so certain vehicles can enter and exit the bikeway; for example, a street sweeper). Officials conducted interviews with stakeholder groups, including bike riders, pedestrians, accessibility advocates, and municipal public works and maintenance staff. They found that most of the options were supported by bike riders, had minimal impacts on pedestrians and accessibility, and would not require significant additional space to install. The city has already relied on the results of the raised bikeway pilot to inform design on bike facilities in other locations, including the Polk Street corridor mentioned above.

Portland, Oregon, is rethinking its street network not only in terms of safety for different users but also the total people-moving capacity of the system. Portland's Central City in Motion is the city's guide to strategic investments in the existing street network.[38] The plan includes several multimodal improvement projects that support the goals of maximizing person-throughput and sustainability. Two examples are included here, which Portland Bureau of Transportation anticipates to be constructed in 2019–20. One project is on Burnside Avenue, including the Burnside Bridge, a major commuting corridor in and out of downtown. Improvements include an eastbound 1.2-mile dedicated bus lane equipped with transit signal priority; buffered bike lanes on both sides of the road approaching and crossing the bridge; new signal timings to better accommodate transit, people walking, and people biking; and safety improvements at five intersections to improve crossing conditions for people walking and biking. To accommodate the bus and bike lanes, on-street parking along the corridor would be removed. Anticipated outcomes include improved speed and reliability of transit service,

[37] San Francisco Municipal Transportation Agency, "Market Street Raised Bikeway Demonstration Project: Findings Report," January 2017, https://www.sfmta.com/sites/default/files/projects/2017/Market%20St_Raised%20Bikeway_Evaluation.pdf.

[38] See note 3.

safer and more intuitive bike connections, improved pedestrian safety and connectivity to downtown, and an overall increase in people-moving capacity of 145 percent.

On Madison Street, installing a dedicated bus and bike lane is expected to alleviate congestion, improve transit performance, and increase safety for people riding bikes. The lane will be wide enough to provide space for bikes to pass buses at stops. Space for the lane will be made possible by removing a lane of parking, currently reserved for police and government vehicles, and shifting the travel lanes into that space. The change is expected to increase people-moving capacity by 74 percent.

### *Improving safety with shared streets*

One way that cities are improving safety and access for people walking or biking is by calming vehicular traffic and creating shared streets. Jefferson Street, in the busy San Francisco tourist area of Fisherman's Wharf, was once a two-lane, one-way street with narrow sidewalks and poor lighting.[39] To address safety concerns and improve the experience for people walking or biking, in 2013 officials removed parking, widened the sidewalks, improved crosswalks, and slowed vehicular traffic by narrowing the travel lanes, converting the street to two-way, and installing decorative pavers. Commercial vehicle loading is permitted in the travel lane between midnight and 11:00 AM.

Officials in Seattle took a similar approach to improve the pedestrian experience with its first shared street conversion. Bell Street was converted to a pedestrian-focused shared street in 2014 to improve the pedestrian environment and connect the open space network.[40] The street is now a single, continuous surface, which enhances accessibility and reduces tripping hazards. There are areas provided for art installations, plantings, and seating, all placed in a way to calm vehicular traffic. The design has forced drivers to slow down, which has improved both pedestrian safety and access to public open space. The project has seen strong support from both neighborhood residents and business owners.

## 4.2 Opportunities in the Boston Region

### *Opportunities for dedicated bus lanes*

The region's growing congestion is acutely felt among transit riders. A recent report by Massachusetts Department of Transportation documenting the growing

[39] San Francisco Public Works, Jefferson Street Improvement Project, sfpublicworks.org/project/jefferson-streetscape-improvement-project, retrieved August 2019.

[40] National Association of City Transportation Officials, *Case Study: Bell Street Park Shared Street*, 2014, https://nacto.org/case-study/bell-street-park-seattle/, retrieved August 2019.

congestion across the state found that Massachusetts Bay Transportation Authority (MBTA) bus trip times have gotten 17 percent longer in both the AM and PM peak hours.[41] Buses are travelling at 11.5 miles per hour on average, the slowest speeds since the MBTA has had data available. The report emphasizes that congestion is felt not only by trips—transit or otherwise—taking longer. Travelers are especially frustrated by the increasing variability in how long it takes them to get where they need to go.

A 2016 report authored by the Central Transportation Planning Staff (CTPS) prioritized potential bus lane corridors in the region based on bus passenger volumes and delay attributable to congestion.[42] Some of the corridors that were identified now have bus lanes, but there are additional opportunities throughout the region to expand the network. Several bus lane projects, including those currently installed in Arlington, Boston, Cambridge, Everett, Somerville, and Watertown have prioritized bus service and improved the reliability of bus travel times.

### *Opportunities for Complete Streets*

For nontransit travel modes, some municipal Vision Zero and Complete Streets policies are guiding improvements. Boston's Complete Streets policy establishes guidelines for street redesign and reconstruction projects, ensuring that streets are designed for walking, biking, using transit, and driving.[43] Two streets—Winter Street downtown and Cross Street in the North End—are provided as examples of shared streets, where the sidewalk and travel lanes are a single, level surface and speeds are low enough that people walking and biking and occasional vehicle traffic can safely mix. There may be opportunities in many neighborhood centers, especially wherever large numbers of people come to gather and shop, to convert portions of streets to shared streets.

For example, Cambridge is installing safety improvements on Massachusetts Avenue between Lafayette Square and the Charles River in accordance with the city's Vision Zero and Complete Streets policies.[44] The goals of the project are to address safety issues and reduce crashes, to reduce delay to transit service, and

[41] Massachusetts Department of Transportation, *Congestion in the Commonwealth: Report to the Governor*, August 2019, https://www.mass.gov/doc/congestion-in-the-commonwealth/download.

[42] Central Transportation Planning Staff, "Prioritization of Dedicated Bus Lanes," June 2016, ctps.org/data/pdf/studies/transit/Prioritization_of_Dedicated_Bus_Lanes_20180626.pdf.

[43] Boston Transportation Department, *Boston Complete Streets: Design Guidelines*, May 2013, bostoncompletestreets.org/pdf/2013/BCS_Guidelines.pdf.

[44] City of Cambridge, "South Mass Ave Corridor Safety Improvements," October 2018, cambridgema.gov/traffic/News/2018/10/southmassavecorridorsafetyimprovements; see also note 23.

to enable and encourage people of all ages and abilities to choose sustainable modes of transportation. Specific improvements include improved signal timings at intersections, new crosswalks, parking-protected bike lanes, sections of dedicated bus lanes, and new commercial vehicle loading zones and passenger pickup and drop-off zones.

# 5 MANAGING ON-STREET PARKING

The majority of curb space in cities today is typically used for parking. Municipal officials are beginning to reevaluate the way this limited but valuable resource is managed. One strategy is demand-priced parking. When on-street parking is provided for free or at low cost, occupancy tends to be high and turnover is low, especially when spaces do not have time limits. By dynamically pricing parking according to specific occupancy targets, cities can encourage turnover, reduce the number of drivers cruising for parking, and try to ensure one or two spaces will typically be available.

Curb space, especially when used for parking, is often crowded because the demand for parking exceeds the available supply. Since increasing the supply may not be desirable or possible, officials can manage the demand for parking by increasing its cost. Several pilots around the country have demonstrated success with demand-based, on-street parking pricing.

## 5.1 Examples from Other Major Cities

Some cities have implemented programs to improve the management and efficiency of on-street parking. In San Francisco, high parking occupancy caused drivers to circle for parking, which was dangerous to people biking and walking because drivers were distracted by trying to find a parking spot. The congestion from drivers looking for parking also delayed transit service and created additional vehicle emissions. San Francisco conducted a trial demand-priced parking program, *sfPark*, in six locations throughout the city beginning in 2011.[45] Officials installed pavement-embedded sensors and new parking meters to monitor usage and adjust pricing over time to reflect demand based on location (typically by block), time of day, and day of the week. The pilot dramatically improved parking availability based on the target occupancy rate of 60 percent to 80 percent. An evaluation of the program also found

- a 43 percent reduction in time spent searching for parking;
- a 23 percent reduction in parking citations;

[45] San Francisco Municipal Transportation Agency, *SFpark: Pilot Project Evaluation*, June 2014, sfpark.org/wp-content/uploads/2014/06/SFpark_Pilot_Project_Evaluation.pdf; see also note 15.

- a 30 percent reduction in vehicle emissions from vehicles searching for parking; and
- a 30 percent reduction in vehicle-miles traveled in the pilot area.

In 2017 the program was expanded citywide.

Washington, DC's DDOT has tested demand-priced parking in two locations.[46] The first pilot zone was established in 2008 in the Capital Hill/Ballpark district. The second zone was established in 2014 in the Penn Quarter/Chinatown neighborhood. Both programs improved vehicle turnover, improved placard compliance, reduced the incidence of double parking, and increased meter revenues. Local business owners, customers, and delivery drivers provided positive feedback about the pilot programs, which have been made permanent.

In 2017, DDOT implemented the Red Top Meter Program in an effort to provide sufficient accessible parking for disability placard or plate holders. In the downtown area, DDOT installed parking meters marked with a distinctive red top to signal accessible parking spaces. The meters allow parking for up to four hours. Outside of the downtown area, disability placard or plate holders can park at any metered spot free of charge, and are permitted to stay for twice the posted time limit, up to four hours. When the program launched, 5 percent of parking spaces downtown were Red Top meters; 67 percent of those were van accessible.

Officials in New York City identified congestion at the curb as a source of overall congestion during peak commuting hours.[47] To remedy this, they implemented the Clear Curbs program, which prohibited parking, loading and unloading, or standing of any kind at the curb along parts of Flatbush Avenue in Brooklyn, Roosevelt Avenue in Queens, and along some blocks in Midtown Manhattan on Monday through Friday from 7:00 AM to 10:00 AM and 4:00 PM to 7:00 PM. The New York City Department of Transportation received feedback that the program went too far in restricting access to the curb at these times. Business owners cited speeding traffic, poor accessibility for customers and delivery drivers, aggressive ticketing and towing, and lost revenues. The pilots in Brooklyn and Queens were terminated after five months.

[46] See note 10.

[47] City of New York, Press Release: Mayor de Blasio Announces Initiatives to Help Ease Congestion, October 2017, www1.nyc.gov/office-of-the-mayor/news/673-17/mayor-de-blasio-initiatives-help-ease-congestion; Jenna Bagcal, "City calls it quits on DOT Clear Curbs pilot program along Roosevelt Avenue in Queens," *QNS,* August 2018; see also note 23.

## 5.2 Opportunities in the Boston Region

Boston trialed a demand-priced parking program in 2017 with the goals of improving the parking experience, lowering congestion, increasing road safety, and learning how to implement a permanent program in the city.[48] The pilot was conducted in two neighborhoods. In the Back Bay, officials raised the hourly rate of parking from $1.25 per hour to $3.75 per hour, and found that double-parking reduced by 14 percent and parking in commercial vehicle loading zones reduced by 33 percent. In the Seaport, officials implemented flexible parking rates that responded to the demand for parking on a per-block basis. Parking rates along some blocks quickly reached the program's price cap of $4 per hour, suggesting that according to the demand for parking in those locations, the price could have been set even higher. Ultimately, the program found that demand-based pricing is an effective tool to increase parking availability.

# 6 DISCUSSION

This study has identified a number of key findings related to how city officials can prioritize, evaluate, and manage the curb.

## 6.1 Key Takeaways

**Prioritizing curb lane uses.** There is a growing need to reevaluate the way our curb lanes are used. Creating a framework that helps planners, city officials, and the general public understand that curb lanes can be used for many different purposes can shift the conversation away from removing parking and refocus it around a community's goals.

A community's goals can help inform the most appropriate use for a segment of curb lane. For example, in a major commuting corridor, mobility might be the goal, and so the curb lane might best be used as space for high-capacity transit service or a bike lane. For downtown commercial corridors, access for people and goods might be most important, and so the curb might be best served with ample bike parking and space for commercial loading. Goals can also change by time of day. Space used for travel during peak commuting hours can be used for food trucks in the afternoon, passenger pickup and drop-off in the evening, and parking at night. This study has shown that cities are well-served by considering their goals and designating their curb lanes accordingly.

**Evaluating the curb lane.** Another key lesson from this literature review is that the value of a curb lane is more tangible when it is measured, and that there are different ways to measure the curb depending on the curb's function. For

[48] City of Boston, *Performance Parking: Final Report*, February 2018, https://www.boston.gov/transportation/performance-parking-pilot.

example, mobility can be measured in terms of passenger throughput. Other goals can be measured in terms of economic impacts: commercial vehicle loading zones support the sales of nearby businesses; food trucks and parklets attract customers to an area. The effectiveness of on-street parking can also be measured. Turnover, occupancy, and revenues should all be closely monitored to ensure that using a segment of curb lane for parking is advancing the community's goals.

**Active management.** Balancing the competing needs of different street users will require additional attention from officials as demands increase. Officials should consider flexibility in curb lane designations because, in many locations, the demands on the curb from different users change throughout the day. A curb segment might see high demand for commuting space in the morning, commercial deliveries in the midday, passenger pickups and drop-offs in the evening, and parking overnight. Allowing a curb's designation to change according to time of day or the day of the week can create greater efficiency in its use. The curb of the future will likely also include dynamic management systems, which can change curbside designations in response to current conditions. City officials will need to monitor, evaluate, and adjust curb regulations and management strategies to respond to changing demands.

**Building on the success of others.** It is the hope that this memorandum serves as a resource for planners and municipal officials in the Boston region, and that as they confront issues surrounding curbside management, they are able to learn from the experiences of other regions. In many cases, the lessons learned in other locations are relevant here.

One common theme across locations is that many of the solutions to curbside congestion detailed in this memorandum began as short-term pilot projects. Pilot projects can give planners and officials the flexibility to trial several solutions, collect and analyze data, and evaluate the project before making a permanent change. Pilot projects can often be delivered more quickly and at lower cost than permanent installations.

## 6.2 Further into the Future of the Curb

As interactions with the curb are increasingly made through app-based mobile platforms, municipalities will need a way to clearly and efficiently communicate a curb's designations. For this, a common data syntax could be beneficial.[49] Just as the now widely used General Transit Feed Specification system electronically describes transit service in online and app-based environments, a General Curb

[49] See note 5.

Lane Feed Specification (GCLFS) could describe and communicate curb lane regulations. For example, a GCLFS could describe

- where parking is permitted, how much it costs, and how long the time limit is;
- where passenger pickups and drop-offs are permitted; and
- when street sweeping or other maintenance activities occur.

Such a system could prove valuable to officials that generate the regulations and the services and people that interpret them.

New technologies in vehicles and transportation infrastructure may also affect the curb of the future. City streets and curb lanes could be completely reshaped in the wake of autonomous vehicle technology. NACTO released a guide to help cities prepare and respond for this potential future.[50] The guide highlights several principles for autonomous urbanism, including the need to design for safety and to focus on moving people and not cars, and notes how real-time information and dynamic pricing structures could guide passenger pickups and drop-offs or commercial deliveries.

Ultimately, the curb lane of the future will need to be designated in a way that reflects a community's goals, be measured in a way that is appropriate to the goal, and be actively managed and monitored to ensure the way it is being used supports that goal.

[50] National Association of City Transportation Officials, *Blueprint for Autonomous Urbanism*, 2019, https://nacto.org/publication/bau2/.