



Curb Management:

A PRACTICAL START TO IMPLEMENTING SMART MOBILITY
IN YOUR COMMUNITY

A cold November evening in 2013 was when I took my first rideshare and found myself participating in a paradigm shift as app-based mobility solutions brought the luxuries of on-demand transportation to the average person at affordable prices. What was interesting was not the act of ridesharing (we had taxis for quite a while), but rather the underlying business model and technology that allowed it to exist, and what it represented for the future of mobility and the street curb.

Historically, municipalities had taxi pricing schedules for specific periods that required a license (often referred to as medallions) to limit the supply of taxis, but app-based ridesharing offered a solution that applied the concept of supply & demand in real-time without licensing restrictions. An oversupply of drivers would result in fees going down to attract more riders, while an undersupply would result in higher fees to attract more drivers. Smartphones and 4G telecommunications networks made this possible by allowing services to be adjusted instantly, as opposed to annually or seasonally.

Since their introduction many questioned whether the monetary incentive of app-based rideshares and the lack of regulation was a net benefit with companies facing criticism in relation to further contributing to roadway congestion. A 2021 study from the Massachusetts Institute of Technology (MIT) conducted a historical review of travel data across the U.S. and concluded that ridesharing had generally increased road congestion in urban areas with minimal impacts on personal car ownership¹.

This is a story that continues to play out in various forms as new private mobility options emerge including e-scooters that currently face criticism for their contribution to urban cluttering and environmental impacts. A study published by North Carolina State University in 2019 estimated that the carbon footprint of e-scooters is ~202g of CO² per Km per passenger over their entire life cycle, which is equivalent to a conventional car and 3.5 times more than an electric one². The City of Toronto recently opted out of Ontario's e-scooter pilot in May 2021 stating concerns related to safety, accessibility, enforcement, and liability, which is consistent with several other major North American cities³.

The global on-demand mobility market was estimated to be valued at over \$99B USD in 2019 and is expected to reach over \$238B by 2026 growing at a rate of 15.4% per annum⁴. Most rideshare companies are now referred to as Transport Network Companies (TNCs) to emphasize the spectrum of mobility services they offer between ridesharing, bikeshares, e-scooters, and deliveries. Their influence and contributions to mobility are increasing and are projected to continue to be commonplace in our lives as autonomous vehicles (AVs) and vertical take-off and landing (VTOL) vehicles emerge over the next decade and beyond.

These realities emphasize the dichotomy between for-profit mobility and public infrastructure and the need for municipalities to be proactive, rather than reactive, in addressing emerging mobility. In Ontario there is an estimated \$34.7B infrastructure deficit attributed to roads and structures meaning we are falling short on maintaining our existing mobility network⁵. Regional traffic models, master plans, and land use plans are developed every few years to address a mobility sector that is changing by the day. If our recent experiences have shown us anything, it's that tomorrow's mobility technology won't ask for permission, it will arrive on our street curbs first and beg for forgiveness afterwards.

Investing in curbside management presents a practical starting point for your community to manage existing and future needs, mitigate maintenance costs, and create new placemaking opportunities by focusing on getting more out of what you already have rather than building new and costly infrastructure.

1 (Diao, Kong, & Zhao, 2021)

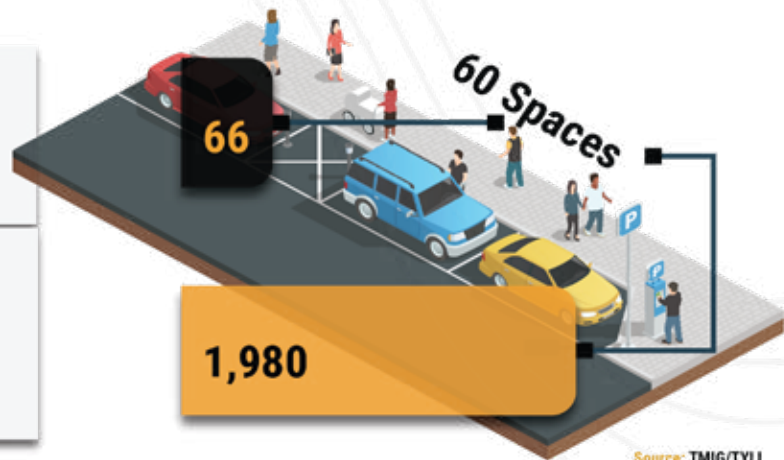
2 (Holingsworth, Copeland, & Johnson, 2019)

3 (City of Toronto, 2021)

4 (Globe Newswire, 2020)

5 (Gismondi, 2021)

WHAT DOES THE CURB REPRESENT?



WHY MANAGE THE CURB?

The varying layers of mobility integrate with land use and urban design at the curb which makes them part and parcel to the public realm where residents meet and interact with one another; whether it's getting dropped off to visit a friend or catching a bus to attend an important meeting.

Curbside management focuses on the transitional space (the curb), between the street and sidewalk, to optimize it for multi-modal and land use needs. Curb space can be used as car parking and loading, but also as the front stoop, sidewalk café, transit hub, freight delivery zone, taxi stand, or bike dock. It is a malleable resource that has value, but that value is not always collected from all curb users.

This isn't an entirely new concept. Seventy years ago, competing interests for the curb were limited – taxi stands, parking and no-parking zones, and transit stops were common forms of managing curb space. In the 1980s and 90s private parcel delivery services such as UPS and FedEx popularized timely curbside deliveries with Business-to-Consumer (B2C) parcel deliveries now accounting for over 50% of today's online e-commerce deliveries⁶. We also can't ignore the impacts that the COVID-19 pandemic has had on further normalizing buy-online-pickup-in-store (BOPIS) and curbside pickup due to physical retail restrictions.

The number of services vying for curb space has exploded within in recent years with the introduction of ridesharing/hailing services such as Uber and Lyft; shared economy delivery services like UberEats and DoorDash; the expansion of Amazon into delivery services; the use of private shuttles; and many other kinds of uses.

In parallel, the sidewalk has seen a rise in demand for bike and scooter parking, and expanded business footprints into the public realm through patios and other uses.

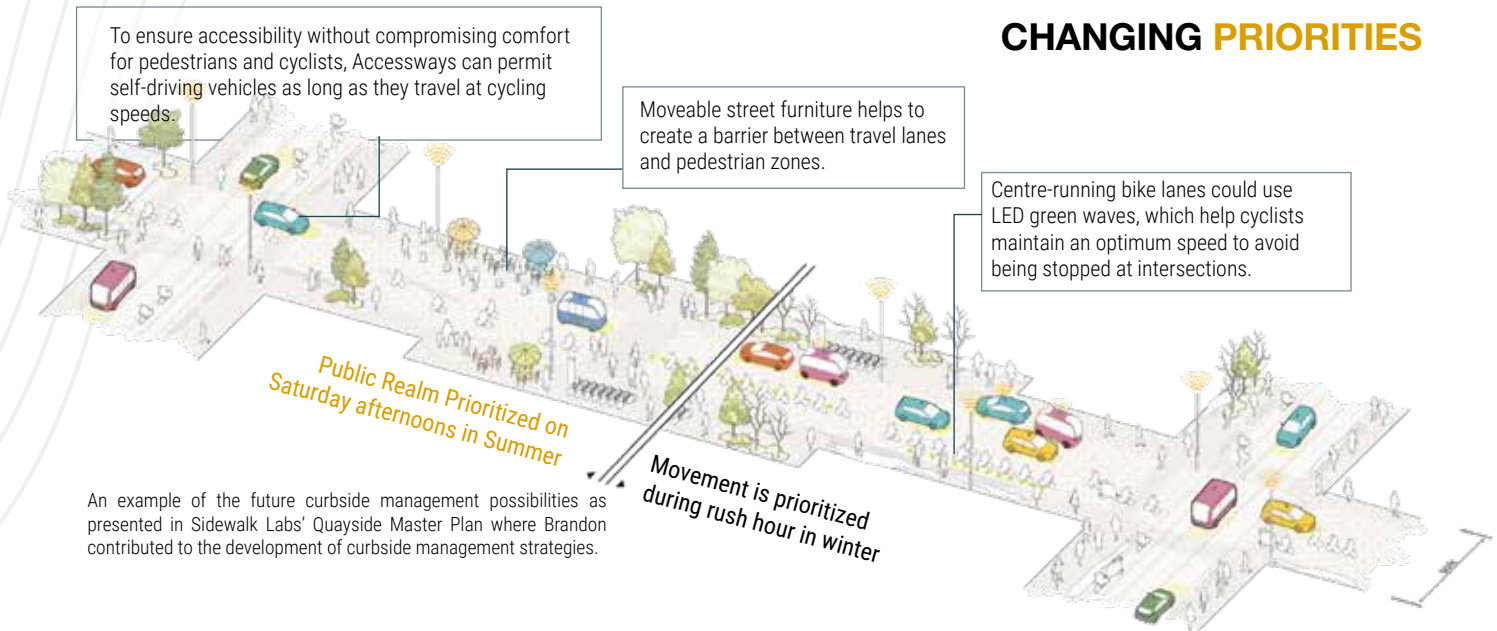
Let's take an example of sixty (60) vehicles parked at the curb for an hour. If we assume a vehicle occupancy of 1.1 people per hour the number of people served would be approximately 66 people, whereas if those same spaces were re-allocated for pick-up, drop-offs, or active transportation, they might serve upwards of 1,000 people within the same timeframe, assuming a typical turnover rate of 2 minutes per pick-up or drop-off, as conceptualized in the figure **above**.

Another aspect of curbside management is its potential to be a flexible zone that adjusts to the needs of the community based on real-time data. Communities go through cycles during the day and week. During rush hour, why not give more space to buses, and include pick-up/drop-off zones for shared rides? During the evening or on weekends, why not give this space back to an outdoor café, or urban gathering space? Smart sensors and AI solutions can empower municipalities with real-time information to make informed decisions and iterate on them quicker while mitigating the amount of underutilized infrastructure that needs to be maintained.

Opportunities to transform urban mobility using curb management exist but realizing that transformation requires defining the public interest in policy, setting clear modal priorities for access to the curb, and making strategic investments to activate curbside space and streets for people.

6 (McKinsey & Company, 2016)

CHANGING PRIORITIES



An example of the future curbside management possibilities as presented in Sidewalk Labs' Quayside Master Plan where Brandon contributed to the development of curbside management strategies.

Source: Sidewalk Labs Street Design Principles

WHAT ARE YOUR PRIORITIES?

Contemporary curbside management is a nascent area within transportation planning with few jurisdictions having formally developed curbside management strategies. Some of the most notable examples include Seattle, Washington D.C., Toronto, and most recently San Francisco. Industry organizations including the Institute of Transportation Engineers (ITE) and the National Association of City Transportation Officials (NACTO) have both developed curbside management guidelines to support the continued development of curbside management practices which adds further credibility to it as a tool for municipalities. All of these strategies and guidelines revolve around two primary components:

1.- IDENTIFYING ESSENTIAL CURB FUNCTIONS: who would like access to curb space and the various different needs. Your community should consider what your objectives are in relation to mobility, parking, revenue, and placemaking. The City of San Francisco uses the following curb functions:

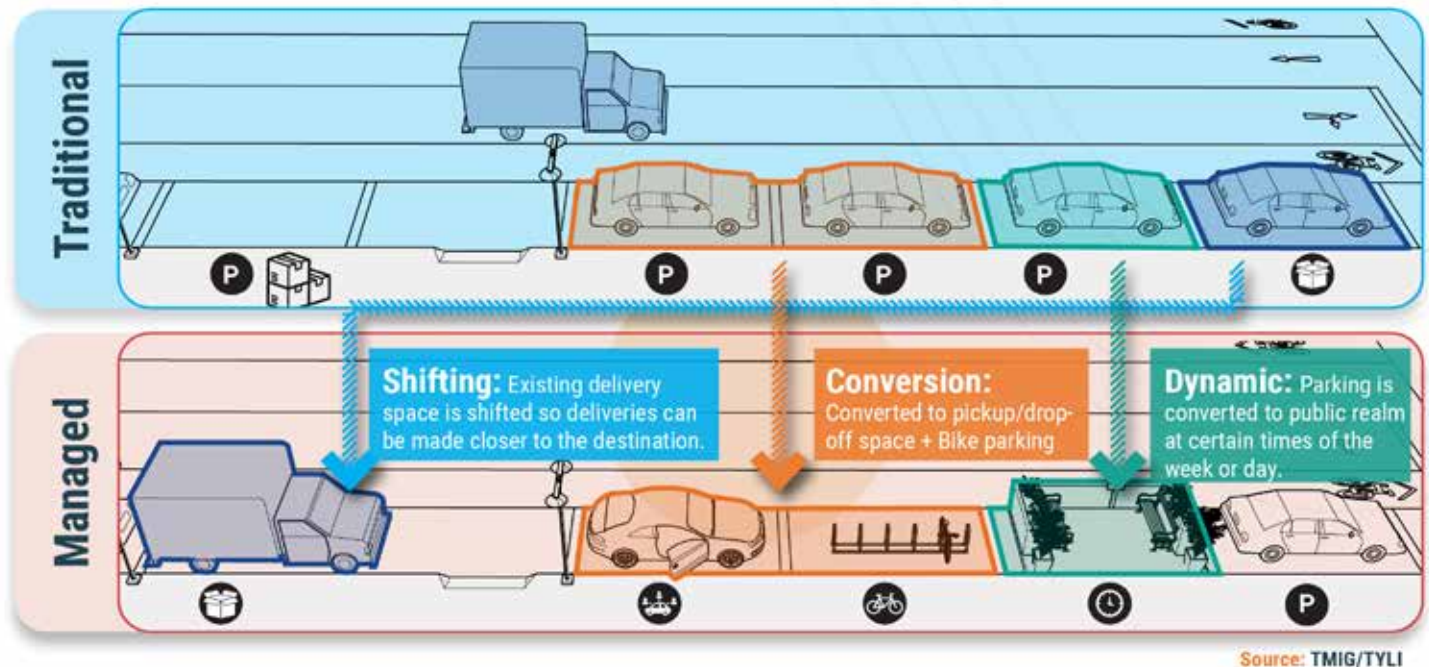
- **Access for People:** Active spaces that priorities transit boardings, and accommodates pick-ups/-drop-offs, and shared mobility services.
- **Access for Goods:** Space for deliveries of different types and sizes, used for short periods of time.
Public Space and Services: Curb designated for use by people and public services.
- **Storage for Vehicles:** Space intended to be occupied by vehicles for extended periods, such that no other users can access the space.
- **Movement:** Curb lane is used for the through-movement of motorized and non-motorized means of transportation, such that the curb lane is unavailable for other functions.

2.- PRIORITIZING CURB FUNCTIONS BY

TYOLOGY: identifying the various street typologies and determining which essential functions are a higher or lower priority for those areas. For instance, an industrial or big-box retail would likely prioritize movement because that is vital for their needs, whereas a town core might rather prioritize active transportation or parking. San Francisco uses the following typologies:

- **Low-Density Residential:** Predominantly single-family homes or single-family homes split into several units. There may be a small number of businesses serving nearby residents such as corner stores, dry cleaners, and coffee shops.
- **Mid-to-High-Density Residential:** Predominantly mid- to high-rise apartments with businesses nearby serving residents such as corner stores, dry cleaners, and coffee shops.
Neighbourhood Commercial: A mix of residential and commercial services such as restaurants, coffee shops, corner stores, laundry services, and small-scale retail.
- **Downtown High-density and intensity area:** Predominantly office, retail and other commercial with some high-density residential. Well served by transit.
- **Major Attractor:** Areas, institutions, or buildings that attract a unique set of users that may have specialized or discrete curb needs. These needs may be specific to time, day, or season.
- **Industrial/Production, Distribution & Repair:** Areas that serve light or heavy industry, or production, distribution, and repair services.

CURBSIDE MANAGEMENT CONCEPTS



MANAGEMENT MEASURES

At a high-level, curbside management generally focuses on how to improve the productivity of the curb to get the best value. Beyond static uses based on clear demand, the following three strategies represent typical measures that a municipality might use to address site-focused curbside concerns:

SHIFTING: Focuses on shifting curb space around to optimize utilization with no net removal of parking, nor increase or decrease of loading zones. For instance, in areas where there is a propensity for freight vehicles to double-park due to an existing loading space being too small, there may be an opportunity to shift another underutilized loading space on the block to the location to address the specific demand. The shifted loading space would in turn be converted to an equivalent of the space it replaced, perhaps on-street parking.

CONVERSION: Consists of converting existing curb space to a different use to better match demand. For instance, there may be a street that has low vehicular parking usage, but a lack of bike parking supply. Such a space may be a candidate for converting to an on-street bike rack to better utilize the space and provide better value to the corridor. Alternatively, there may be a significant demand for pick-up and drop-off activity in a commercial district with many bars and nightclubs, which might be better served with several loading spaces rather than static parking spaces.

DYNAMIC: Involves converting curb space, leveraging technology, and potentially modifying physical infrastructure to change the curb use to adapt to changing demands through the day or week that usually result from a mix of land uses with overlapping demand for the curb. For instance, a dynamic curb may change from an on-street patio space during the weekends to support place-making activities but converted to a commercial loading zone during the week. Alternatively, since commercial loading demands are highest during the mornings and evenings a space could change between a transit priority lane during the day to support transit usage and then converted to a loading zone during off-peak periods to balance the fluctuating demands between the two modes. This solution would require more management and enforcement to ensure compliance, and depending on the degree of dynamic changes, it might require a higher investment in technology.

The figure **above** visualizes an example of how all three of these strategies might play on a busy commercial street in Ottawa. The overarching intent of these curbside management strategies are not to take-away space from motorists, but rather balance the varying competing needs with a focus on moving people rather than vehicles

MANAGEMENT FRAMEWORK

Once you’ve determined your community’s priorities there are general four steps that are recommended for selecting appropriate curbside treatments when planning or addressing curbside issues:

Inventory of existing curbside restrictions and facilities: Collect information on the existing policies, by-laws, and restrictions, as well as collect curbside utilization data to quantify how the curb is currently used. Depending on the configuration, it may include an assessment of on-street parking turnover and utilization, pedestrian and cycling activity, transit boardings & alightings, or freight loading demand. This step is important to identify what the existing usage is like to create a baseline upon which to compare through the development and testing of curbside management solutions. This step should also obtain feedback from key stakeholders and the public to ascertain any existing issues or constraints that may be difficult to determine through the quantitative data alone. The FHWA Curbside Inventory Report provides in-depth technical guidance for evaluating curbside performance.

Identify appropriate treatment alternatives: Develop and evaluate alternative solutions to address constraints and support modal priorities. Generally, curbside management focuses on shifting space, converting space, or incorporating flexibility into curb space to balance multi-modal demands, however the possibilities can be expanded to consider future needs like autonomous mobility, and automated sidewalk drones.

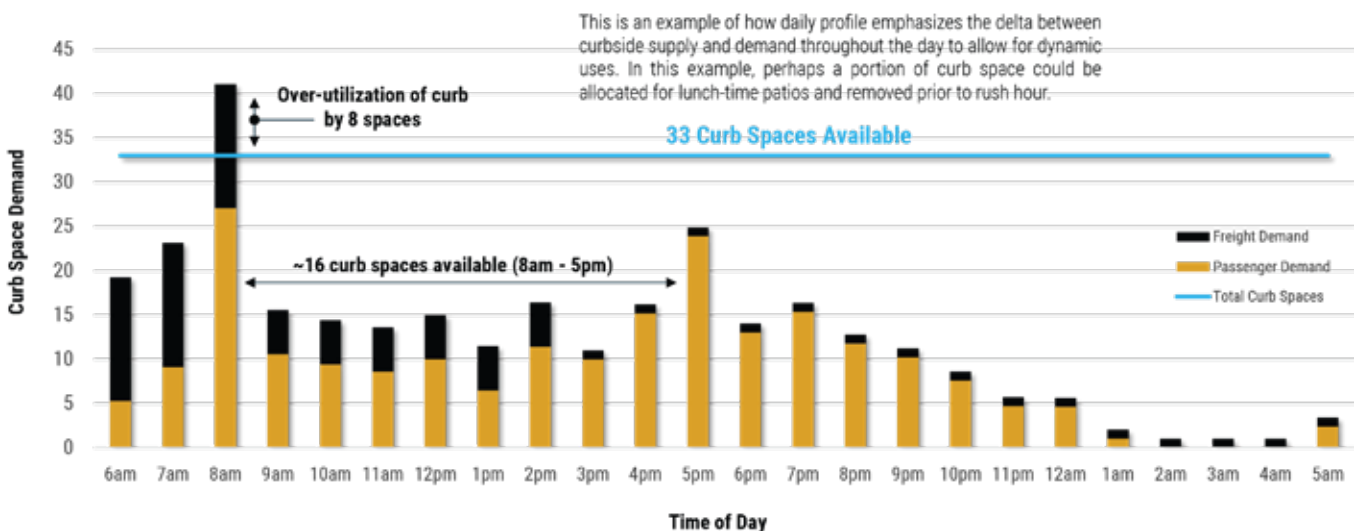
Assess and present alternatives for public feedback: Present the findings resulting from evaluation of alternative solutions and seek feedback from stakeholders and the public to refine solutions.

Refine and implement treatments: Incorporate feedback received to finalize the recommended solutions for implementation.

Be Flexible: take it case-by-case, there may not be a perfect solution. Re-calibrating against the over-arching curbside management priorities and objectives can help focus dialogue.

The benefit of this framework is that it is adapted to both progressively manage demand, as well as addressing issues they may arise in less dense areas like the lack of permit/accessible parking in residential areas, or delivery vehicles illegally parking on a street. While these four steps represent a generalization of peer frameworks from across North America, it is important that your community consider a framework that is tailored to the local context and needs. For instance, communities with increased winter precipitation may desire to incorporate winter maintenance considerations into their curbside management strategy. Furthermore, a curbside management strategy should be developed in collaboration with a municipality’s multi-disciplinary departments between planning, operations, and maintenance to ensure such a strategy is implementable, enforceable, and conducive of broader municipal initiatives and objectives.

Example of Hourly Curbside Demand vs. Supply



MANAGING THE CURB

Allocating use

The allocation of curb access to various users is done through distributing permits for a fee, either monthly or on-demand. Future-proofing regulation can help facilitate payment collection. For example, a courier company may have a permit to park in a loading zone but pay a fee for each curb interaction. This could be done in real-time with a parking app, auto-billing through license plate recognition (LPR) or directly from courier fleet data.

As the spectrum of curb uses expand, the method of allocating space will migrate from static methods to dynamic ones. A dynamic system will need to monitor the current supply and demand of curb space and re-allocate usage in real-time; adapting to conditions. The expansion of virtual credentials, LPR systems, RFID capabilities and other means to securely & privately identify users, along with electronic and mobile payments, will make it easier for a program to allocate access on a variable basis.

CONSOLIDATING DATA

Curb management programs require the ability to collect data from many different sources, not all of which are in the control of the municipality. The ability to share data with users will be vital to communicate status of activity (delivery truck location and status, rideshare activity, parking payment activity), share information about changes to the curb (construction, etc.), and confirm access permissions. Third-party partners with data are valuable to managing the curb program, such as weather, construction status, mass transit status, and traffic flow information, to name a few.

In addition, a curb management program needs to share its data with other platforms and technology; consider digital signage to communicate current operating restrictions or pricing. An entity may share data with a mapping app to communicate real-time status or changes to users.

To reduce the amount of investment and time necessary to integrate various data sources, the International Parking & Mobility Institute (IPMI) is working with the Alliance for Parking Data Standards (APDS) to develop a global standard to share parking related data. APDS is developing a consensus-built, international standard that establishes a common language for data elements and definitions in the parking, transportation, and mobility sectors. More information about the standards, including access to the data standard documents and the mission of APDS, can be obtained at allianceforparkingdatastandards.org

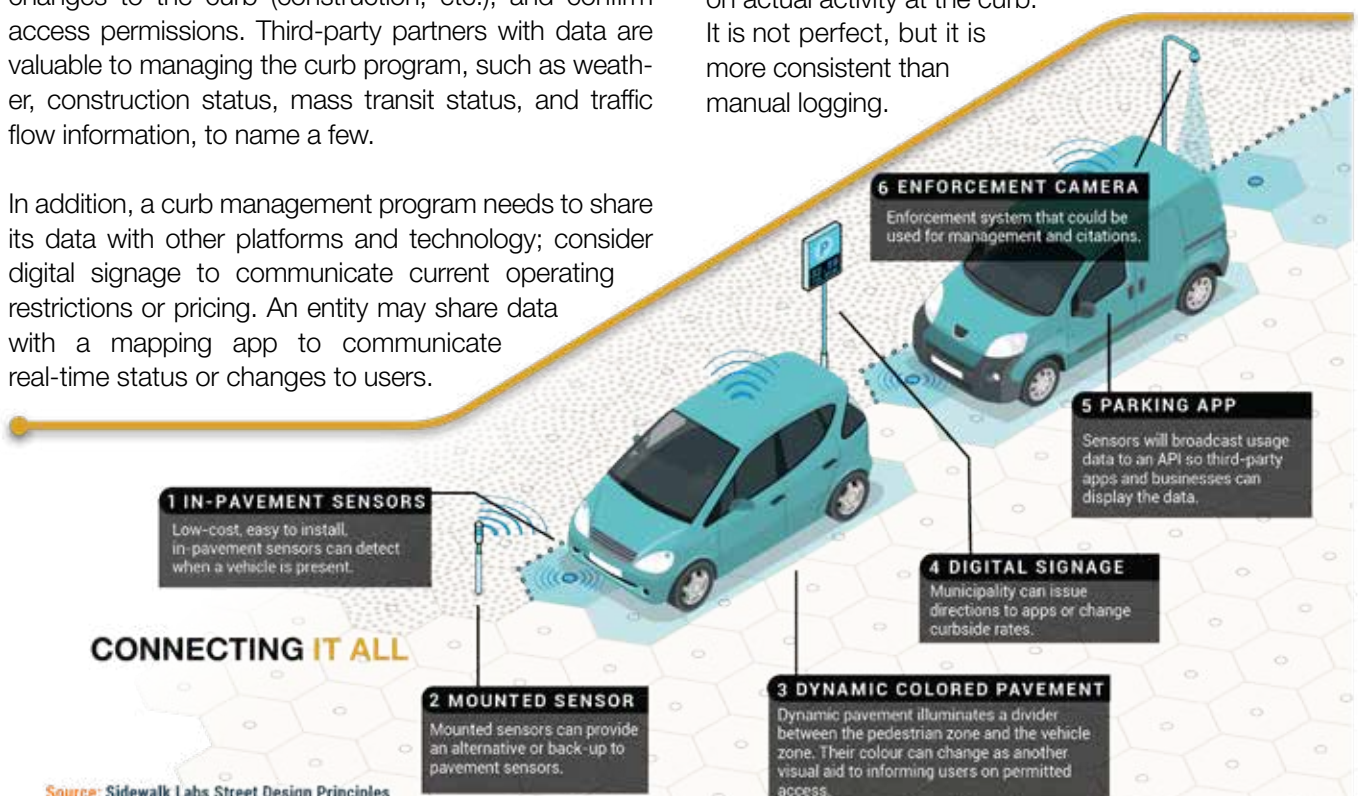
MONITORING

There are a variety of monitoring options including:

Manual logging: simple activity of a person with a clipboard counting vehicles and activity events at the curb. How many ride-share vehicles used the passenger loading zone? How many cars are parked on the street? What is the average length of stay for a delivery? While manual logging does not provide consistent data, the sample can provide useful insight to a curb management program just getting started.

Derived monitoring: taking data from various payment methods to approximate current activity at a curb. An example is assuming that a paid transaction at a meter or via a payment app is equal to a parking or curb event. This allows a curb program to gain more real-time data on actual activity at the curb.

It is not perfect, but it is more consistent than manual logging.



Actual monitoring: using a variety of technology methods to detect the presence of vehicles and activity. Technology methods such as space sensors to detect stopped vehicles, cameras connected to video analytics, LPR, RFID, or Bluetooth to validate virtual permits are just a few examples.

COMMUNICATING THE RULES

Residents may be concerned about their ability to obtain access to the curb or frustrated that they have to pay for access. Each curb management program needs to have a clear communication plan to the users and public explaining the objectives of the program and how a user can access the curb. Messages should focus on the various rules and policies, various curb restrictions, how to obtain permission to access the curb, and payment methods. Explaining the value and trade-off considerations will help users understand how needs are balanced at the curb.

Websites, mobile platforms, and curb signage should be used. While mobile apps and phone-based mapping services can provide detailed customized instructions to each user, signage is still a very effective way to communicate. With physical signs the information is always present when the users arrive at the curb. As programs are launched, having a plan to ensure your rules, practices, and pricing are clearly communicated is critical.

ENFORCEMENT

Enforcement is critical to ensuring the rules are followed. Many technologies that are already in use in many cities for other purposes can be adapted to curbside management including video analytics technology, LPR tools to verify credential holders are in the proper parking areas, and Bluetooth and RFID tags.

The change toward digital technology presents an opportunity to digitize the citation process; perhaps via email rather than paper tickets, which many municipalities require to be placed on the vehicle at the time of violation.

The technology could also serve to modernize the way paying for curb space is handled. An example presented by Charley Debow and Mike Drow in the May 2019 issue of *The Parking Professional* is to consider if a delivery truck service that currently receives five tickets a week for illegal parking were able to pre-pay for monthly access to a specific section of the curb? The program benefits by better controlling where the delivery truck stops, and the delivery service reduces its

cost in processing the fees. The system could also be used to track compliance and report issues to companies that need to adjust behaviour or risk losing access⁷.

MANAGING TOMORROW'S NEEDS

We are on the precipice of the 5th industrial revolution which economists predict will place a greater importance on AI and Human Intelligence. According to a 2017 report from the Institute for the Future (ITF) 85% of the jobs that will exist in 2030 have not been invented yet. We may not know what the future holds, but we know that it will be a result of the decisions we make today.

The advent of autonomous mobility raises a variety of questions and concerns that can't be measured. Ranging from moral and ethical questions surrounding AI, and the uncertainty as to how the technology will manifest. Will it be a shared-service model? Or will it be a private? These questions and others cannot be answered with any certainty today, but curbside management is likely to be a major barrier to AV implementation.

While the future of AVs still remain nebulous, there is a growing consensus toward AVs as a shared-use model where vehicles would continuously pick-up and drop-off passengers throughout the day. This might result in less on/off-street vehicular parking demand and more curbside demand for pick-up & drop-offs. The introduction of AVs may make different passenger loading operations possible, such as dedicated, orderly, or centralized pickup / dropoff locations. It could also open up opportunities to re-allocate parking spaces to other uses including public realm enhancements supported by active transportation.

The associated monitoring technology for dynamic curbside management could lay the foundation to a broader connected and integrated mobility network where data between curbside, roadways, intersections, transit, and emergency services are all communicating to dynamically adapt operations to your community.

The late psychologist Erich Fromm said "Creativity requires the courage to let go of certainties." In a world of uncertainties, perhaps the rational approach is to consider that the best solution for the future cannot always be measured, but can be made adaptable to future changes. Curbside management is a practical first step towards adding flexibility to your community's mobility network and preparing for tomorrow's needs.

⁷ (Debow & Drow, 2019)